REVISED DRAINAGE REPORT
VENTANA RANCH SUBDIVISION
SEDONA SUBDIVISION

JANUARY 9, 1998

PREPARED FOR:

LAS VENTANAS LIMITED PARTNERSHIP
#10 TRAMWAY LOOP NE
ALBUQUERQUE, NM 87122

I hereby certify that I am a registered professional engineer licensed to practice in the State of New Mexico, that this report was prepared by me or under my supervision and is true and accurate to the best of my knowledge and belief.

1/9/98

Kerry L. Davis, P.E. # 9984 | Date

KERRY L. DAVIS
NEW MEXICO
9984
REGISTERED PROFESSIONAL ENGINEER

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APPENDICES

I PURPOSE

This report presents the amended drainage management plan for the purposes of amended preliminary plat and grading plan approval for Sedona Subdivision, a portion of Ventana Ranch Tract Z-2. Sedona Subdivision at Ventana Ranch consists of approximately [illegible] single family detached residential lots. The remaining portion of Tract Z-2 will remain undeveloped at this time, although the ultimate development of Tract Z-2 was identified in the approved Storm Drain Design Analysis Report. The Drainage Ordinance and the Development Process Manual (DPM) are utilized to develop this plan.

II. SITE LOCATION AND EXISTING CONDITIONS

Ventana Ranch Subdivision is a 940 acre development located west of Paradise Hills, between Paseo del Norte and Irving Boulevards. Tract Z-2 is located at the northeast corner of the Ventana Ranch Master Plan area. A 300' drainage, utility, pedestrian, recreation, and access corridor separates the development from the existing Paradise Hills development to the east. Access to the site is from Irving Boulevard and Ventana Road.

In its existing condition, the site consists of undulating terrain with shallow and exposed basalt present throughout. The site drains generally from west to east at slopes of approximately 1-5%.

A proposed storm sewer outfall from the Las Ventanas Detention Dam to the Calabacillas Arroyo is currently under construction by AMAFCA, which will provide the outfall mechanism for this development. Excerpts from the construction plans for these drainage improvements are included in Appendix Three.

Upstream of the site exists Tract A of Ventana Ranch, which is an undeveloped tract of land consisting of approximately 32 acres, currently zoned for multi-family residential development. Portions of Tract A drain through Tract Z-2 from west to east.

III. EXISTING APPROVED DRAINAGE REPORTS AND BACKGROUND INFORMATION

Existing approved drainage reports utilized in the preparation of this plan include the following:

1. The Drainage Master Plan for Las Ventanas Subdivision (LVDMP), was originally prepared by Bohannan Huston in April of 1995, updated in October 1995. The Drainage Master Plan identifies downstream drainage improvements including the AMAFCA Las Ventanas Drainage Facility #1 and the pipe outfall diversion to the Calabacillas Arroyo, which will provide for the ultimate development of the Las Ventanas Subdivision. The LVDMP also identified offsite runoff generated on portions of Tract A, as well as Tracts 28 and 29 of Tract X, to the west and upstream of this project, which will be required to be accepted and conveyed through the site. Excerpts from the LVDMP are included in Appendix Three, which identifies the proposed subdivision to be primarily within Basin 320. In the ultimate development of Tract Z-2, Basin 320 is collected in internal streets within the subdivision, and conveyed by a storm sewer to the Las Ventanas Detention Facility #2, which is proposed to be constructed within Tract B-2 which will be dedicated to AMAFCA. In addition, Basin 505 comprises the extreme northeastern portion of the property, which discharges directly to the AMAFCA Outfall from the Las Ventanas Dam. Undeveloped flows within Basin 320 and 505 total 69 and 20 CFS, respectively.

2. The Final Design Analysis Report for the Las Ventanas Detention Dam and Outfall Pipe, was prepared by Bohannan Huston and utilized for the design of drainage facilities currently under construction by AMAFCA. This report identifies a total of 32 CFS discharge from the Las Ventanas Detention Facility #2, and 37 CFS discharge to

the Outfall Pipe at Irving from Basin 505. These figures were updated and amended by the Storm Drain Design Analysis Report to be 32 CFS (no change) and 5[illegible] CFS respectively.

[illegible] The Storm Drain Design Analysis Report for Ventana Ranch Tract Z-[illegible] Subdivision, dated November 17, 1997, was prepared by Bohannan Huston and approved by AMAFCA and the City of Albuquerque. [illegible]is and AHYMO model for the entire subdivision at ultimate development. That report is hereby amended as follows: the internal subdivision layout is revised, but the basin areas and resulting flow rates are not affected.

IV HYDROLOGIC AND HYDRAULIC ANALYSES

The modified rational method contained within the August, 1991 amendments to Chapter 22.2 of the Development Process Manual (DPM Update) are utilized to determine the hydrologic discharges and volumes generated by this development.

Note that the hydraulic analysis provided herein is for Phase I development only as indicated on the amended preliminary plat (included in Appendix One). The analysis for ultimate development of the entire Tract Z-2 subdivision is provided in the Storm Drain Design Analysis Report and is unchanged by this amendment.

Hydraulic analysis of the typical street sections is performed utilizing Manning's Equation for proposed street slopes. This analysis identifies the street flow capacities allowed within the typical street sections, resulting in proposed storm sewer inlets required to remove excess street flow from the surface. All hydrologic and hydraulic calculations are included in Appendices Two and Three herein or are referenced in the Storm Drain Design Analysis Report.

V. DRAINAGE MANAGEMENT PLAN AND CONCLUSIONS

The development of 120 lots within the Sedona Subdivision, a portion of Tract Z-2 of the Ventana Ranch Subdivision, is proposed to occur in a single phase. Future development of the remainder of Tract Z-2 will be described in subsequent detailed drainage report(s) as required for preliminary plat approval for that subsequent development.

Basin A includes all of the northerly portion of the Sedona Subdivision, formerly identified in the Las Ventanas Drainage Master Plan as Basin 505 and as Basins 1, 2, [illegible] Storm Drain Design Analysis. This basin includes Irving Boulevard, Castle Dome Place, and Bisbee Place. The flow generated by Basin A is directed by the internal streets and collected by a storm sewer within Bisbee Place. The Bisbee storm drain extends from the intersection with Irving Boulevard and the intersection with Kayenta Place to the Las Ventanas Detention Dam Outfall Pipe. The storm drain will range in size from 24" at the upstream end to 36" at the outfall. See Appendix E and Exhibits 3 and 4 from the Storm Drain Design Analysis Report for a plan and profile of this storm drain and the HGL analysis, incorporated into this report in Appendix Three.

The outflow from the Bisbee Place storm drain to the outfall pipe is 53 CFS, which is greater than the original design outflow of 37 CFS. As noted in the Storm Drain Design Analysis Report, the small detention pond originally proposed within Tract B-1 in the "Ventanas Ranch Subdivision, Sedona Subdivision" drainage report dated October 22, 1997 to attenuate these flows is not required and has been eliminated. Based on the outfall hydrographs of the Las Ventanas Drainage Facilities (LVDF) No. 1 and 2 and the Bisbee storm drain outflow, the Las Ventanas Dam Outfall Pipe has sufficient capacity to accommodate the increased flow from the Bisbee storm drain. For supporting calculations, including the evaluation of hydraulic grade lines, street flow and inlet capacities of the storm drain and the Las Ventanas Outfall Pipe, see Appendices B and E from the Storm Drain Design Analysis Report, incorporated into this report in Appendix Three.

Basin B1, which includes Scottsdale Avenue and adjacent sections of Safford Place and Bisbee Place, was formerly a part of Basin 320 in the Las Ventanas Drainage Master Plan. The 100-year storm discharge for Basin B1 is 30.38 CFS (see calculations in Appendix Two). The generated runoff is directed to a low point within the internal streets which is where Scottsdale Avenue ends at the east boundary of Sedona Subdivision. At this point, a drainage rundown is proposed to deliver the collected runoff to an existing swale which will carry the runoff to the LVDF No. 2.

Basin 320A, which includes primarily undeveloped land, has a calculated 100-year storm discharge of 38.32 CFS (see AHYMO model calculations in Appendix Two). Runoff generated by the undeveloped portion will follow the existing drainage path toward the LVDF [illegible] detention pond shown in Tract A in the Storm Drain Design Analysis Report, which will store the discharge generated by the northwest section of Basin 302A, will not be constructed as part of this phase. Future development of the remaining portions of Tract Z-2 will include detailed analysis and design of the drainage improvements required to accomplish this drainage concept.

LVDF No. 2 is the only detention pond affected by this development. An AHYMO model for the pond's contributing basins, Basins B1 and 320A, has been included in Appendix Two. A 9' high berm height along the east side of LVDF No 2 is proposed to increase the facility's storage capacity from 1.61 acre-feet. With the proposed development in Basins B1 and 320A, ponding will be at 4.80 acre-feet. The ultimate pond size will be 6.63 acre-feet, which will not require State Engineer approval. The total inflow to LVDF No. 2 is 47.23 CFS and the maximum outflow to the Las Ventanas Outfall Pipe is 32 CFS. See Appendix Two for supporting calculations. Future development of Tract C will include design and construction of the ultimate LVDF No. 2.

Increases in runoff, depth and velocity due to proposed development are within anticipated parameters for this area and can be safely conveyed by the improvements proposed in this drainage plan to drainage facilities existing, planned, or currently under construction which have adequate capacity to accept such runoff. Erosion and dust control, consisting of erosion control berms, snow fencing and sedimentation basins, are proposed to prevent soil washing or blowing into paved streets, storm sewers, and existing development areas.

CALCULATION OF TIME TO PEAK
REVISED DPM PROCEDURE

DESCRIPTION	VAR.	UNIT	BASIN A				BASIN B1	BASIN 320A
			I1	I2	A1	A2		
Basin Area		Acres	1.21	4.11	9.85	3.44	8.97	90.81
Total Reach	L	Feet	750.0	2000.0	1411.0	695.0	880.0	3300.0
Overland Reach	L1	Feet	400.0	400.0	400.0	400.0	400.0	400.0
Overland K	K1		0.7	0.7	0.7	0.7	0.7	0.7
Overland Slope	S1	Percent	0.50	1.25	1.05	1.18	1.71	4.50
Adj. Overland Slope	S1'	Percent	0.500	1.250	1.047	1.180	1.710	4.434
Gully Reach	L2	Feet	350.0	1600.0	1011.0	295.0	480.0	1600.0
Gully K	K2		2.000	2.000	2.000	2.000	2.000	0.840
Gully Slope	S2	Percent	0.500	1.284	1.168	0.775	1.000	0.775
Adj. Gully Slope	S2'	Percent	0.500	1.284	1.168	0.775	1.000	0.775
Arroyo Reach	L3	Feet	0.0	0.0	0.0	0.0	0.0	1300.0
Arroyo K	K3		3.000	3.000	3.000	3.000	3.000	3.000
Arroyo Slope	S3	Percent	2.740	2.760	2.630	3.250	2.630	2.170
Adj. Arroyo Slope	S3'	Percent	2.740	2.760	2.630	3.250	2.630	2.170
Lca	Lca	Feet	-	-	-	-	-	-
Base Discharge	Qb	cfs	0.0	0.0	0.0	0.0	0.0	0.0
Ground Slope S	S	Percent	0.500	1.278	1.310	1.007	1.310	1.776
Adjusted Slope S'	S'	Percent	0.500	1.278	1.310	1.007	1.310	1.776
K	K		1.005	1.454	1.202	0.999	1.136	0.908
K'	K'		1.005	1.454	1.201	0.999	1.136	0.907
K''	K''		0.000	0.000	0.000	0.000	0.000	0.000
K'''	K'''		0.000	0.000	0.000	0.000	0.000	0.000
Kn	Kn		0.042	0.042	0.042	0.042	0.042	0.042
Orig. TC	TC	Hrs.	0.293	0.338	0.285	0.193	0.188	0.758
Adjusted TC	TC'	Hrs.	0.293	0.338	0.285	0.193	0.188	0.758
Time Lag	Lg	Hrs.	-	-	-	-	-	-
Time to Peak	TP	Hrs.	0.195	0.225	0.190	0.133	0.133	0.505

HYDROLOGIC VOLUMETRIC AND DISCHARGE DATA
SEDONA SUBDIVISION, VENTANA RANCH

BASIN I.D.	AHYMO I.D.	DESCRIPTION	AREA (acres)	% LAND TREATMENT A	B	C	D	VOLUME (ac-ft) 10 YR.	100 YR.	DISCHARGE (cfs) 10 YR.	100 YR.
A	I1	NORTH VENTANA LOOP	1.21	4%	12.33%	16.32%	67.35%	0.118	0.196	2.31	3.78
	I2	SOUTH VENTANA LOOP	4.11	4%	12.33%	16.32%	67.35%	0.396	0.661	7.19	11.75
	A1	BISBEE, KAYENTA, CASTLE DOME	9.85	0%	23%	23%	54%	0.823	1.419	17.04	28.88
	A2	KAYENTA / BISBEE	3.44	0%	23%	23%	54%	0.289	0.498	7.23	12.21
								1.626	**2.774**		
B1	B1	SCOTTSDALE	8.97	0%	25.6%	25.6%	48.8%	**0.719**	**1.226**	17.82	30.38
302A	302A	BACKYARDS / OFFSITE	90.81	94.71%	0.07%	5.07%	0.15%	**2.098**	**3.576**	22.47	38.32

Note: 1) For basin discharge rates, volume, and hydrograph analysis, see the AHYMO model summary, Appendix 2.

Basin B1 Discharge Calculations - 10-yr

NOTE: Blue shaded cells require user input, all other cells should not be edited.
ASSUMPTIONS:
1. Area less than 40 acres (simplified hydrograph method).
2. 10-year, 6-hour storm event

Number of Units : 44
Total Area : 8.97
# of dwelling units per acre : 4.91

Developed % Treatment D - DPM Section 22.2 Table A-5

%D= 48.79%

Developed % Treatment A, B & C

%A= 0.00%
%B= 25.60%
%C= 25.60%

Peak Flow per Acre - DPM Section 22.2 Table A-9

Zone	A	B	C	D
1	0.24	0.76	1.49	2.89
2	0.38	0.95	1.71	3.14
3	0.58	1.19	2.00	3.39
4	0.87	1.45	2.26	3.57

Basin Name : B1
Choose Zone (1 - 4) 1
Basin Area = (acres) 8.97

Exist Conditions				Proposed Conditions			
Treatment	Percentage	Area	Q (cfs)	Treatment	Percentage	Area	Q (cfs)
A	98.00%	8.79	2.11	A	0.00%	0.00	0.00
B	0.00%	0.00	0.00	B	25.60%	2.30	1.75
C	2.00%	0.18	0.27	C	25.60%	2.30	3.42
D	0.00%	0.00	0.00	D	48.79%	4.38	12.65
	Q Peak - exist.=		**2.38**		**Q Peak - dev.=**		**17.82**

bhi-main\97213\c02-layouts\study\hydrology\developed\Pond 2 Analysis.xls

Basin B1 Discharge Calculations - 100-yr

NOTE: Blue shaded cells require user input, all other cells should not be edited.
ASSUMPTIONS:
1. Area less than 40 acres (simplified hydrograph method).
2. 100-year, 6-hour storm event

Number of Units :	44
Total Area :	8.97
# of dwelling units per acre :	4.91

Developed % Treatment D - DPM Section 22.2 Table A-5

%D= 48.79%

Developed % Treatment A, B & C

%A=	0.00%
%B=	25.60%
%C=	25.60%

Peak Flow per Acre - DPM Section 22.2 Table A-9

Zone	A	B	C	D
1	1.29	2.03	2.87	4.37
2	1.56	2.28	3.14	4.7
3	1.87	2.6	3.45	5.02
4	2.2	2.92	3.73	5.25

Basin Name :	B1
Choose Zone (1 - 4)	1
Basin Area = (acres)	8.97

Exist Conditions				**Proposed Conditions**			
Treatment	Percentage	Area	Q (cfs)	Treatment	Percentage	Area	Q (cfs)
A	98.00%	8.79	11.34	A	0.00%	0.00	0.00
B	0.00%	0.00	0.00	B	25.60%	2.30	4.66
C	2.00%	0.18	0.51	C	25.60%	2.30	6.59
D	0.00%	0.00	0.00	D	48.79%	4.38	19.13
		Q Peak - exist.=	**11.85**			**Q Peak - dev.=**	**30.38**

***** PC PROGRAM STREAM DECEMBER 1997 *****

Scottsdale at Cutoff (East Edge ofBasin B1)

MANNING'S N= .017 SLOPE= .00565

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.67	3	16.00	0.32	5	32.00	0.67
2	0.10	0.00	4	31.99	0.00	6	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)	
0.10	0.10	0.50	0.4	10.17	0.88	9.98	0.01	0.11	
0.20	0.20	2.00	2.8	20.34	1.40	19.96	0.03	0.23	
0.30	0.30	4.49	8.2	30.51	1.83	29.95	0.05	0.35	
0.40	0.40	7.67	19.2	32.70	2.50	31.96	0.10	0.50	Q_{100} = 30.38 CFS
0.50	0.50	10.86	34.1	32.90	3.14	31.97	0.15	0.65	
0.60	0.60	14.06	52.2	33.10	3.71	31.99	0.21	0.81	
0.67	0.67	16.30	66.6	33.24	4.09	32.00	0.26	0.93	

EH MAX = 0.87' $\longrightarrow$ Q_{MAX} = 59.4 CFS > 30.38 CFS

d = 0.48' < 0.67'

EH = 0.61' < 0.67' OK

Existing Pond Volume Calculations

Contour Elevation	Area (ft²)	Total Areas	Average Areas	Distance Between Contours	Volume (ft^3)	Volume (yd^3)	Volume (Ac-ft)
5386	77000.4						
		106,889.00	53,444.50	1	53,444.50	1,979.43	1.23
5385	29888.6						
		33,251.80	16,625.90	1	16,625.90	615.77	0.38
5384	3363.2						
			Total Volume of Pond =		70,070.40	2,595.20	1.61

Required Pond Volume Calculations

Condition	Volume (ft^3)	Volume (yd^3)	Volume (Ac-ft)
Existing	70,070.40	2,595.20	1.61
Proposed	209,131.56	7,745.61	4.80 **
lecessary increase in pond volume =	139,061.16	5,150.41	3.19

*** derived from AHYMO model - see Appendix 2.

Proposed Pond Volume Calculations

Contour Elevation	Area (ft²)	Total Areas	Average Areas	Distance Between Contours	Volume (ft^3)	Volume (yd^3)	Volume (Ac-ft)
5388	161365.0						
		276,648.05	138,324.03	1	138,324.03	5,123.11	3.18
5387	115283.0						
		192,037.83	96,018.91	1	96,018.91	3,556.26	2.20
5386	76754.8						
		109,329.78	54,664.89	1	54,664.89	2,024.63	1.25
5385	32575.0						
			Total Volume of Pond =		289,007.83	10,703.99	6.63

Bisbee Place Storm Drain

Q_p = 53.0 cfs @ 1.6 hrs
Q = 2.1 cfs @ 2.8 hrs
Q = 0.7 cfs @ 3.4 hrs

LVDF #2

Q = 2.7 cfs @ 1.6 hrs
Q_p = 10.9 cfs @ 2.8 hrs
Q = 10.3 cfs @ 3.4 hrs

LVDF #1

Q = 28.7 cfs @ 1.6 hrs
Q_1 = 78.2 cfs @ 2.8 hrs
Q_p = 78.5 cfs @ 3.4 hrs

Q_{TOTAL} = (53.0 + 2.7 + 28.7) cfs = 84.4 cfs @ 1.6 hrs

Q_{TOTAL} = (2.1 + 10.9 + 78.2) cfs = 91.2 cfs @ 2.8 hrs < 112.8 cfs*

$\boxed{\text{OK}}$

Q_{TOTAL} = (0.7 + 10.3 + 78.5) cfs = 89.5 cfs @ 3.4 hrs

*112.8 CFS is the total peak flow routed into the Las Ventanas Dam Outflow Pipe in the Storm Drain Design Analysis Report, which was shown to have sufficient capacity. See Exhibits in Appendix 3.

BOHANNAN-HUSTON INC.
ENGINEERS • PLANNERS • PHOTOGRAMMETRISTS • SURVEYORS • LANDSCAPE ARCHITECTS
ALBUQUERQUE LAS CRUCES SANTA FE

PROJECT NAME	TRACT - Z 2	SHEET 1	OF 1
PROJECT NO.		BY DEB	DATE
SUBJECT	Hydrograph Flowrates	CH'D	DATE

Shaded cells require user input. Non-shaded cells cannot be edited.*

BISBEE PLACE HGL

***** HYDRAULIC GRADE LINE CALCULATIONS *****

Manning's n = 0.013
for pipe

Station	Structure	Diam. (in.)	Q (cfs)	Area	Vel.	K	Sf	Length (ft.)	MH Dia. (ft.)	JNCT Angle	Hf	Hb	Hj	Hmh	Ht	Total Losses	HGL(dn)	HGL(up)	Low Point	HV	EGL(dn)	EGL(up)
10+00	OUTLET								0.0	0.0		0.00	0.00	0.00	0.00	0.00		5381.99	5395.00	0.87	5382.86	5382.86
		36	53.0	7.07	7.50	667	0.0063	227.53			1.44					1.44						
12+27.53	MH#1								6.0	45.0		0.07	0.00	0.00	0.00	0.07	5383.43	5384.12	5396.03	0.26	5384.30	5384.37
		36	28.8	7.07	4.08	667	0.0019	190.00			0.36					0.36						
14+17.53	MH#2								6.00	0.00		0.00	0.27	0.00	0.00	0.27	5384.47	5384.70	5396.98	0.29	5384.73	5385.00
		24	13.6	3.14	4.33	226	0.0036	80.00			0.29					0.29						
14+97.53	MH#3								6.00	0.00		0.00	0.20	0.00	0.00	0.20	5384.99	5385.49	5397.41	0.00	5385.28	5385.49
		24	0.1	3.14	0.03	226	0.0000	1.00			0.00					0.00						
									0.00	0.00		0.00	0.00	0.04	0.00	0.04	5385.49	5385.53	5397.41	0.00	5385.49	5385.53

JUNCTION LOSSES

Dia. 3 (in.)	Junct. Angle	<delta>y	Ht(inc.)	Ht(dec.)	Actual Slope	Elev.	Depth
0	0	0.0000	0.0873	0.0000		5387.54	7.46
					0.0080	1.82	
0	0	0.0000	0.0000	0.0000		5389.36	6.67
					0.0080	1.52	
36	45	0.2328	0.00	0.00		5390.88	6.10
					0.0080	0.64	
48	45	0.4914	0.00	0.00		5391.52	5.89
					0.0080	0.01	
0	0	0.0000	0.00	0.00		5391.53	5.88

Shaded cells require user input. Non-shaded cells cannot be edited.*

KAYENTA PLACE

***** HYDRAULIC GRADE LINE CALCULATIONS *****

Manning's n = 0.013
for pipe

Station	Structure	Diam. (in.)	Q (cfs)	Area	Vel.	K	Sf	Length (ft.)	MH Dia. (ft.)	JNCT Angle	Hf	Hb	Hj	Hmh	Ht	Total Losses	HGL(dn)	HGL(up)	Low Point	HV	EGL(dn)	EGL(up)
10+00	OUTLET								0.0	0.0		0.00	0.00	0.00	0.00	0.00		5390.54	5395.00	0.87	5391.41	5391.41
		36	53.0	7.07	7.50	667	0.0063	40.00			0.25					0.25						
9+60	MH#1								6.0	45.0		0.07	0.00	0.00	0.00	0.07	5390.79	5391.48	5396.03	0.26	5391.67	5391.74
		36	28.8	7.07	4.07	667	0.0019	190.00			0.35					0.35						
7+70	MH#2								6.00	45.00		0.04	0.14	0.00	0.00	0.18	5391.84	5391.91	5396.98	0.37	5392.09	5392.28
		24	15.2	3.14	4.85	226	0.0045	40.00			0.18					0.18						
7+40	MH#3								6.00	45.00		0.05	0.00	0.02	0.00	0.07	5392.09	5392.16	5395.90	0.37	5392.46	5392.53
		24	15.2	3.14	4.85	226	0.0045	150.00			0.68					0.68						
5+90	MH#4								6.00	90.00		0.14	0.00	0.04	0.04	0.23	5392.84	5392.28	5396.20	1.15	5393.21	5393.44
		18	15.2	1.77	8.62	105	0.0210	60.00			1.26					1.26						
16+58.32	INLET								6.00	54.00		0.04	0.00	0.00	0.00	0.04	5393.54	5394.74	5395.80	0.00	5394.70	5394.74
		18	0.0	1.77	0.00	105	0.0000	1.00			0.00					0.00						
									0.00	0.00		0.00	0.00	0.00	0.00	0.00	5394.74	5394.74	5395.80	0.00	5394.74	5394.74

JUNCTION LOSSES							
Dia. 3 (in.)	Junct. Angle	<delta>y	Ht(inc.)	Ht(dec.)	Actual Slope	Elev.	Depth
0	0	0.0000	0.0873	0.0000		5387.54	7.46
					0.0080	0.32	
0	0	0.0000	0.0000	0.0000		5387.86	8.17
					0.0080	1.52	
24	45	0.0315	0.00	0.00		5389.38	7.60
					0.0080	0.32	
0	0	0.0000	0.00	0.00		5389.70	6.20
					0.0080	1.20	
0	0	0.0000	0.00	0.04		5390.90	5.30
					0.0080	0.48	
0	0	0.0000	0.00	0.00		5391.38	4.42
					0.0080	0.01	
0	0	0.0000	0.00	0.00		5391.39	4.41

From Conceptual - Basin NE Phase I:

Irving Blvd. $Q = 15.13$ cfs

See Sheet 2 for typical street cross section.

Assume Entire flow enters Storm Drain System.

$Q_{in} = 15.13$ cfs

Basin A1: $Q = 28.45$ cfs

see sheet 3 for typical street cross section. (Castle Dome Pl.)

street has capacity ⇒ Entire flow to Bisbee Pl.

see sheet 4 for typical Street cross section. (Bisbee Pl.)

$Q_{in} = (3.8 \text{ cfs}) \times 2 = 7.6$ cfs (see Sheet 5)

$28.45 \text{ cfs} - 7.6 \text{ cfs} = 20.85$ cfs

$Q_{in} = (3.0 \text{ cfs}) \times 2 = 6.0$ cfs (see Sheet 5)

$20.85 \text{ cfs} - 6.0 \text{ cfs} = 14.85$ cfs

$Q_{BY} = 14.85$ cfs

Basin A2: $Q = 12.03$ cfs* ($Q = 25.05$ cfs see AHYMO model)

Two single "A" Inlets in sump condition

$Q_{in} = 25.05$ cfs (see Sheet 6)

TOTAL Q TO LAS VENTANAS OUTFALL = 52.58 cfs ≅ $\boxed{53.0 \text{ cfs}}$

BOHANNAN-HUSTON INC.
ENGINEERS • PLANNERS • PHOTOGRAMMETRISTS • SURVEYORS • LANDSCAPE ARCHITECTS
ALBUQUERQUE LAS CRUCES SANTA FE

PROJECT NAME [illegible]	SHEET 1	OF 7	
PROJECT NO. [illegible]	BY [illegible]	DATE 11/4/97	
SUBJECT Street Capacity / Storm Drain	CH'D	DATE	

ANALYSIS OF AN INLET IN SUMP CONDITION - VENTANA RANCH TRACTS B, C, D, AND E

INLET TYPE: Type "A" with curb openings

WEIR: Q=C*L*H^1.5

Curb opening	Grate opening
C = 3.0	C = 3.0
L = 4.0 FT.	L = 2.96FT +1.54' = 4.5'
Q = 3.0(4.0)H^1.5	Q = 3.0(4.5)H^1.5
Q = 12*H^1.5	Q = 13.5*H^1.5

ORIFICE: Q=C*A*(2*G*H)^0.5

Curb opening	Grate opening
C = 0.6	C = 0.6
A = 2.67 SF	A = 2.96 FT * 1.54 FT = 4.56 SF
Q = 0.6(2.67)(2*32.2*H)^0.5	Q = 0.6(4.56)(2*32.2*H)^0.5
Q = 1.6*(64.4*H)^0.5	Q = 2.74*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR CURB OPENING	Q (CFS) WEIR GRATE OPENING	Q (CFS) ORIFICE CURB OPENING	Q (CFS) ORIFICE GRATE OPENING	Q (CFS) TOTAL	COMMENTS
FLOW LINE @ INLET	0.00	0.00	0.00	0.00	-	-	0.00	Flow at "A" inlet with curb opening weir controls on grate analysis.
	0.10	0.10	0.38	0.43	-	-	0.81	
	0.20	0.20	1.07	1.21	-	-	2.28	
	0.30	0.30	1.97	2.22	-	-	4.19	
	0.33	0.33	2.27	2.56	-	-	4.83	
	0.40	0.40	-	3.42	8.12	-	11.54	
	0.50	0.50	-	4.77	9.08	-	13.85	
	0.60	0.60	-	6.27	9.95	-	16.22	
TOP OF CURB	0.67	0.67	-	7.40	10.51	-	17.91	

25.05cfs / 17.91cfs/inlet = 1.3 ⇒ 2 inlets

Bisbee Place Storm Drain

$Q_p = 53.0$ cfs @ 1.6 hrs
$Q = 7.4$ cfs @ 2.25 hrs
$Q = 0.7$ cfs @ 3.4 hrs

LVDF No. 2

$Q = 21.4$ cfs @ 1.6 hrs
$Q_p = 29.0$ cfs @ 2.25 hrs
$Q = 25.6$ cfs @ 3.4 hrs

LVDF No. 1

$Q = 28.7$ cfs @ 1.6 hrs
$Q = 76.4$ cfs @ 2.25 hrs
$Q_p = 78.5$ cfs @ 3.4 hrs

Routed Peak Flow in Las Ventanas Dam Outflow Pipe:

$Q_{TOTAL} = (53.0 + 21.4 + 28.7)$ cfs $= 103.1$ cfs @ 1.6 hrs

$Q_{TOTAL} = (7.4 + 29.0 + 76.4)$ cfs $= 112.8$ cfs @ 2.25 hrs ←

$Q_{TOTAL} = (0.7 + 25.6 + 78.5)$ cfs $= 104.8$ cfs @ 3.4 hrs.

BOHANNAN-HUSTON INC.
ALBUQUERQUE — LAS CRUCES — SANTA FE

PROJECT NAME	Tracts B, C, D, & E	SHEET 1	OF 13
PROJECT NO	97213 C01	BY DEB	DATE 11/14/97
SUBJECT	Hydrograph Flowrates	CH'D	DATE

Reach	Routed Flow Entering	Flow in Outfall Pipe	Pipe Dia.	Flow Depth	Condition
Calabacillas to Irving	—	112.8cfs			
Irving to Bisbee Pl. S.D.	7.4cfs	112.8cfs	60"	35.5"	Non-Pressure Flow
Bisbee Pl. S.D. to LVDF #2	29cfs	106.2cfs	54"	37"	Non-Pressure Flow
LVDF #2 to LVDF #1	—	78.5cfs	42"	36.5"	Non-Pressure Flow – flow is 6" from top of pipe – Assuming HGL will rise to top of pipe from wave action.

Conclusion – Peak flows from subdivision (1.6 hrs) have past before peak from LVDF #1 (3.5hrs) enters the Outfall Pipe. Pipe has capacity to carry flows as shown by supporting calculations.

Table 1

Flowrates for Existing and Developed Conditions

Flow Into Las Ventanas Subdivision

EXISTING			DEVELOPED		
Analysis ID	Drainage Area (sq mi)	Flow (cfs)	Analysis ID	Drainage Area (sq mi)	Flow (cfs)
501	.273	135	501.0	.273	432
502.0	.034	20	502.0	.034	76
318A	.043	21	318A	.043	96
319A	.572	215	319A	.572	959
601.0	.020	17	601.0	.020	45
317A	.017	7	317A	.017	38

Flow Out of Las Ventanas Subdivision

EXISTING			DEVELOPED		
Analysis ID	Drainage Area (sq mi)	Flow (cfs)	Analysis ID	Drainage Area (sq mi)	Flow (cfs)
503.4	.739	198	503E.1	.080	115
505.0	.022	20	505.2	2.28	92
320.0	.190	69	320.0	.190	0
314B.2	1.35	38	314BS	.023	34
315B	.047	43	315B.1	.047	39*
602.2	.084	37	602.2	.084	0

*Developed flow = 0 cfs if a retention pond is used in Basin 315B.
Developed flow = 39 cfs if a detention pond is used.

- At the southwest corner of Las Ventanas, offsite flows are routed east down Paseo del Norte as street flows. At the intersection of Paseo del Norte and Universe Boulevard, these street flows are routed north down Universe and added to the North Branch Piedras Marcadas Channel.

- At the intersection of Universe Boulevard and North Branch Piedras Marcadas Channel, the channel increases to 8' deep and flows east 800 feet before discharging to the west side of LVD&R Facility No. 1.

7.3.3 Outfall to the Calabacillas Summary (Includes Las Ventanas Drainage & Recreation Facilities No. 1 and No. 2)

- LVD&R Facility No. 1 is a detention pond with 142 ac-ft of storage that occupies over 34 acres of land. This pond accommodates all of the flows discharged to it from the West Branch Calabacillas Diversion Channel and the North Branch Piedras Marcadas Channel. Total peak inflow in the 100-year storm is 2700 cfs, which is attenuated to a peak outflow of 49 cfs.

- The outfall from Facility No. 1 is a 42" storm drain (Reach 6) that flows north 2250 feet to where it intercepts the outfall of LVD&R Facility No. 2.

- LVD&R Facility No. 2 is a detention pond with a storage of less than 10 ac-ft and accommodates local flows from the region north of LVD&R Facility No. 1. Total peak inflow in the 100-year storm is 294 cfs, which is attenuated to a peak outflow of 32 cfs. This pond outfalls to a 36" pipe (Reach 7) that flows eastward a distance of 150 feet.

- At the confluence of the outfall from LVD&R Facility No. 2, the 42" outfall pipe from LVDR No. 1 increases to a 54" pipe (Reach 8).

- Over a distance of 1500 feet, the 54" pipe gathers local flows from the northeast region of Las Ventanas, crosses Irving Boulevard, and outfalls to the West Branch of the Calabacillas Arroyo.

- The outfall discharges through a drainage easement to the West Branch of the Calabacillas, directly north of the northeast corner of Las Ventanas. This is to be a joint trench with a waterline being installed by New Mexico Utilities, Inc. (NMUI). In addition to the original 25' drainage easement, NMUI has acquired a 20' easement and AMAFCA has dedicated 15', for a total easement width of 60 feet.

- A USBR Type IV baffle-wall energy dissipator is proposed to reduce the velocity of the 91 cfs where it exits to the natural arroyo.

7.4 Development Phasing

Infrastructure and home construction is anticipated to begin in 1996. The current development phasing strategy calls for multiple phases, tentatively starting near the intersection of Paseo del Norte and Rainbow Boulevard and expanding outward from south to north, and west of Universe Boulevard.

7.5 Drainage Infrastructure Phasing

A formal phasing plan for construction of drainage facilities has not yet been devised. Phasing of the infrastructure to support the development is planned to track with lot sales rates.

LVD&R Facility No. 1, the AMAFCA detention pond, is proposed to be built when developed flows exceed the existing playa's storage capacity. Storage of the existing playa without any improvements is estimated from FEMA mapping to be 26 ac-ft.

- ➢ Tributary "A" and Tributary "B" Channels join at a confluence located in the park at the well site. This confluence will need to be analyzed and modeled in the future during design. From here, the channel becomes the North Branch Piedras Marcadas Channel, a 7-foot deep channel.

- ➢ The North Branch Piedras Marcadas Channel flows east across Las Ventanas paralleling an existing water line easement, crossing Rainbow Boulevard and the Loop Road. It travels 3200 feet, gathering local flows and off-site flows from the southwest corner of Las Ventanas before reaching Universe Boulevard.

- ➢ At the intersection of Universe Boulevard and North Branch Piedras Marcadas Channel, the channel increases to 8' deep and flows east 800 feet before discharging to the west side of LVDF No. 1.

7.3.3 Outfall to the Calabacillas Summary (Includes Las Ventanas Drainage Facilities No. 1 and No. 2 and Reaches 6, 7, and 8)

- ➢ LVDF No. 1 is a detention pond with 143 ac-ft of storage that occupies over 34 acres of land. This pond accommodates all of the flows discharged to it from the West Branch Calabacillas Diversion Channel and the North Branch Piedras Marcadas Channel, and will be sized for 5-year sediment accumulation. Total peak inflow in the 100-year storm is 2998 cfs, which is attenuated to a peak outflow of 49 cfs.

- ➢ The outfall from Facility No. 1 is a 42" storm drain (Reach 6) that flows north 2250 feet to where it intercepts the outfall of LVDF No. 2.

- ➢ LVDF No. 2 is a detention pond with a storage of less than 10 ac-ft and accommodates local flows from the region north of LVDF No. 1. Total peak inflow in the 100-year storm is 293 cfs, which is attenuated to a peak outflow of 32 cfs. This pond outfalls to a 36" pipe (Reach 7) that flows eastward a distance of 150 feet.

- At the confluence of the outfall from LVDF No. 2, the 42" outfall pipe from LVDF No. 1 increases to a 60" pipe (utilizing the 60" pipe that was salvaged from Golf Course Road) (Reach 8).

- Over a distance of 1500 feet, the 60" pipe gathers local flows from the northeast region of Las Ventanas, crosses Irving Boulevard, and outfalls to the West Branch of the Calabacillas Arroyo.

- The outfall discharges through a drainage easement to the West Branch of the Calabacillas, directly north of the northeast corner of Las Ventanas. This is to be a joint trench with a waterline being installed by New Mexico Utilities, Inc. (NMUI). In addition to the original 25' drainage easement, NMUI has acquired a 20' easement, and Sandia is obtaining an additional 15' easement for AMAFCA, for a total easement width of 60 feet.

- A USBR Type IV baffle-wall energy dissipator is proposed to reduce the velocity of the 92 cfs flows where it exits to the natural arroyo.

7.4 Development and Infrastructure Phasing

This section describes the anticipated project phasing with respect to the permanent and interior construction of the AMAFCA outfall facilities. The interior drainage facilities are described in a separate report entitled “Las Ventanas Subdivision Interim Drainage Facilities.” Dedication of temporary and permanent easements will occur at platting.

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Las Ventanas Land Treatment Types

Existing Conditions

Basin ID	Percentage Treatment Type A	B	C	D
314B	96	0	2	2
315B	98	0	2	0
316	98	0	2	0
317A	98	0	2	0
317B	98	0	2	0
318A	96	0	2	2
318B	96	0	2	2
319A	98	0	2	0
319B	98	0	2	0
320	98	0	2	0
501	98	0	2	0
502	98	0	2	0
503	98	0	2	0
504	98	0	2	0
505	96	0	4	0
601	98	0	2	0
602	98	0	2	0

Developed Conditions

Basin ID	Percentage Treatment Type A	B	C	D
314BN	10	70	10	10
314BS	10	70	10	10
315B	2	18	20	60
316NW	2	33	15	50
316NE	5	33	15	47
316SW	2	20	18	60
316SE	2	23	10	65
317B	4	20	22	54
317A	7	14	20	59
318A	7	14	20	59
318BE	4	20	25	51
318BW	7	14	20	59
319A	7	14	20	59
319B	5	20	25	50
320	7	22	22	49
501	7	14	20	59
502	7	14	20	59
503E	4	20	30	46
503M	4	20	30	46
503W	4	20	30	46
504E	4	20	30	46
504W	4	20	30	46
505	7	53	20	20
601	7	14	20	59
602	5	18	20	57

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LAS VENTANAS DRAINAGE MASTER PLAN
Basin Time of Concentration Calculations

DEVELOPED CONDITIONS -- Page 2 of 2

Description	Var.	Unit													
Basin			319A	319B	320	501	502	503E	503M	503W	504E	504W	505	601	602
Basin Area		SqMI	0.572	0.023	0.190	0.273	0.034	0.080	0.072	0.141	0.074	0.045	0.022	0.020	0.064
Total Reach	L	Feet	7000.0	1600.0	3000.0	5600.0	1500.0	2000.0	3700.0	4000.0	3700.0	1700.0	600.0	1300.0	4000.0
Overland Reach	L1	Feet	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Overland K	K1		1	1	1	1	1	1	1	1	1	1	1	1	1
Overland Slope	S1	%	2.71	1.45	1.50	1.86	2.40	0.75	0.97	2.40	1.51	2.00	1.67	3.31	2.05
Adj. Overland Slop	S1'	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Gully Reach	L2	Feet	1600.0	1200.0	1600.0	1600.0	1100.0	1600.0	1600.0	1600.0	1600.0	1300.0	200.0	900.0	1600.0
Gully K	K2		2	2	2	2	2	2	2	2	2	2	2	2	2
Gully Slope	S2	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Adj. Gully Slope	S2'	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Arroyo Reach	L3	Feet	5000.0	0.0	1000.0	3600.0	0.0	0.0	1700.0	2000.0	1700.0	0.0	0.0	0.0	2000.0
Arroyo K	K3		3	3	3	3	3	3	3	3	3	3	3	3	3
Arroyo Slope	S3	%	2.710	0.001	1.500	1.860	2.400	0.001	0.970	2.400	1.510	0.001	0.001	0.001	2.050
Adj. Arroyo Slope	S3'	%	2.710	0.001	1.500	1.860	2.400	0.001	0.970	2.400	1.510	0.001	0.001	0.001	2.050
Lca	Lca	Feet	3700.0	0.0	0.0	2800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Base Discharge	Qb	cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ground Slope S	S	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Adjusted Slope S'	S'	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
K	K		2.442	1.600	1.957	2.333	1.579	1.667	2.094	2.143	2.094	1.619	1.200	1.529	2,143
K'	K'		2.442	1.600	1.957	2.333	1.579	1.667	2.094	2.143	2.094	1.619	1.200	1.529	2.143
K''	K''		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K'''	K'''		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kn	Kn		0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.055	0.033	0.033	0.033	0.055
Orig. TC	TC	Hrs.	0.436	0.231	0.348	0.426	0.170	0.385	0.498	0.335	0.399	0.206	0.107	0.130	0.362
Adjusted TC	TC'	Hrs.	0.436	0.231	0.348	0.426	0.170	0.385	0.498	0.335	0.399	0.206	0.107	0.130	0.362
Time Lag	Lg	Hrs.	-	-	-	-	-.133	-	-	-	-	-	-.133	-.133	-
Time to Peak	TP	Hrs.	0.291	0.154	0.232	0.284	~~0.114~~	0.257	0.332	0.223	0.266	0.137	~~0.072~~	~~0.087~~	0.241

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IX. PRINCIPAL SPILLWAY DESIGN

The principal spillway for LVDD will be located along the east embankment of the dam. At the inlet of the spillway will be an 12' high concrete riser tower feeding a 42" diameter concrete cylinder pipe principal spillway with an invert elevation of 5395.00. A 32" orifice plate attached to the front of the 42" outfall pipe will limit flow from the facility to a maximum of 79 cfs during the 100-year storm and 89 cfs during the ½ PMF (see Appendix IV for riser and orifice design calculations).

The concrete cylinder principal spillway pipe will have an average slope of 1.24% over 169 feet and will be connected to a downstream manhole (manhole #2). At this manhole the outfall will turn north toward the Calabacillas Arroyo. The outfall downstream of this manhole will be reinforced concrete pipe (RCP). Seven anti-seep collars will be constructed around the concrete cylinder pipe at twenty foot intervals to prevent piping (concentrated seepage) along the conduit. The seepage collars will extend 24" beyond the outside of the concrete cylinder pipe or to basalt if the pipe lies within the basalt layer.

X. OUTFALL TO CALABACILLAS ARROYO

The outfall pipe to the West Branch of the Calabacillas Arroyo is divided into three distinct reaches: Reach #6, #7 and #8 (see "Plans for Construction of Las Ventanas Detention Dam Outfall ", BHI, June 1996 for details).

Reach #8 consists of 42" Class III, RCP at a constant slope of 0.56% from station 40+00, just north of manhole #11, to manhole #8 at station 26+07.43 (see Appendix V for Pipe Class Calculations for each reach). The outfall pipe from the detention dam will connect to Reach #8 at the stubout north of manhole #11.

Reach #7 will carry flow from the LVDD #2 to manhole #8 and will be designed and constructed at a later date.

Reach #6 consists of Class III, RCP ranging in size from 54 to 66 inches. This reach carries the combined flow from the LVDD and LVDF #2, as well as runoff from the future extension of Irving Boulevard, into the West Branch of the Calabacillas Arroyo. The pipe slope of Reach #6 varies from 0.43% to 0.60% from manhole #8 to manhole #2 at station 13+80. It then drops steeply at a slope of 15.54% to manhole #1 located at the top slope of the West Branch of the Calabacillas Arroyo at station 12+52. Reach #6 continues to drop at a slope of 22.59% from manhole #1 to the outfall located at the base of the arroyo. Erosion is controlled at the outfall by a 6' thick derrick stone apron. Hydraulic grade lines were calculated for Reach #6 and #8 using a spreadsheet program (see Appendix VI), the results of which are shown on the construction plans. A summary of the pertinent pipe parameters and flows for Reach #6, #7 and #8 are shown in Table 2.

TABLE 2
PIPE DATA FOR REACH #6, #7, AND #8

Reach #	Pipe Size(s)	Type & Class	Slope	Length	100-Year Flow
6	54" to 66"	RCP, Class III	0.43% to 22.59%	1523.43 ft.	149 cfs
7	TBD*	TBD	TBD	TBD	32 cfs
8	41"	RCP, Class III	0.56%	1392.57 ft.	73 cfs

* *Pipe size, type, class and length of Reach #7 will be determined at a later date when LVDF #2 is designed.*

A. OUTFALL ENERGY DISSIPATION AND EROSION CONTROL

Due to the steep slope of the outfall pipe entering the West Branch of the Calabacillas Arroyo, a dumped rock outlet apron is necessary to minimize erosion in the arroyo. The dumped rock outlet apron will consist of derrick stone approximately 6' deep and 40' wide by 37.5 fee long (see construction plans for details).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
4	Station	Structure	Diam	Q	Area	Vel	K	Sf	Length		Dia	Angle		Hf	Hb	Hj	Hmh	Ht	Losses	HGL(dn)	HGL(up)	Point	HV	EGL(dn)	EGL(up)
5																									
6	10+84	OUTLET									0	0			0.00	0.00	0.00	0.00	0.00		5327.18	5327.18	0.61	5327.79	5327.79
7			66	149	23.76	6.27	3358	0.0020	12.00					0.02					0.02						
8	11+00	VERT. BEND									5.5	13			0.01	0.00	0.01	0.00	0.02	5327.20	5327.22	5327.5	0.61	5327.81	5327.83
9			66	149	23.76	6.27	3358	0.0020	152.00					0.30					0.30						
10	12+52	MH #1									8	23			0.06	0.00	0.03	0.00	0.09	5357.67	5357.67	5371.04	0.61	5358.28	5358.28
11			66	149	23.76	6.27	3358	0.0020	128.01					0.25					0.25						
12	13+80	MH #2									8	0			0.00	0.00	0.03	0.00	0.03	5377.65	5377.65	5391.23	0.61	5378.26	5378.26
13			66	149	23.76	6.27	3358	0.0020	183.47					0.36					0.36						
14	15+63.47	MH #3									8	90			0.15	0.00	0.04	0.01	0.19	5380.93	5380.65	5394.01	0.89	5381.54	5381.54
15			60	149	19.63	7.59	2604	0.0033	94.86					0.31					0.31						
16	16+58.32	MH #4									8	54			0.11	0.00	0.03	0.00	0.14	5380.96	5381.49	5392.01	0.51	5381.85	5382.00
17			60	112	19.63	5.70	2604	0.0018	70.59					0.13					0.13						
18	17+28.91	MH #5									8	10			0.03	0.00	0.03	0.00	0.06	5382.61	5381.90	5391.57	0.51	5382.13	5382.18
19			60	112	19.63	5.70	2604	0.0018	206.73					0.38					0.38						
20	19+35.63	MH #6									8	10			0.04	0.00	0.03	0.01	0.08	5382.06	5381.88	5390.08	0.77	5382.57	5382.65
21			54	112	15.90	7.04	1966	0.0032	335.56					1.09					1.09						
22	22+71.18	MH #7									8	0			0.00	0.00	0.04	0.00	0.04	5382.96	5383.00	5388.45	0.77	5383.73	5383.77
23			54	112	15.90	7.04	1966	0.0032	336.25					1.09					1.09						
24	26+07.43	MH #8									8	0			0.00	0.00	0.05	0.01	0.05	5384.09	5383.84	5390.01	1.07	5384.86	5384.91
25			42	80	9.62	8.32	1006	0.0063	500.00					3.16					3.16						
26	31+07.43	MH #9									8	10			0.07	0.00	0.05	0.00	0.13	5387.00	5387.13	5397.15	1.07	5388.08	5388.20
27			42	80	9.62	8.32	1006	0.0063	433.95					2.74					2.74						
28	35+41.37	MH #10									8	10			0.07	0.00	0.05	0.00	0.13	5389.87	5390.00	5401.01	1.07	5390.94	5391.07
29			42	80	9.62	8.32	1006	0.0063	491.47					3.11					3.11						
30	40+32.84	MH #11									8	10			0.07	0.00	0.05	0.00	0.13	5393.10	5393.23	5401.78	1.07	5394.18	5394.30
31			42	80	9.62	8.32	1006	0.0063	500.00					3.16					3.16						
32	45+32.84	MH #12									8	45			0.15	0.00	0.05	0.00	0.21	5396.39	5396.60	5402.23	1.07	5397.46	5397.67
33			42	80	9.62	8.32	1006	0.0063	12.00					0.08					0.08						
34	45+48.84	E.O.P.									0	0			0.00	0.00	0.00	0.00	0.00	5396.67	5397.75	5402.23	0.00	5397.75	5397.75
35			42	0.000	9.62	0.00	1006	0.0000	0.00					0.00					0.00						
36																									
37																									

Table 1

Flowrates for Existing and Developed Conditions

Flow Into Las Ventanas Subdivision

EXISTING			DEVELOPED		
Analysis ID	Drainage Area (sq mi)	Flow (cfs)	Analysis ID	Drainage Area (sq mi)	Flow (cfs)
501	.273	135	501.0	.273	432
502.0	.034	20	502.0	.034	76
318A	.043	21	318A	.043	96
319A	.572	215	319A	.572	959
601.0	.020	17	601.0	.020	45
317A	.017	7	317A	.017	38

Flow Out of Las Ventanas Subdivision

EXISTING			DEVELOPED		
Analysis ID	Drainage Area (sq mi)	Flow (cfs)	Analysis ID	Drainage Area (sq mi)	Flow (cfs)
503.4	.739	198	503E.1	.080	115
505.0	.022	20	505.2	2.28	92
320.0	.190	69	320.0	.190	0
314B.2	1.35	38	314BS	.023	34
315B	.047	43	315B.1	.047	39*
602.2	.084	37	602.2	.084	0

*Developed flow = 0 cfs if a retention pond is used in Basin 315B.
Developed flow = 39 cfs if a detention pond is used.

- At the southwest corner of Las Ventanas, offsite flows are routed east down Paseo del Norte as street flows. At the intersection of Paseo del Norte and Universe Boulevard, these street flows are routed north down Universe and added to the North Branch Piedras Marcadas Channel.

- At the intersection of Universe Boulevard and North Branch Piedras Marcadas Channel, the channel increases to 8' deep and flows east 800 feet before discharging to the west side of LVD&R Facility No. 1.

7.3.3 Outfall to the Calabacillas Summary (Includes Las Ventanas Drainage & Recreation Facilities No. 1 and No. 2)

- LVD&R Facility No. 1 is a detention pond with 142 ac-ft of storage that occupies over 34 acres of land. This pond accommodates all of the flows discharged to it from the West Branch Calabacillas Diversion Channel and the North Branch Piedras Marcadas Channel. Total peak inflow in the 100-year storm is 2700 cfs, which is attenuated to a peak outflow of 49 cfs.

- The outfall from Facility No. 1 is a 42" storm drain (Reach 6) that flows north 2250 feet to where it intercepts the outfall of LVD&R Facility No. 2.

- LVD&R Facility No. 2 is a detention pond with a storage of less than 10 ac-ft and accommodates local flows from the region north of LVD&R Facility No. 1. Total peak inflow in the 100-year storm is 294 cfs, which is attenuated to a peak outflow of 32 cfs. This pond outfalls to a 36" pipe (Reach 7) that flows eastward a distance of 150 feet.

- At the confluence of the outfall from LVD&R Facility No. 2, the 42" outfall pipe from LVDR No. 1 increases to a 54" pipe (Reach 8).

- Over a distance of 1500 feet, the 54" pipe gathers local flows from the northeast region of Las Ventanas, crosses Irving Boulevard, and outfalls to the West Branch of the Calabacillas Arroyo.

- The outfall discharges through a drainage easement to the West Branch of the Calabacillas, directly north of the northeast corner of Las Ventanas. This is to be a joint trench with a waterline being installed by New Mexico Utilities, Inc. (NMUI). In addition to the original 25' drainage easement, NMUI has acquired a 20' easement and AMAFCA has dedicated 15', for a total easement width of 60 feet.

- A USBR Type IV baffle-wall energy dissipator is proposed to reduce the velocity of the 91 cfs where it exits to the natural arroyo.

7.4 Development Phasing

Infrastructure and home construction is anticipated to begin in 1996. The current development phasing strategy calls for multiple phases, tentatively starting near the intersection of Paseo del Norte and Rainbow Boulevard and expanding outward from south to north, and west of Universe Boulevard.

7.5 Drainage Infrastructure Phasing

A formal phasing plan for construction of drainage facilities has not yet been devised. Phasing of the infrastructure to support the development is planned to track with lot sales rates.

LVD&R Facility No. 1, the AMAFCA detention pond, is proposed to be built when developed flows exceed the existing playa's storage capacity. Storage of the existing playa without any improvements is estimated from FEMA mapping to be 26 ac-ft.

- Tributary "A" and Tributary "B" Channels join at a confluence located in the park at the well site. This confluence will need to be analyzed and modeled in the future during design. From here, the channel becomes the North Branch Piedras Marcadas Channel, a 7-foot deep channel.

- The North Branch Piedras Marcadas Channel flows east across Las Ventanas paralleling an existing water line easement, crossing Rainbow Boulevard and the Loop Road. It travels 3200 feet, gathering local flows and off-site flows from the southwest corner of Las Ventanas before reaching Universe Boulevard.

- At the intersection of Universe Boulevard and North Branch Piedras Marcadas Channel, the channel increases to 8' deep and flows east 800 feet before discharging to the west side of LVDF No. 1.

7.3.3 Outfall to the Calabacillas Summary (Includes Las Ventanas Drainage Facilities No. 1 and No. 2 and Reaches 6, 7, and 8)

- LVDF No. 1 is a detention pond with 143 ac-ft of storage that occupies over 34 acres of land. This pond accommodates all of the flows discharged to it from the West Branch Calabacillas Diversion Channel and the North Branch Piedras Marcadas Channel, and will be sized for 5-year sediment accumulation. Total peak inflow in the 100-year storm is 2998 cfs, which is attenuated to a peak outflow of 49 cfs.

- The outfall from Facility No. 1 is a 42" storm drain (Reach 6) that flows north 2250 feet to where it intercepts the outfall of LVDF No. 2.

- LVDF No. 2 is a detention pond with a storage of less than 10 ac-ft and accommodates local flows from the region north of LVDF No. 1. Total peak inflow in the 100-year storm is 293 cfs, which is attenuated to a peak outflow of 32 cfs. This pond outfalls to a 36" pipe (Reach 7) that flows eastward a distance of 150 feet.

- At the confluence of the outfall from LVDF No. 2, the 42" outfall pipe from LVDF No. 1 increases to a 60" pipe (utilizing the 60" pipe that was salvaged from Golf Course Road) (Reach 8).

- Over a distance of 1500 feet, the 60" pipe gathers local flows from the northeast region of Las Ventanas, crosses Irving Boulevard, and outfalls to the West Branch of the Calabacillas Arroyo.

- The outfall discharges through a drainage easement to the West Branch of the Calabacillas, directly north of the northeast corner of Las Ventanas. This is to be a joint trench with a waterline being installed by New Mexico Utilities, Inc. (NMUI). In addition to the original 25' drainage easement, NMUI has acquired a 20' easement, and Sandia is obtaining an additional 15' easement for AMAFCA, for a total easement width of 60 feet.

- A USBR Type IV baffle-wall energy dissipator is proposed to reduce the velocity of the 92 cfs flows where it exits to the natural arroyo.

7.4 Development and Infrastructure Phasing

This section describes the anticipated project phasing with respect to the permanent and interior construction of the AMAFCA outfall facilities. The interior drainage facilities are described in a separate report entitled "Las Ventanas Subdivision Interim Drainage Facilities." Dedication of temporary and permanent easements will occur at platting.

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Las Ventanas Land Treatment Types

Existing Conditions

Basin ID	Percentage Treatment Type A	B	C	D
314B	96	0	2	2
315B	98	0	2	0
316	98	0	2	0
317A	98	0	2	0
317B	98	0	2	0
318A	96	0	2	2
318B	96	0	2	2
319A	98	0	2	0
319B	98	0	2	0
320	98	0	2	0
501	98	0	2	0
502	98	0	2	0
503	98	0	2	0
504	98	0	2	0
505	96	0	4	0
601	98	0	2	0
602	98	0	2	0

Developed Conditions

Basin ID	Percentage Treatment Type A	B	C	D
314BN	10	70	10	10
314BS	10	70	10	10
315B	2	18	20	60
316NW	2	33	15	50
316NE	5	33	15	47
316SW	2	20	18	60
316SE	2	23	10	65
317B	4	20	22	54
317A	7	14	20	59
318A	7	14	20	59
318BE	4	20	25	51
318BW	7	14	20	59
319A	7	14	20	59
319B	5	20	25	50
320	7	22	22	49
501	7	14	20	59
502	7	14	20	59
503E	4	20	30	46
503M	4	20	30	46
503W	4	20	30	46
504E	4	20	30	46
504W	4	20	30	46
505	7	53	20	20
601	7	14	20	59
602	5	18	20	57

LAS VENTANAS DRAINAGE MASTER PLAN
Basin Time of Concentration Calculations

DEVELOPED CONDITIONS -- Page 2 of 2

Description	Var.	Unit													
Basin			319A	319B	320	501	502	503E	503M	503W	504E	504W	505	601	602
Basin Area		SqMI	0.572	0.023	0.190	0.273	0.034	0.080	0.072	0.141	0.074	0.045	0.022	0.020	0.064
Total Reach	L	Feet	7000.0	1600.0	3000.0	5600.0	1500.0	2000.0	3700.0	4000.0	3700.0	1700.0	600.0	1300.0	4000.0
Overland Reach	L1	Feet	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Overland K	K1		1	1	1	1	1	1	1	1	1	1	1	1	1
Overland Slope	S1	%	2.71	1.45	1.50	1.86	2.40	0.75	0.97	2.40	1.51	2.00	1.67	3.31	2.05
Adj. Overland Slop	S1'	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Gully Reach	L2	Feet	1600.0	1200.0	1600.0	1600.0	1100.0	1600.0	1600.0	1600.0	1600.0	1300.0	200.0	900.0	1600.0
Gully K	K2		2	2	2	2	2	2	2	2	2	2	2	2	2
Gully Slope	S2	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Adj. Gully Slope	S2'	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Arroyo Reach	L3	Feet	5000.0	0.0	1000.0	3600.0	0.0	0.0	1700.0	2000.0	1700.0	0.0	0.0	0.0	2000.0
Arroyo K	K3		3	3	3	3	3	3	3	3	3	3	3	3	3
Arroyo Slope	S3	%	2.710	0.001	1.500	1.860	2.400	0.001	0.970	2.400	1.510	0.001	0.001	0.001	2.050
Adj. Arroyo Slope	S3'	%	2.710	0.001	1.500	1.860	2.400	0.001	0.970	2.400	1.510	0.001	0.001	0.001	2.050
Lca	Lca	Feet	3700.0	0.0	0.0	2800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Base Discharge	Qb	cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ground Slope S	S	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
Adjusted Slope S'	S'	%	2.710	1.450	1.500	1.860	2.400	0.750	0.970	2.400	1.510	2.000	1.670	3.310	2.050
K	K		2.442	1.600	1.957	2.333	1.579	1.667	2.094	2.143	2.094	1.619	1.200	1.529	2,143
K'	K'		2.442	1.600	1.957	2.333	1.579	1.667	2.094	2.143	2.094	1.619	1.200	1.529	2.143
K"	K"		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K'"	K'"		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kn	Kn		0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.055	0.033	0.033	0.033	0.055
Orig. TC	TC	Hrs.	0.436	0.231	0.348	0.426	0.170	0.385	0.498	0.335	0.399	0.206	0.107	0.130	0.362
Adjusted TC	TC'	Hrs.	0.436	0.231	0.348	0.426	0.170	0.385	0.498	0.335	0.399	0.206	0.107	0.130	0.362
Time Lag	Lg	Hrs.	-	-	-	-	-.133	-	-	-	-	-	-.133	-.133	-
Time to Peak	TP	Hrs.	0.291	0.154	0.232	0.284	~~0.114~~	0.257	0.332	0.223	0.266	0.137	~~0.072~~	~~0.087~~	0.241

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IX. PRINCIPAL SPILLWAY DESIGN

The principal spillway for LVDD will be located along the east embankment of the dam. At the inlet of the spillway will be an 12' high concrete riser tower feeding a 42" diameter concrete cylinder pipe principal spillway with an invert elevation of 5395.00. A 32" orifice plate attached to the front of the 42" outfall pipe will limit flow from the facility to a maximum of 79 cfs during the 100-year storm and 89 cfs during the ½ PMF (see Appendix IV for riser and orifice design calculations).

The concrete cylinder principal spillway pipe will have an average slope of 1.24% over 169 feet and will be connected to a downstream manhole (manhole #2). At this manhole the outfall will turn north toward the Calabacillas Arroyo. The outfall downstream of this manhole will be reinforced concrete pipe (RCP). Seven anti-seep collars will be constructed around the concrete cylinder pipe at twenty foot intervals to prevent piping (concentrated seepage) along the conduit. The seepage collars will extend 24" beyond the outside of the concrete cylinder pipe or to basalt if the pipe lies within the basalt layer.

X. OUTFALL TO CALABACILLAS ARROYO

The outfall pipe to the West Branch of the Calabacillas Arroyo is divided into three distinct reaches: Reach #6, #7 and #8 (see "Plans for Construction of Las Ventanas Detention Dam Outfall ", BHI, June 1996 for details).

Reach #8 consists of 42" Class III, RCP at a constant slope of 0.56% from station 40+00, just north of manhole #11, to manhole #8 at station 26+07.43 (see Appendix V for Pipe Class Calculations for each reach). The outfall pipe from the detention dam will connect to Reach #8 at the stubout north of manhole #11.

Reach #7 will carry flow from the LVDD #2 to manhole #8 and will be designed and constructed at a later date.

Reach #6 consists of Class III, RCP ranging in size from 54 to 66 inches. This reach carries the combined flow from the LVDD and LVDF #2, as well as runoff from the future extension of Irving Boulevard, into the West Branch of the Calabacillas Arroyo. The pipe slope of Reach #6 varies from 0.43% to 0.60% from manhole #8 to manhole #2 at station 13+80. It then drops steeply at a slope of 15.54% to manhole #1 located at the top slope of the West Branch of the Calabacillas Arroyo at station 12+52. Reach #6 continues to drop at a slope of 22.59% from manhole #1 to the outfall located at the base of the arroyo. Erosion is controlled at the outfall by a 6' thick derrick stone apron. Hydraulic grade lines were calculated for Reach #6 and #8 using a spreadsheet program (see Appendix VI), the results of which are shown on the construction plans. A summary of the pertinent pipe parameters and flows for Reach #6, #7 and #8 are shown in Table 2.

TABLE 2
PIPE DATA FOR REACH #6, #7, AND #8

Reach #	Pipe Size(s)	Type & Class	Slope	Length	100-Year Flow
6	54" to 66"	RCP, Class III	0.43% to 22.59%	1523.43 ft.	149 cfs
7	TBD*	TBD	TBD	TBD	32 cfs
8	41"	RCP, Class III	0.56%	1392.57 ft.	73 cfs

* *Pipe size, type, class and length of Reach #7 will be determined at a later date when LVDF #2 is designed.*

A. OUTFALL ENERGY DISSIPATION AND EROSION CONTROL

Due to the steep slope of the outfall pipe entering the West Branch of the Calabacillas Arroyo, a dumped rock outlet apron is necessary to minimize erosion in the arroyo. The dumped rock outlet apron will consist of derrick stone approximately 6' deep and 40' wide by 37.5 fee long (see construction plans for details).

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
Station	Structure	Diam.	Q	Area	Vel.	K	Sf	Length		Dia.	Angle		Hf	Hb	Hj	Hmh	Ht	Losses	HGL(dn)	HGL(up)	Point	HV	EGL(dn)	EGL(up)
10+84	OUTLET									0	0			0.00	0.00	0.00	0.00	0.00		5327.18	5327.18	0.61	5327.79	5327.79
		66	149	23.76	6.27	3358	0.0020	12.00					0.02					0.02						
11+00	VERT. BEND									5.5	13			0.01	0.00	0.01	0.00	0.02	5327.20	5327.22	5327.5	0.61	5327.81	5327.83
		66	149	23.76	6.27	3358	0.0020	152.00					0.30					0.30						
12+52	MH #1									8	23			0.06	0.00	0.03	0.00	0.09	5357.67	5357.67	5371.04	0.61	5358.28	5358.28
		66	149	23.76	6.27	3358	0.0020	128.01					0.25					0.25						
13+80	MH #2									8	0			0.00	0.00	0.03	0.00	0.03	5377.65	5377.65	5391.23	0.61	5378.26	5378.26
		66	149	23.76	6.27	3358	0.0020	183.47					0.36					0.36						
15+63.47	MH #3									8	90			0.15	0.00	0.04	0.01	0.19	5380.93	5380.65	5394.01	0.89	5381.54	5381.54
		60	149	19.63	7.59	2604	0.0033	94.86					0.31					0.31						
16+58.32	MH #4									8	54			0.11	0.00	0.03	0.00	0.14	5380.96	5381.49	5392.01	0.51	5381.85	5382.00
		60	112	19.63	5.70	2604	0.0018	70.59					0.13					0.13						
17+28.91	MH #5									8	10			0.03	0.00	0.03	0.00	0.06	5382.61	5381.90	5391.57	0.51	5382.13	5382.18
		60	112	19.63	5.70	2604	0.0018	206.73					0.38					0.38						
19+35.63	MH #6									8	10			0.04	0.00	0.03	0.01	0.08	5382.06	5381.88	5390.08	0.77	5382.57	5382.65
		54	112	15.90	7.04	1966	0.0032	335.56					1.09					1.09						
22+71.18	MH #7									8	0			0.00	0.00	0.04	0.00	0.04	5382.96	5383.00	5388.45	0.77	5383.73	5383.77
		54	112	15.90	7.04	1966	0.0032	336.25					1.09					1.09						
26+07.43	MH #8									8	0			0.00	0.00	0.05	0.01	0.05	5384.09	5383.84	5390.01	1.07	5384.86	5384.91
		42	80	9.62	8.32	1006	0.0063	500.00					3.16					3.16						
31+07.43	MH #9									8	10			0.07	0.00	0.05	0.00	0.13	5387.00	5387.13	5397.15	1.07	5388.08	5388.20
		42	80	9.62	8.32	1006	0.0063	433.95					2.74					2.74						
35+41.37	MH #10									8	10			0.07	0.00	0.05	0.00	0.13	5389.87	5390.00	5401.01	1.07	5390.94	5391.07
		42	80	9.62	8.32	1006	0.0063	491.47					3.11					3.11						
40+32.84	MH #11									8	10			0.07	0.00	0.05	0.00	0.13	5393.10	5393.23	5401.78	1.07	5394.18	5394.30
		42	80	9.62	8.32	1006	0.0063	500.00					3.16					3.16						
45+32.84	MH #12									8	45			0.15	0.00	0.05	0.00	0.21	5396.39	5396.60	5402.23	1.07	5397.46	5397.67
		42	80	9.62	8.32	1006	0.0063	12.00					0.08					0.08						
45+48.84	E.O.P.									0	0			0.00	0.00	0.00	0.00	0.00	5396.67	5397.75	5402.23	0.00	5397.75	5397.75
		42	0.000	9.62	0.00	1006	0.0000	0.00					0.00					0.00						