

## **MEMORANDUM**

**TO:** City of Albuquerque  
**FROM:** Brad Dixon, P.E.  
**DATE:** August 7, 2003  
**RE:** VENTANA RANCH NORTH 20 STORM DRAIN DESIGN

### **INTRODUCTION**

This memo is written to supplement the 7/3/2000 Final Addendum No. 4 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities and to present Bohannon Huston Inc.'s (BHI) analyses of the hydrology of the watershed and the hydraulics of the storm drain that contribute to the North Outfall. The AHYMO model from Addendum No. 4 was updated to include changes to drainage basin areas and the storm drain route. Storm & Sanitary SelectCAD software was used to design and analyze the storm drain according to City of Albuquerque standards.

### **HYDROLOGY**

Figure 1 shows the onsite and offsite drainage basins that contribute to the North 20 storm drain. Offsite drainage basins include Ventana Ranch Tracts 23, 24, 29A, and 29B to the south and Tract A to the west. Portions of Irving and Rainbow Boulevards and Tract 13 also contribute to the storm drain. The North 20 site is divided into two onsite drainage basins: B-7 and B-8. Modifications to the subdivision grading plan have occurred subsequent to Addendum No. 4. As a result, approximately 1.4 acres from Tract 29A now contribute to the North Outfall rather than the West Branch Calabacillas Storm Drain Diversion, and 1.8 acres from the North 20 no longer contribute to the North Outfall storm drain. An additional 0.8 acres from Irving Blvd., west of the North 20 site, also contribute to the North Outfall. The overall result is an increase in the area that contributes to the North Outfall storm drain from 123.0 acres to 123.4 acres.

Changes to the storm drain route and the subdivision design required the recalculation of AHYMO input parameters. Flows from Ventana Ranch, which had previously been concentrated at two points, are concentrated at three points. In addition, flows are modeled as being routed through inlets into the storm drain and through streets to more accurately represent the peak discharge in each portion of the system. These changes required the recalculation of drainage basin areas and time to peak values. Land treatment data for each basin was updated based on the current subdivision design. Appendix A of this report contains the updated time to peak calculations, AHYMO input parameters for each drainage area, and a summary of the peak discharges.

The most significant changes in the design flow rates were due to decreased time to peak values. In Addendum No. 4, the conveyance factor for overland flow used to calculate time to peak was for a turf, landscaped, or undisturbed natural condition. The conveyance factor was updated to represent a bare, disturbed, or paved condition, which significantly decreased time to peak values and increased the design flow rates. A model that included all other updates but used the same conveyance factor as the Addendum No. 4 model resulted in the same peak discharge, 330 cfs. Using the updated conveyance factor, the 100-year peak discharge to the arroyo from Ventana Ranch and Tracts A and B is 363 cfs.

## **STORM & SANITARY ANALYSIS**

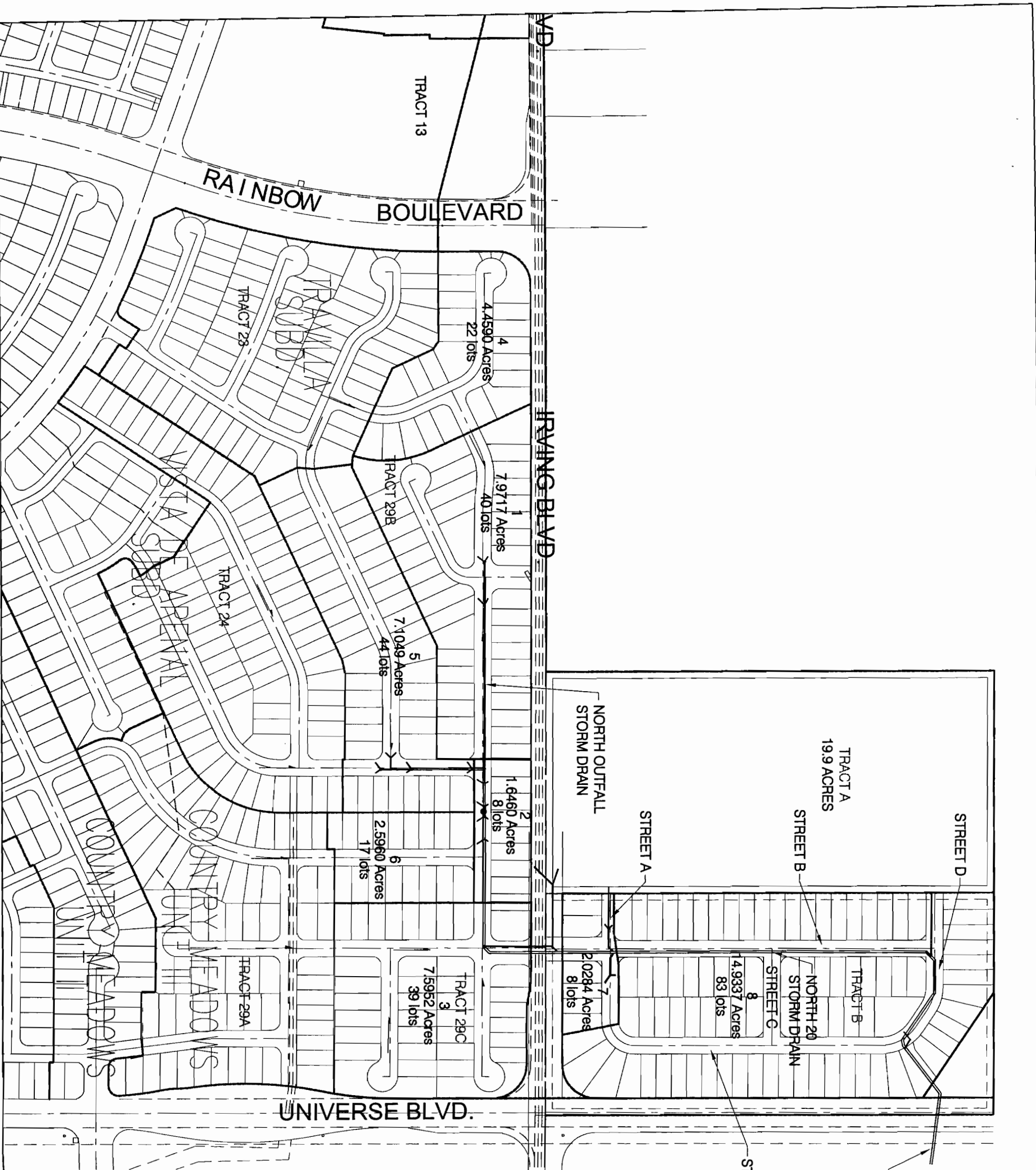
Storm & Sanitary SelectCAD software was used to design and analyze the proposed storm drain pipe system. The 66-inch (typ.) storm drain pipe will be connected to the Ventana Ranch portion of the storm drain pipe just south of Irving and to an existing pipe that discharges to the Calabacillas Arroyo near the northeast corner of the North 20. The invert elevations at these points of connection will be 5402.5 ft and 5383.5 ft, respectively. A drainage model containing the North 20 portion of the storm drain pipe and the Ventana Ranch portion of storm drain pipe was utilized. For hydraulic grade line calculations, the water level in the arroyo was assumed to be at the soffit of the discharging pipe. The proposed storm drain pipe system is shown in Figure 2. Appendix B contains the Storm & Sanitary design output.

In Addendum No. 4, the pipes were sized and laid out based on Manning's equation and the assumption of non-pressure flow. In order to raise the pipes, the slopes were decreased from the values presented in Addendum No. 4, and the system was designed to operate under pressure. The pipe size has remained 66 inches, as proposed in Addendum No. 4. The controlling point for the design was a low point in Tract 29 (AHYMO AP3B). The storm drain pipe was positioned so that the hydraulic grade line was below the ground elevation at this point. The pipe slopes are minimized at 0.5% along Street B. The slope then becomes steeper along Street D to meet the existing invert.

## **CONCLUSION**

The storm drain pipe design presented herein conforms to City of Albuquerque code. Minimum cover is maintained, as well as vertical separation from other utilities. The hydraulic grade line for the North 20 storm drain pipe remains below gutter line elevation at all points.

# FIGURES



WEST BRANCH CALABICILLAS ARROYO

EXISTING 66" STORM DRAIN

STREET D

STREET B

STREET A

STREET C

STREET D

TRACT A  
19.9 ACRES

TRACT B

TRACT 20  
NORTH 20 STORM DRAIN

TRACT 13

TRACT 23

TRACT 24

TRACT 28A

TRACT 29A

TRACT 29B

TRACT 29C

TRACT 29D

RAINBOW BOULEVARD

IRVING BLVD

UNIVERSE BLVD.

4.4590 Acres  
22 lots

7.9717 Acres  
40 lots

7.1049 Acres  
44 lots

1.6460 Acres  
8 lots

2.5960 Acres  
17 lots

7.5952 Acres  
39 lots

2.0284 Acres  
8 lots

14.9337 Acres  
83 lots

4

1

5

2

6

3

7

8

**LEGEND**

— UPDATED DRAINAGE BASIN BOUNDARY

--- ADDENDUM NO. 4 NORTH OUTFALL DRAINAGE BASIN BOUNDARY

→ FLOW DIRECTION

— STORM DRAIN PIPE

0 75 150 300

SCALE: 1"=300'

N

**Bohannon & Huston**

County: 7500 Jefferson St. NE Albuquerque, NM 87109-4335

ENGINEERING & SPATIAL DATA & ADVANCED TECHNOLOGIES

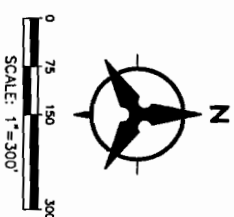
VENTANA RANCH NORTH 20

STORM DRAIN DESIGN

FIGURE 1

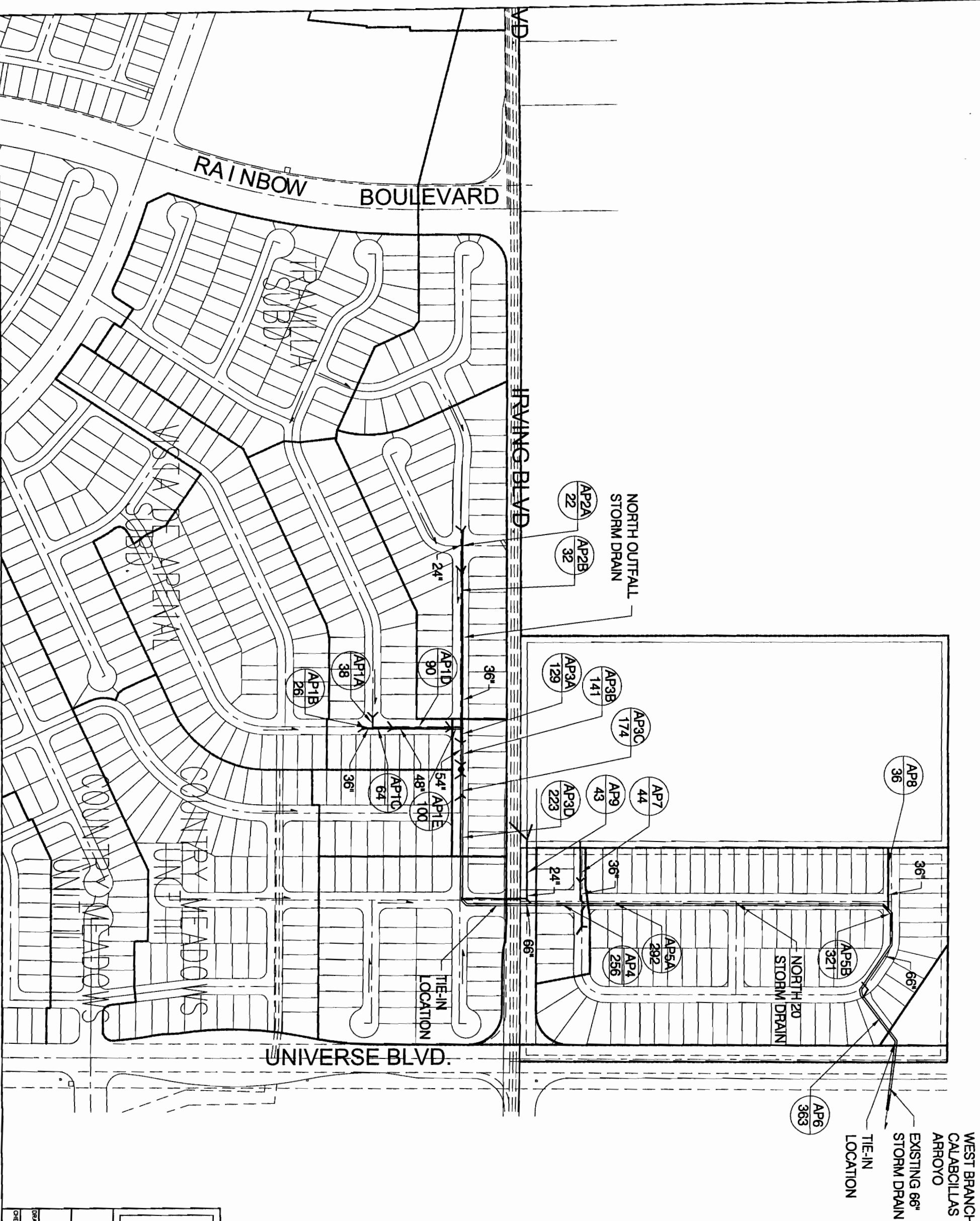
DRAINAGE BASIN MAP

DRAWN BY:	S.F.G.	DATE:	08.07.03
CHECKED BY:	A.C./B.D.T.	PROJECT NO:	020169



LEGEND

- ANALYSIS POINT  
100-YR FLOW (cfs)
- DRAINAGE BASIN
- FLOW DIRECTION
- STORM DRAIN PIPE



**Bohannon & Huston**

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335  
ENGINEERING & SPATIAL DATA & ADVANCED TECHNOLOGIES

VENTANA RANCH NORTH 20  
STORM DRAIN DESIGN

FIGURE 2

PROPOSED DRAINAGE PLAN

DRAWN BY:	S.F.G.	DATE:	08.07.03
CHECKED BY:	A.C./B.T.D.	PROJECT NO.:	020169

# **APPENDIX A**

**Ventana Ranch Subdivision**  
**Technical Memorandum, North 20 Storm Drain Design**

Calculation of Time to Peak  
 Revised DPM procedure

Revised 2/19/03 for North 20 Storm Drain Design  
 (Updated analysis of basins contributing to the north outfall).

Description	Var.	Unit	29 - 1	29 - 2	29 - 3	29 - 4	29 - 5	29 - 6	Tract 23	Tract 24	Tract 29A	IW	IE	R13	A-1&2	B-1	B-2
Basin			7.972	1.646	7.595	4.459	7.105	2.596	15.2	8.083	12.87	6.1	4.9	6.5	18.752	18.752	18.752
Basin Area	acres		7.972	1.646	7.595	4.459	7.105	2.596	15.2	8.083	12.87	6.1	4.9	6.5	18.752	18.752	18.752
Length	L	feet	620	450	1200	1130	1090	540	1045	1800	1515	2650	2450	1000	1180	450	1180
Overland Reach	L <sub>1</sub>	feet	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Overland K	K <sub>1</sub>		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Overland Slope	S <sub>1</sub>	%	2.14	0.70	0.70	2.14	0.70	0.70	1.10	0.95	1.47	1.50	3.00	1.00	1.80	1.05	1.05
Gully Reach	L <sub>2</sub>	feet	220	50	800	730	690	140	645	1400	1115	1600	1600	600	780	50	780
Gully K	K <sub>2</sub>		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Gully Slope	S <sub>2</sub>	%	2.75	0.70	0.70	2.75	0.70	0.70	0.80	1.24	1.92	1.50	0.50	1.50	1.80	0.40	0.40
Arroyo Reach	L <sub>3</sub>	feet	0	0	0	0	0	0	0	0	0	650	450	0	0	0	0
Arroyo K	K <sub>3</sub>		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Arroyo Slope	S <sub>3</sub>	%	2.75	0.70	0.70	2.75	0.70	0.70	0.80	0.80	0.70	1.50	0.50	2.70	4.12	1.50	1.50
Lca	L <sub>CA</sub>	feet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Base Discharge	Q <sub>B</sub>	cfs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ground Slope	s	%	2.36	0.70	0.70	2.53	0.70	0.70	0.91	1.18	1.80	1.50	0.91	1.30	1.80	0.98	0.62
K	K		1.189	1.059	1.500	1.438	1.463	1.149	1.473	1.598	1.542	1.871	1.633	1.360	1.494	1.059	1.488
K <sub>N</sub>	K <sub>N</sub>		0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.02	0.02	0.021	0.021	0.021
t <sub>c</sub>	t <sub>c</sub>	hrs	0.094	0.141	0.266	0.137	0.247	0.156	0.206	0.289	0.203	0.321	0.437	0.179	0.164	0.119	0.280
Time to Peak	t <sub>p</sub>	hrs	0.133	0.133	0.177	0.133	0.165	0.133	0.137	0.192	0.136	0.214	0.292	0.133	0.133	0.133	0.186



**Ventana Ranch Subdivision  
Technical Memorandum, North 20 Storm Drain Design**

**AHYMO Input Parameters**

Revised 2/19/03 for North 20 Storm Drain Design  
(Updated analysis of basins contributing flow to north outfall).

Drainage Area	Area (ac)	Area (sq mi)	Lots	%A	%B	%C	%D	t <sub>p</sub>
Tract 23	12.2816	0.01919	73	0.00%	21.75%	21.75%	56.50%	0.137
Tract 24	12.4416	0.01944	76	0.00%	21.15%	21.15%	57.70%	0.192
Tract 29A	12.8700	0.02011	72	0.00%	23.06%	23.06%	53.89%	0.136
Tract 29 - 1	7.9717	0.01246	40	0.00%	25.20%	25.20%	49.60%	0.133
Tract 29 - 2	1.6460	0.00257	8	0.00%	25.75%	25.75%	48.50%	0.133
Tract 29 - 3	7.5952	0.01187	39	0.00%	24.75%	24.75%	50.50%	0.177
Tract 29 - 4	4.4590	0.00697	22	0.00%	25.50%	25.50%	49.00%	0.133
Tract 29 - 5	7.1049	0.01110	44	0.00%	20.00%	20.00%	60.00%	0.165
Tract 29 - 6	2.5960	0.00406	17	0.00%	20.00%	20.00%	60.00%	0.133
Tract A	19.9040	0.03110	-	0.00%	25.00%	25.00%	50.00%	0.133
Tract B-1	2.0284	0.00317	8	0.00%	29.20%	29.20%	41.60%	0.133
Tract B-2	14.9337	0.02333	83	0.00%	23.20%	23.20%	53.60%	0.186
Irving (West)	6.1400	0.00959	-	0.00%	15.00%	10.00%	75.00%	0.214
Rainbow/Tract 13	6.5280	0.01020	-	0.00%	25.00%	10.00%	65.00%	0.133
Irving (East)	4.9280	0.00770	-	0.00%	15.00%	10.00%	75.00%	0.292
Total	123.1740	0.19246						