CITY OF ALBUQUERQUE

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September 24, 2004

Yolanda Padilla, PE
Bohannan Huston, Inc
7500 Jefferson NE
Albuquerque, NM 87109

Re: Ventana Townhomes @ VR Drainage Report
Engineer's Stamp dated 8-19-04, (B10/D3G)

Dear Ms. Padilla,

Based upon the information provided in your submittal dated 8-26-04, the above referenced report is approved for Preliminary Plat action by the DRB. Once that board has approved the plan, please submit a mylar copy for my signature in order to obtain Grading Permit.

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

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

Sincerely,

Bradley L. Bingham

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

C: Chuck Caruso, CoA
file

P.O. Box 1293

Albuquerque

New Mexico 87103

www.cabq.gov

DRAINAGE REPORT
FOR
VENTANA TOWNHOMES AT VENTANA RANCH

AUGUST 19, 2004

Prepared for:

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

Prepared by:

BOHANNAN HUSTON, INC.
COURTYARD I
7500 JEFFERSON STREET NE
ALBUQUERQUE, NM 87109

PREPARED BY:

Rudolph P. Archuleta 8/19/2004

Rudolph P. Archuleta, E.I. **Date**

UNDER THE SUPERVISION OF:

Yolanda Padilla 8/19/04

Yolanda Padilla, P.E. **Date**

YOLANDA O. PADILLA
NEW MEXICO
16035
LICENSED PROFESSIONAL ENGINEER

Bohannan Huston INC.

TABLE OF CONTENTS

APPENDICES

EXHIBITS

I. PURPOSE

The purpose of this report is to present the drainage management plan for Ventana Townhomes at Ventana Ranch (Tract A-1-B) and to obtain approval of the preliminary/final plat and grading plan by the Development Review Board (DRB). The proposed development consists of 51 attached residential lots (fourplexes, triplexes, and duplexes) on approximately 6.91 acres.

II. METHODOLOGIES

Drainage conditions were analyzed utilizing 10-year and 100-year, 6-hour storm event in accordance with the City of Albuquerque Drainage Ordinance and the Development Process Manual (DPM) Volume 2, Design Criteria, Section 22.2, Hydrology, for the City of Albuquerque, January 1993.

This site, as described in the 'Site Location and Characteristics' section below, is approximately 6.91 acres. Therefore, Part A of the DPM, Section 22.2 was used, which provides a simplified procedure for projects with sub-basins smaller than 40 acres.

This report will reference the following City of Albuquerque and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) approved studies prepared for the Ventana Ranch Subdivision development.

1) *Las Ventanas Subdivision Drainage Master Plan*, dated April 1995
2) *Final Design Analysis Report for the Las Ventanas Detention Dam and Outfall Pipe*
3) *Drainage Report for Sedona Subdivision Tract C at Ventana Ranch*, dated October 1999
4) *Drainage Report for Ventana Ranch Apartments*, dated January 2004

The *Las Ventanas Subdivision Drainage Master Plan*, (LVDMP) prepared by Bohannan Huston (originally dated April 1995 and updated October 1995).dated April 1995 (hereafter referred to as the LVSDMP), was prepared to summarize the findings of a hydrologic analysis of existing and developed drainage conditions for the proposed Las Ventanas Subdivision and formulates a drainage master plan for the development of the property. The report evaluated

drainage in Las Ventanas Subdivision based on the Piedras Marcadas Hydrologic model prepared by Molzen-Corbin & Associates in 1993, and provided a conceptual plan for drainage in order to determine drainage facilities sizes and total costs. In addition, it provided drainage outfall alternatives for the Las Ventanas Subdivision. Additional information was provided in "The Final Addendum No. 4 for The Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities" prepared by Bohannan Huston dated December 1997. This report identifies downstream drainage improvements and confirms that the storm drain hydraulics for the North Outfall or the West Branch Calabacillas Storm Drain Diversion presented in Addendum 3, have not been changed. The developed flows from this tract will ultimately drain into the West Branch Calabacillas Storm Drain.

The *Final Design Analysis Report for the Las Ventanas Detention Dam and Outfall Pipe*, was prepared by Bohannan Huston and was utilized for the design of drainage facilities by AMAFCA. It details the spillway for the dam, the outfall pipe to the Calabacillas Arroyo, the outfall energy dissipation, and erosion control.

The *Drainage Report for Sedona Subdivision Tract C at Ventana Ranch*, was prepared by Easterling & Associates. This report outlines the drainage concepts for the Cantabella subdivision Unit 1 located directly north and downstream of Cantabella Units 2 and 3. During the development of this subdivision, a storm drain was designed and built to accommodate the drainage from the northern portion of Cantabella Units 2 and 3 and storm drain lines were extended into Unit 2.

The *Drainage Report for Ventana Ranch Apartments*, was prepared by Isaacson & Arfman, P.A. This report details the drainage conditions for Ventana Ranch Apartments. A detention pond was built with this project that allows flow to discharge at a controlled rate into the two-pond system within the Ventana Townhomes.

III. SITE LOCATION AND CHARACTERISTICS

Ventana Ranch is a 940-acre development located west of Paradise Hills between Paseo del Norte and Irving Boulevards. Tract A-1-B is bound by Universe Blvd. and the Country

Meadows Subdivision to the west, the Ventana Ranch Apartments to the north, a proposed park Tract A-1-A to the northeast, and Ventana Road, Cantabella Subdivision Units II and III to the south. The site will be accessible from existing Ventana Road.

IV. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

For additional assistance throughout this portion of the report, please refer to the Existing Drainage Basin Map enclosed in the Exhibit section of this report.

In its existing condition, Tract A-1-B consists of mass graded terrain with slopes ranging from 5% to less than 1%. There is one existing onsite basin, Basin A and one offsite basin, Basin 1 offsite. The soils within existing Basins A and 1 have a Hydrologic Soil Group (HSG) classification of Type "A". Soils with a Type "A" classification are known to have high infiltration and low runoff characteristics. The runoff generated from the existing onsite Basin A (6.91 acres, Q_{100}=19.80 cfs) and Basin 1 (0.30 acres, Q_{100}=0.86 cfs) flows to an existing earthen retention pond. There are no recognized FEMA Floodplains within the proposed development.

V. DEVELOPED HYDRAULIC AND HYDROLOGIC CONDITIONS

For additional assistance throughout this portion of the report, please refer to the Proposed Drainage Basin Map and the Grading and Drainage Plan enclosed in the Exhibit section of this report.

This site will utilize many drainage schemes, which include storm drain, ribbon channels and a dual pond system. Ultimately, all runoff will be conveyed into the pond system. The pond will have a controlled discharge to an existing storm drain within Ventana Road which carries flow to the Little Window Dam.

A. On-Site Basins

The proposed site is comprised of two basins, one large basin and an adjoining smaller basin to the northeast. The large basin has been broken into nine (9) basins. Four (4) of the nine basins have been divided into sub-basins for hydraulic analysis reasons. The major basins are discussed below.

Basin A-1 (1.06 ac, Q_{100} = 4.02 cfs) encompasses lots 29-31, 33-36 and 38, approximately half of lots 32 and 37, and the northern half of Los Pueblos from the west cul-de-sac to Basin E. Basin B-1 (1.13 ac, Q_{100} = 4.29 cfs) encompasses lots 11, 14-15 and 22-28 to the back of the pad, lots 17-21 to the front of the pad, half of lots 12,13 and 16, and the southern half of Los Pueblos from the west cul-de-sac to Basin E. Basin F (0.14 ac, Q_{100} = 0.61 cfs) encompasses the west cul-de-sac. Basin H discharges flow (Q_{100} = 0.72 cfs) into Los Pueblos and will be discussed further in the Off-Site Basins section. The combined flow (Q_{100} = 9.64) cfs from Basin A-1, Basin B-1, Basin F and Basin H is conveyed by standard curb and gutter east to the low point in Los Pueblos and captured by the inlet on the north side of the street, ultimately discharging into Pond 1.

Basin A-2 (Q_{100} = 0.12 cfs) contains lot 32. The flow from basin A-2 is directed east to lot 33 via backyard swale and enters through a turn block. A five foot drainage easement runs across the backyard and along the east property line of Lot 33 and conveys the flow to Los Pueblos. Similarly, Basin A-3 (Q_{100} = 0.12 cfs) drains to Lot 38. Flow is conveyed along a five foot easement across Lot 38 to a turn block on the east property line and drains to Pond 1 via five foot cobble rundown. The flow from Basin A-2 and A-3 travels east and is collected by the inlet on the north half of the street, ultimately discharging into Pond 1.

Basin C-1 (0.88 ac, Q_{100} = 3.35 cfs) encompasses lots 39, 42-45, 47-48 and 51 to the back of the pad, half of lots 40-41, 46 and 49-50 and the north half of Los Pueblos from the east cul-de-sac to Basin E. Basin D-1 (0.64 ac, Q_{100} = 2.43 cfs) encompasses lots 1, 3-4, 7-8 and 10 to the back of the pad, half of lots 2, 5-6 and 9 and the south half of Los Pueblos from the east cul-de-sac to Basin E. Basin G (0.16 ac, Q_{100} = 0.69 cfs) encompasses the east cul-de-sac. Basin I discharges flow (Q_{100} = 0.37 cfs) into Los Pueblos and will be discussed further in the Off-Site Basins section. The combined flow (Q_{100} = 6.84 cfs) from Basin C-1, Basin D-1, Basin G and Basin I will travel west on

Los Pueblos, be collected by the inlet on the north half of the street, and discharge into Pond 1.

Basin B-2 (0.10 ac, Q_{100} = 0.37 cfs) contains the backyards of lots 24-28. Basin B-3 (0.58 ac, Q_{100} = 2.20 cfs) contains lots 17-21 from the front of the pad to the back property line, half of lots 12, 13 and 16, and the backyards of lots 11, 14-15 and 22-23. The flow from lots 24-26 drains to a ribbon channel along the back property line and exits through a turned block in the south east corner of lot 24 into Ventana Road, where it is captured downstream by existing inlets. The remaining flow from Basin B-2 and all flow from Basin B-3 enters Ventana Road through turn blocks located within each lot. Similarly, the flow is captured downstream by existing inlets.

Basin C-2 (0.36 ac, Q_{100} = 1.37 cfs) contains half of lots 40-41, 46 and 49-50, and the backyards of lots 39, 42-45, 47-48, and 51. The flow from Basin C-2 drains to a ribbon channel along the back property line and will be captured by a type "D" inlet at the southwest corner of lot 39 and discharge via storm drain into Pond 1.

Basin D-2 (0.25 ac, Q_{100} = 0.94 cfs) contains half of lots 2, 5-6 and 9, and the backyards of lots 1, 3-4, 7-8 and 10. The flow from Basin D-2 drains to Ventana Road through turn blocks located within each lot and is captured downstream by existing inlets.

All flow discharging into Ventana Road will be captured by existing inlets located east of La Ciudad. The flow will then be discharged into Pond 2. See the pond analysis section for more information

B. Off-Site Basins

Basin H (0.29 ac, Q_{100} = 0.72 cfs) encompasses the area west of lots 28 and 29 and the west cul-de-sac up to the trail. The generated flow enters Los Pueblos through a turn block north of the cul-de-sac to combine with the onsite flow as described in the On-Site Basins section.

Basin I (0.29 ac, Q_{100} = 0.37 cfs) is the adjoining basin north east of the site. The flow enters Los Pueblos north of the cul-de-sac and combines with the onsite flow as described in the On-Site Basins section.

Basin J (0.14 ac, Q_{100} = 0.34 cfs) encompasses the trail west of Basin F and the area up to the western curb of Universe Blvd. The developed flow from this basin will flow into Universe Blvd. and be captured by inlets downstream.

C. Pond Analysis

Pond 1 (0.38 ac, 0.73cfs) located northwest of La Ciudad has a capacity of 0.673 ac-ft allowing for 17" of freeboard. This detention pond will capture a total flow of 28.78 cfs, Q_{100} = 25.28 cfs from onsite and offsite basins and a controlled flow of 3.50 cfs from the offsite pond to the north at the Ventana Ranch Apartments. The controlled discharged from Pond 1 is Q_{100} = 12.90cfs, requiring a pond volume of 0.419 ac-ft. This flow is controlled by the capacity of an 18" storm drain pipe at the outfall of the pond and will discharge to Pond 2. Pond 2 (0.55 ac, Q100=1.49 cfs) located to the northeast of La Ciudad has a capacity of 1.600 ac-ft allowing for 20" of freeboard. This detention pond will collect 17.56 cfs from inlets in sump condition in Ventana Road and 12.90 cfs discharged from Pond 1. An allowable discharge from Pond 2 of 6.65 cfs, as determined by the "Drainage Report for Sedona Subdivision Tract C at Ventana Ranch", requires a pond volume of 1.087 ac-ft and will be controlled by an orifice plate on the pond outfall pipe. Ultimately the existing 48" storm drain in Ventana Rd. will collect the discharge from the pond and continue on to the Little Window Dam, which outfalls to the Calabacillas Arroyo. See Appendix E for pond analysis.

VI. CONCLUSION

The LVDMP governs the development of Ventana Townhomes at the Ventana Ranch Subdivision. Increases in runoff, depth and velocity due to proposed development are within parameters anticipated within the previously approved Master Drainage Plan for this area. These flows can be safely conveyed by the improvements proposed in this drainage plan to existing drainage facilities, which have adequate capacity to accept such runoff. Erosion and dust control, consisting of erosion control berms, silt fencing and sedimentation basins, are proposed to prevent soil washing or blowing into paved streets, storm drains, and existing development areas. This report supports the preliminary/final plat and grading plan and should be approved as requested.

BASIN SUMMARY FOR VENTANA TOWNHOMES AT VENTANA RANCH

HYDROLOGICAL VOLUMETRIC & DISCHARGE DATA

BASIN I.D.	AREA (AC)	UNITS #	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 10 YR	100YR
HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (EXISTING CALCULATED)								
Parcel I	6.91		97.0%	0.0%	0.0%	3.0%	2.3	9.4
TOTAL	6.91						2.3	9.4
HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (DEVELOPED)								
OFFSITE (FLOWS OFFSITE)								
J	0.14		0.0%	50.0%	50.0%	0.0%	0.15	0.34
SUBTOTAL							**0.2**	**0.34**
OFFSITE (FLOWS ONSITE)								
H	0.29	0	0.0%	50.0%	50.0%	0.0%	0.33	0.72
I	0.29	0	100.0%	0.0%	0.0%	0.0%	0.07	0.37
SUBTOTAL	0.59						**0.40**	**1.09**
ONSITE								
BASINS								
A	1.12	10	0.0%	15.0%	15.0%	70.0%	2.64	4.25
B	1.81	13	0.0%	15.0%	15.0%	70.0%	4.26	6.86
C	1.24	18	0.0%	15.0%	15.0%	70.0%	2.93	4.72
D	0.89	10	0.0%	15.0%	15.0%	70.0%	2.09	3.37
E	0.35	0	0.0%	5.0%	5.0%	90.0%	0.95	1.46
F	0.14	0	0.0%	5.0%	5.0%	90.0%	0.39	0.61
G	0.16	0	0.0%	5.0%	5.0%	90.0%	0.45	0.69
Pond-1	0.38	0	0.0%	50.0%	50.0%	0.0%	0.42	0.93
Pond-2	0.38	0	0.0%	50.0%	50.0%	0.0%	0.42	0.93
SUBTOTAL	**6.91**	**51**					**15.0**	**24.9**
SUB-BASINS								
A-1	1.06		0.0%	15.0%	15.0%	70.0%	2.50	4.02
A-2	0.03		0.0%	15.0%	15.0%	70.0%	0.07	0.12
A-3	0.03		0.0%	15.0%	15.0%	70.0%	0.07	0.12
B-1	1.13		0.0%	15.0%	15.0%	70.0%	2.67	4.29
B-2	0.10		0.0%	15.0%	15.0%	70.0%	0.23	0.37
B-3	0.58		0.0%	15.0%	15.0%	70.0%	1.37	2.20
C-1	0.88		0.0%	15.0%	15.0%	70.0%	2.08	3.35
C-2	0.36		0.0%	15.0%	15.0%	70.0%	0.85	1.37
D-1	0.64		0.0%	15.0%	15.0%	70.0%	1.51	2.43
D-2	0.25		0.0%	15.0%	15.0%	70.0%	0.58	0.94
SUBTOTAL	**5.06**						**11.9**	**19.2**

1) Impervious percentages for developed flows were determined from the DPM Table A-5. with the remaining percentages distributed evelny between land treatment types B and C, except Basin I which was determined to be 100% A.

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Los Pueblos Lt.**

INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: Q=C*L*H^1.5

Wing opening
C= 3.0
L= 4.0 ft
Q=3.0(4.0')H**1.5= 12.0H**1.5

Grate opeining
C=3.0
L(double grate)=[2(2.67')+2(1.8')]=8.94 ft
Q=3.0(8.94)H^1.5=26.82*H^1.5

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

Grate opening
C=0.6
A(double grate)=8.19 sf
Q=4.194*(64.4*H)^0.5

Wing opening
C=0.6
A=2.0 sf
Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.38	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	1.07	2.40	17.64	4.55	
	0.30	0.30	1.97	4.41	21.60	8.35	
	0.40	0.40	3.04	6.78	24.94	12.86	
	0.50	0.50	4.24	9.48	27.88	17.97	
	0.60	0.60	5.58	12.46	30.55	23.62	Q(100 yr) = 18.18 cfs is provided at this depth
TOP OF CURB	0.70	0.70	7.03	15.71	32.99	29.76	
	0.80	0.80	8.59	19.19	35.27	36.36	Q(2*100 yr) = 36.36 cfs is provided at this depth
	0.90	0.90	10.25	22.90	37.41	43.39	
ROW LIMIT	1.00	1.00	12.00	26.82	39.43	50.82	

NOTE: The total runoff intercepted by the inlet at the low point in the road is:
Qr(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].
THE 100 YR STORM EVENT = 18.18 CFS at the sump condition
THE 2 x 100 YR STORM EVENT = 36.36 at the sump condition

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Ventana Road Lt.**

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR:	Q=C*L*H^1.5		ORIFICE:	Q=C*A*(2*G*H)**0.5
Wing opening	Grate opeining		Grate opening	Wing opening
C= 3.0	C=3.0		C=0.6	C=0.6
L= 4.0 ft	L(single grate)=[(2.67')+2(1.8')]=6.2'		A(single grate)=4.09 sf	A=2.0 sf
Q=3.0(4.0')H**1.5= 12.0H**1.5	Q=3.0(6.27)H^1.5=18.81*H^1.5		Q=2.46*(64.4*H)^0.5	Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR WING OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at single "A" inlet w/ two wing openings
	0.10	0.10	0.38	0.59	6.24	1.35	Weir controls on grate analysis
	0.20	0.20	1.07	1.68	8.82	3.83	
	0.30	0.30	1.97	3.09	10.80	7.03	
	0.40	0.40	3.04	4.76	12.47	10.83	Q(100 yr) = 10.08 cfs is provided at this depth
	0.50	0.50	4.24	6.65	13.94	15.14	
	0.60	0.60	5.58	8.74	15.27	19.90	
TOP OF CURB	0.70	0.70	7.03	11.02	16.50	25.07	Q(2x100 yr) = 20.16 cfs is provided at this depth
	0.80	0.80	8.59	13.46	17.64	30.63	
	0.90	0.90	10.25	16.06	18.71	36.55	
ROW LIMIT	1.00	1.00	12.00	18.81	19.72	42.81	

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

THE 100 YR STORM EVENT = 10.08 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 20.16 CFS at the sump condition

C-6/6

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =07/29/2004
INPUT FILE = TH-3.HYM USER NO.= AHYMO-S-9702c1BohanHu-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION	
S	PROJECT NAME: TRACT A-1-B										
S	JOB NO. 040051										
S	DATE: July 29, 2003										
S											
S	INPUT FILE NAME: A1B.HYM										
S	OUTPUT FILE NAME: A1B.out										
S	FILES LOCATION: P:\CDP\040051\HYDRO\AHYMO										
S COMMENTS:											
S	6 HR,100 year storm event										
S											
RAINFALL TYPE= 2										RAIN24=	2.670
SEDIMENT BULK										PK BF =	1.02
*S**********											
S											
*S**********											
*S BASIN 100											
COMPUTE NM HYD	100.00	-	1	.00384	9.78	.400	1.95251	1.500	3.980	PER IMP=	67.00
*S BASIN 101 (TO POND 'A')											
COMPUTE NM HYD	101.00	-	3	.00267	6.26	.251	1.76114	1.500	3.664	PER IMP=	59.00
*S BASIN 101.1 (TO POND 'A')											
COMPUTE NM HYD	101.10	-	4	.00097	2.48	.101	1.93862	1.500	3.985	PER IMP=	66.00
*S ADD BASINS 101 AND 101.1 = 101.2											
ADD HYD	101.20	3& 4	5	.00364	8.74	.351	1.80855	1.500	3.750		
*S POND 'A' OUTFLOW--2-8" PIPES = 101.A											
ROUTE RESERVOIR	101.A	5	6	.00364	2.05	.349	1.79460	1.933	.878	AC-FT=	.176
*S BASIN 102 (TO POND 'B')											
COMPUTE NM HYD	102.00	-	7	.00536	12.69	.506	1.77049	1.500	3.703	PER IMP=	58.00
*S ADD 101.A (POND 'A' OUTFLOW) AND 102 = 102.1											
ADD HYD	102.10	6& 7	8	.00900	13.61	.854	1.78025	1.500	2.364		
*S POND 'B' OUTFLOW--3-8" PIPES											
ROUTE RESERVOIR	102.B	8	9	.00900	4.02	.848	1.76808	2.100	.699	AC-FT=	.307
*S ROUTE POND 'B' OUTFLOW THROUGH 24' PARKING DRIVE IN BASIN 103											
ROUTE	102.20	9	10	.00900	4.02	.848	1.76684	2.100	.698		
*S BASIN 103											
COMPUTE NM HYD	103.00	-	11	.00435	11.47	.484	2.08780	1.500	4.122	PER IMP=	77.00
*S ADD 102.2 (ROUTED POND 'B' OUTFLOW) AND 103 = 103.1											
ADD HYD	103.10	10&11	12	.01335	12.59	1.332	1.87142	1.500	1.474		
*S ADD FLOWS AT BASIN 103											
ADD HYD	103.20	1&12	14	.01719	22.37	1.732	1.88953	1.500	2.034		
*S ROUTE FLOWS TO MH 1 IN 24" PIPE											
ROUTE	103.30	14	15	.01719	22.34	1.732	1.88940	1.500	2.031		
*S BASIN 104 (TO POND 'E')											
COMPUTE NM HYD	104.00	-	16	.00207	4.71	.172	1.56250	1.500	3.557	PER IMP=	39.00
*S ADD 103.3 TO BASIN 104 = 104.1											
ADD HYD	104.10	15&16	17	.01925	27.05	1.904	1.85430	1.500	2.195		
*S POND 'E' OUTFLOW--MANHOLE W/ ORIFICE PLATE ACCEPTING 3.5 CFS											
ROUTE RESERVOIR	104.E	17	18	.01925	3.50	1.898	1.84807	2.733	.284	AC-FT=	.860
S											
S											
S											

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION

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*S*                          FLOW ENTERS TRACT A-1-B
*S*
*S*
*S*
*S*                   COMPUTE BASIN OFF
COMPUTE NM HYD              B1    -    10         .00047          .76         .021         .83608    1.500     2.526 PER IMP=     .00
*S*                   COMPUTE BASIN ONSITE
COMPUTE NM HYD              B1    -     1         .00986        24.53        1.020        1.93934    1.500     3.887 PER IMP=   70.00
*S**** ADD OFF AND ONSITE ****
ADD HYD                     B1 10& 1  20         .01033        25.28        1.041        1.88925    1.500     3.825
*S**** ADD OFF POND AND ONSITE ****
ADD HYD                     B1 18&20  21         .02958        27.96        2.938        1.86245    1.500     1.477
*S*                   COMPUTE BASIN POND 1 BASIN
COMPUTE NM HYD              B2    -     2         .00041          .73         .020         .94117    1.500     2.792 PER IMP=     .00
ADD HYD                     B3 21& 2  22         .02999        28.69        2.959        1.84997    1.500     1.495
*S*                   ROUTE THROUGH DETENTION POND 1
ROUTE RESERVOIR             P1    22    51         .02999        12.96        2.950        1.84453    1.767      .675 AC-FT=      .419
*S*                   COMPUTE BASIN VENT RD
COMPUTE NM HYD            VENTRD  -     3         .00647        17.56         .772        2.23935    1.500     4.242 PER IMP=   90.00
ADD HYD                     B2 51& 3  23         .03645        25.70        3.722        1.91457    1.533     1.102
*S*                   COMPUTE BASIN POND 2 BASIN
COMPUTE NM HYD              B2    -     4         .00052          .92         .026         .94117    1.500     2.786 PER IMP=     .00
ADD HYD                   POND2 23& 4  24         .03697        26.61        3.748        1.90098    1.533     1.125
*S*                   ROUTE THROUGH DETENTION POND 2
ROUTE RESERVOIR             P2    24    52         .03697         6.45        3.727        1.89006    2.667      .272 AC-FT=     1.087
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E 2/2

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																									