CITY OF
Albuquerque

P.O. Box 1293 Albuquerque, NM 87103

August 27, 1996

Martin J. Chávez, Mayor

Kevin Patton
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

RE: DRAINAGE REPORT FOR TRACT 14B - HIGHLANDS @ H.D. (E-23/D3K)
RECEIVED AUGUST 8, 1996 FOR W.O., PRELIMINARY & FINAL PLAT
ENGINEER'S STAMP DATED 8/8/96

Dear Mr. Patton:

Based on the information included in the submittal referenced above, City Hydrology accepts the Drainage Report for Work Order, Preliminary & Final Plat.

Submit the Grading Plan, dated 8/8/96 to the DRB for their approval. AMAFCA must approve the crossing structure in the AMAFCA Easement at Buffalo Grass Ct.

If you have any questions about this project, You may contact me at 768-2727.

Sincerely,

John P. Curtin

John P. Curtin, P.E.
Civil Engineer, Hydrology

c: Andrew Garcia
Fred Aguirre, DRB 96-408
Kurt Browning, AMAFCA
Doug Collister, High Desert Investment Corp, 13000 Academy Rd NE 87111

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT N.E. - ALBUQUERQUE, N.M. 87107

TELEPHONE (505) 884-2215

MEMO

September 19, 1996

To: John Curtin, COA PWD Hydrology

FR: Kurt Browning, AMAFCA KB

RE: Highlands at High Desert - Licenses

Kevin Patton from Bohannan-Huston contacted me regarding License Agreements for the Highlands at High Desert, and asked me to send you a memo.

Attached are the minutes from the meeting held to discuss this issue. Units 1 and 2 are already constructed. Most of the utility crossings (of our easements) are located within the City ROW at bridges or culverts (and shown on the City work order drawings). It was decided that licenses would not be required for items located in City ROW/, as they are operated and maintained by the City, and the record drawings are available at the City.

Any crossings of AMAFCA drainage easements not within the City ROW will require a license. The rest of the minutes are self explanatory. Should you have any questions, do not hesitate to call me.

End

c: Kevin Patton, BHI

DRAINAGE REPORT
FOR
HIGH DESERT - TRACT 14B
(Proposed Unit 2A of the Highlands)

JULY 1996

Prepared by:

BOHANNAN-HUSTON INC.
COURTYARD I, 7500 JEFFERSON STREET N.E.
ALBUQUERQUE, NM 87109

Prepared for:

HIGH DESERT INVESTMENT CORPORATION
13000 ACADEMY ROAD NE
ALBUQUERQUE, NM 87111

PREPARED BY:

KEVIN PATTON, E.I. 8/8/96 Date

UNDER THE SUPERVISION OF:

MICHIAL EMERY, P.E. 8/8/96 Date

I. PURPOSE

The purpose of this report is to provide site-specific drainage analysis for existing and proposed conditions for the residential development, referred to as High Desert - Tract 14B (Proposed Unit 2A of the Highlands). This plan is prepared and submitted to support rough grading, infrastructure design, preliminary and final plat approvals.

This Report will reference the following City of Albuquerque and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) approved studies prepared for the High Desert Development: 1) the *High Desert Drainage Management Master Plan*, dated December 1993; 2) the *High Desert - Phase I Prudent Line Analysis*, dated March 1994; 3) the *Drainage Management Plan Highlands Subdivision at High Desert*, dated August 1994; and 4) the *Final High Desert Subdivision Academy Storm Drain Design Report*, dated September 1994.

The *High Desert Drainage Management Master Plan*, dated December 1993, was prepared to support future drainage plans submitted for the development of individual land parcels within High Desert and to provide design guidance for the design of primary drainage infrastructure to be constructed by High Desert in advance of or simultaneously with individual parcel development. In addition, it provides fully developed flow rates for basins that influence the Highlands Subdivision in the High Desert Development.

The *Drainage Management Plan Highlands Subdivision at High Desert*, dated August 1994, was prepared to integrate the above referenced reports with the development of Tracts 15A (Unit 1), 15B (Unit 2), 15C (Unit 3) and a portion of Tract 14 (currently referred to as Unit 14). The report also provided site-specific drainage analysis for the existing and proposed development conditions.

The *Final High Desert Subdivision Academy Storm Drain Design Report*, dated September 1994, was prepared to determine what drainage infrastructure was required to be in place prior to the development of certain tracts within the High Desert Development. This infrastructure now exists and was approved and accepted by the City of Albuquerque under COA Project #4809.95, Phase 1-B-1.

The *High Desert - Phase I Prudent Line Analysis*, dated March 1994, was prepared to establish the prudent lines for the proposed High Desert Development south of the South Pino Tributary Arroyo. The report establishes prudent lines from fully developed flow rates of the basins influencing the Highlands Subdivision in the High Desert Development.

II. PRUDENT LINES

Please refer to the *High Desert - Phase I Prudent Line Analysis*, dated March 1994. The concept of the "prudent line" was established by AMAFCA. The prudent line represents the minimum setback necessary to provide protection for development from an active arroyo. The prudent line concept encompasses not only the flood plain necessary to pass the 100-year storm, but also represents the potential for natural arroyos to move laterally and degrade over time. The long-term effects are based on potential erosion associated with "representative" storm events occurring for a 30-year period.

The Preliminary Grading and Drainage Plan enclosed contains the prudent lines calculated in the above mentioned report. The prudent lines within Tract 14, were granted as drainage easements to AMAFCA on January 9, 1995, under Document No. 95002447, Book 95-1, Pages 5294-5299. The building envelopes shown within Tract 14B are not located within the prudent lines. The prudent lines in Tract 14 begin less than 300 feet north of Tract 14's eastern boundary in Unit 1 of the Highlands.

III. METHODOLIGIES

Please refer to the above referenced reports for the specific methodologies used in preparing those individual reports or plans.

The methodology selected for hydrological comparison of the above mentioned reports or plans for proposed development is in accordance with the City of Albuquerque's Development Process Manual, Chapter 22, as revised in January 1993 (DPM).

IV. SUMMARY OF THE RELATED PLATTING AND EASEMENTS

Please refer to the proposed Bulk Land Plat enclosed in the Plates section of this report.

Tract 14 at High Desert is currently being subdivided into two separate tracts, Tract 14A and 14B, via a bulk land plat. This Plat was heard by the City of Albuquerque Development Review Board on August 6, 1996, and was delegated to City Transportation Development, City Engineering and City Planning. The Bulk Land Plat is currently being routed for final signatures and will soon be recorded.

Tract 14A is surrounded by High Desert Street on the west, Unit 1 of the Highlands at High Desert to the north, High Desert Open Space OS-3 (AKA the Bear Canyon Arroyo) to the south and the US Forest Service Land and Tract 14B to the east. Tract 14A is currently zoned SU-2/HD-R-LT and is approximately 38.0 acres in size.

Tract 14B is east of Tract 14A and south of Unit 1 of the Highlands at High Desert. For the purposes of this report, the "Site" will be referred to as High Desert - Tract 14B (Proposed Unit 2A of the Highlands) and will be further defined in the Site Location and Characteristics below.

One easement and one maintenance agreement need to be recorded with the county clerk prior to final plat approval. High Desert Investment Corporation is currently

drafting a public drainage easement to the City of Albuquerque addressing cross-lot drainage. This easement is identical to the public drainage easement that was granted to the City with the development of Units 1 and 2 of the Highlands at High Desert. As mentioned above, the prudent lines already exist as drainage easements granted to AMAFCA and the Residential Owners Association.

High Desert Investment Corporation has drafted the maintenance agreement, associated with the existing AMAFCA easements mentioned above, defining the different responsibilities required by AMAFCA and the Residential Owners Association. This agreement is identical to the agreement recorded with the development of Units 1 and 2 of the Highlands at High Desert.

V. SITE LOCATION AND CHARACTERISTICS

For location of the site, please refer to the vicinity map on the grading and drainage plan enclosed with this report. I have also enclosed, within the Appendix of this report, a few photos of the site and an orientation map as to where the photos were taken. Please refer to these photos to obtain a better understanding of the site characteristics.

The site is located south of Unit 1 of the Highlands Development, east of Tract 14A and north of the US Forest Service Land. The site is currently zoned SU-2/HD-R-1 and is approximately 16.5 acres in size. Access to the site will be provided from Canada del Oso Place located within Unit 1 of the Highlands.

Vegetation consists primarily of prairie grasses and a few juniper trees. Slopes in the project site range from 2% to 20%, with the majority of the project sloping at 5% to 8%. The Soil Conservation Service has classified the soils on this site as Embudo-Tijeras complex, Embudo gravelly fine sandy loam and Tijeras gravelly fine sandy loam, all of which correspond to a common hydrological soil group classification of B.

VI. EXISTING HYDROLIGIC AND SITE DRAINAGE CONDITIONS

Please refer to the *Drainage Management Plan Highlands Subdivision at High Desert,* dated August 1994, and the Existing Drainage Conditions Map enclosed with this report.

The above referenced report supports the development of Units 1, 2 and 3 of the Highlands and a portion Tract 14 at High Desert. The above report also provides existing and developed flow rates within the prudent lines from the surrounding area. As shown on the Existing Drainage Conditions Map enclosed, the basins within Tract 14 are relatively small due to the existing Bear Canyon Training Dike diverting upland flows to the south of the this tract.

The existing flow rates for the area within and around Tract 14 will vary due to the ongoing construction of individual lots within Units 1 and 2 of the Highlands. Thus, this report will focus on the fully developed conditions, and how it will affect the proposed development within Tract 14B. The Existing Drainage Conditions Map enclosed provides the reader with an idea of what has been platted and what can be developed upland of Tract 14B. The following are the Land Treatment Type Percentages and Peak Discharge determined for the existing conditions in the *High Desert Drainage Management Master Plan*:

Land Treatment Types (%)				Peak Discharge(cfs/acre)
A	B	C	D	
60.03	6.45	7.23	26.29	2.56

A. FEMA Floodplain

Please refer to the *High Desert - Phase 1 Prudent Line Analysis*, dated March 1994. There are no FEMA flood plains within Tract 14.

The prudent lines established in the above referenced report define the boundaries of the drainage easements that exist in High Desert - Tract 14.

VII. DEVELOPED HYDROLOGICAL AND HYDRAULIC CONDITIONS

Please refer to the *High Desert Drainage Management Master Plan,* dated December 1993, *Drainage Management Plan Highlands Subdivision at High Desert,* dated August 1994, and the Grading and Drainage plan enclosed with this report.

A. Cross-Lot Drainage and Building Envelopes

The site proposes to preserve the natural terrain in every way possible. The site contains 18 lots on approximately 16.5 acres. Each lot contains a maximum building envelope of 12,000 square feet. The site will utilize cross-lot drainage, which will require an easement within each lot in order to legally permit storm water to maintain its natural course across public roadway(s) and through private property. Property owners are required by covenant agreements to build only within their building envelope and to utilize drainage concepts (i.e. water harvesting) that will not produce concentrated flows outside of their envelope limits. Building or non-native landscaping will not be permitted outside building envelopes.

Each lot owner is required to submit a grading and drainage plan, stamped by a professional engineer, to the High Desert New Construction Committee. Prior to final acceptance of the construction of each individual lot by the High Desert New Construction Committee, the lot owner is required to provide the committee with a drainage plan certified by a professional engineer. After the Highlands is fully developed, High Desert Investment Corporation will provide the City with one comprehensive grading and drainage plan reflecting the individual lot grading.

The above referenced reports have projected storm water runoff values for fully developed conditions within the High Desert Development in order to properly size downstream storm drainage structures that were built with the Phase 1-B-1 Academy Storm Drain Construction Plans. This report compares the projected land treatment percentages assumed in the above report(s) with a more accurate estimate from our

enclosed preliminary plat layout. The following results indicate approximately the same values with only negligible differences:

	Land Treatment Types (%)				Peak Discharge
	A	B	C	D	(cfs/acre)
HDDMMP 1993	60.03	6.45	7.23	26.29	3.16
Tract 14B (Unit 2A)*	58.20	9.10	5.90	26.80	3.17

As noted above, the maximum building envelope allowed within each lot is 12,000 square feet. In determining the land treatment percentages shown above, this report calculated an <u>average</u> building envelope of 11,785 square feet within an <u>average</u> lot size of 0.86 acres(37,383 sf). This report assumes that on average, at least 27% of the area within the building envelope will be landscaped (Land Treatments A, B and C) and 73%(or 8,603 sf) will be impervious (Land Treatment Type D). According to the subdivision guidelines, any portion (of the assumed 27%) of landscaping within the envelope and located outside of any privacy walls must be native landscaping.

*I believe that this is a conservative estimate due to the fact that the estimate did not take into account that each lot is required to manage storm water flows, using minor detention and water harvesting techniques, within its building envelope, thus reducing peak flow rates indicated above.

B. The Highlands Ponds and Academy Storm Drain

Tracts 15E and 15F contain detention/desilting ponds which will convey storm water runoff from the Highlands arroyo's into the Academy Storm Drain. These tracts were dedicated to the High Desert Residential Owners Association and granted to the City of Albuquerque as a drainage easement. The Academy Storm Drain begins at the ponds in Tracts 15E and 15F and heads west along the north side of Academy Boulevard until its connects with the Tramway Boulevard storm drain system. The Academy Storm Drain is a public storm drain owned and maintained by the City of Albuquerque.

C. The Highlands Roadways and Crossing Structures

The public roadways within the Highlands Subdivision are long and narrow cul-de-sacs that are intended to conform to the natural grades. The intent of this report is to design a roadway that will not significantly interrupt the existing route in which storm water runoff would naturally sheet flow. The site proposes to construct one cul-de-sac 1100 linear feet away from the intersection with Canada Del Oso Street in Unit 1. The proposed roadway width is 22' wide and is situated between estate type curbs (refer to the enclosed cross-sections located in Appendix A of this report). This will allow storm water to substantially maintain its natural course without consolidating into a concentrated flow.

Please refer to the grading and drainage plan located in the plates section of this report.

There are at least two locations that require a crossing structure. The first is located on the proposed public street, Buffalo Grass Court, which will cross an arroyo near the intersection with Unit 1. The natural terrain inhibits the roadway from dipping down to match existing grades while still maintaining City requirements for vertical grades. A bridge, similar to the ones constructed in Unit 1, could not be constructed due to the required clearance (necessary for maintenance equipment) and the relation to the natural grades. The proposed culvert crossing at this location will be similar to the one which was constructed on Fringe Sage Court within Unit 1 of the Highlands. The flow intersecting these culverts is approximately 47 cfs in the 100-year 6-hour storm event (fully developed conditions).

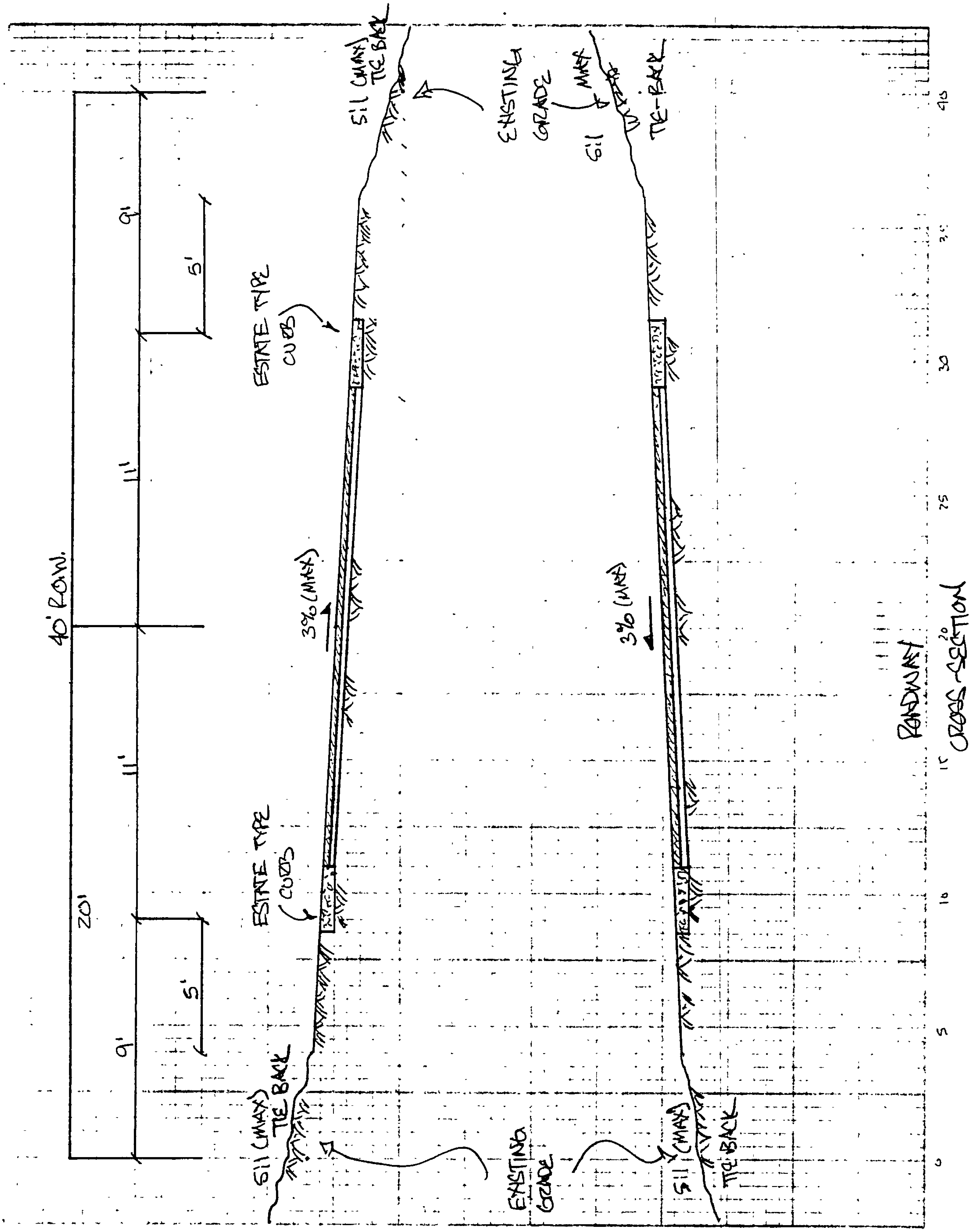
There are three lots (Lots 7, 8 and 9) in which an existing arroyo separates the building envelopes from the proposed public roadway, thus requiring access across the arroyo. Development of the individual lots will determine whether a culvert is necessary. It is my opinion that Lot 7 will require a crossing with any type of layout. These culverts will be constructed by the individual lot owners. This crossing structure would be the responsibility of the individual lot owner, while the routine maintenance,

i.e. clearing of debris and silt, would be the responsibility of the Residential Owners Association and the lot owner.

VIII. CONCLUSION

The primary goal of this drainage plan for High Desert - Tract 14B, is to provide sound and innovative drainage management schemes that permit preservation of the natural terrain with the least possible impact. The utilization of drainage schemes outlined in this report accomplishes this goal in a safe and adequate manner. We recommend that this plan be approved as requested.

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



BOHANNAN-HUSTON INC.

PROJECT NAME ______ SHEET ______ OF ______

PROJECT NO. ______ BY ______ DATE ______

SUBJECT ______ CH'D ______ DATE ______

THE HIGHLANDS AT HIGH DESERT - UNIT 2A (Tract 14B)

LOT #	LOT AREA (ACRES)	LOT AREA (SF)	BUILDING ENVELOPE AREA (ACRES)	BUILDING ENVELOPE AREA (SF)
1	1.0226	44,542.3	0.2743	11,949.7
2	0.6656	28,994.0	0.2676	11,656.1
3	0.6709	29,225.3	0.2723	11,859.7
4	0.6235	27,161.4	0.2458	10,708.0
5	0.6531	28,449.5	0.2584	11,254.8
6	0.6979	30,400.5	0.2738	11,926.8
7	1.0806	47,070.9	0.2755	12,000.0
8	1.4280	62,204.6	0.2755	12,000.0
9	1.4643	63,784.9	0.2755	12,000.0
10	1.1362	49,492.0	0.2701	11,764.0
11	1.1940	52,011.1	0.2728	11,883.6
12	0.6381	27,797.4	0.2755	12,000.0
13	0.7388	32,182.1	0.2553	11,120.6
14	0.6965	30,338.2	0.2755	12,000.0
15	0.7224	31,468.6	0.2755	11,999.6
16	0.6478	28,217.3	0.2755	12,000.0
17	0.5914	25,763.1	0.2755	12,000.0
18	0.7758	33,793.8	0.2755	12,000.0
Averages	0.8582	37,383.2	0.2705	11,784.6

UNDEVELOPED CONDITIONS

BASIN	AREA (ACRES)	% LAND TREATMENT* A	B	C	D	PEAK DISCHARGE - (CFS/ACRE)** A	B	C	D	Q(100-YR) UNDEVELOPED (CFS)
14B	16.50	90.00	7.00	3.00	0.00	2.20	2.92	3.73	5.25	37.89

DEVELOPED CONDITIONS FOR EACH LOT

LOTS	AREA (ACRES)	% LAND TREATMENT* A	B	C	D	PEAK DISCHARGE - (CFS/ACRE)** A	B	C	D	Q(100-YR) DEVELOPED (CFS)
1	1.02	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	3.24
2	0.67	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.11
3	0.67	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.13
4	0.62	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	1.98
5	0.65	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.07
6	0.70	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.21
7	1.08	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	3.43
8	1.43	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	4.53
9	1.46	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	4.65
10	1.14	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	3.61
11	1.19	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	3.79
12	0.64	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.02
13	0.74	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.34
14	0.70	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.21
15	0.72	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.29
16	0.65	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.06
17	0.59	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	1.88
18	0.78	58.20	9.10	5.90	26.80	2.20	2.92	3.73	5.25	2.46
ROW	1.04	12.00	15.00	15.00	58.00	2.20	2.92	3.73	5.25	4.46
TOTAL	16.48									49.02

NOTES:
Obtained from Section 22.2, Hydrology of the Development Process Manual, Volume 2, Design Criteria for the City of Albuquerque, January, 1993
* Table A-4
** Table A-9

PLATE 4
ULTIMATE DEVELOPED CONDITIONS
PER THE APPROVED HIGH DESERT DRAINAGE MANAGEMENT MASTER PLAN
DATED DECEMBER 1993

HDDMMP BASIN #	HDDMMP BASIN NAMES	AREA (SQ MI)	AREA (ACRES)	DISCHARGES TO	UNBULKED Q(100-YR) (CFS)	BULKING FACTOR (%)	BULKED Q(100-YR) (CFS)	MASTER PLAN Q (cfs)
1	NMBA-1	0.049	31.36	42" SD	80.81	10.00	88.9	88
2	NMBA-2	0.026	16.64	36" SD	53.50	10.00	58.9	59
3	NMBA-3A	0.016	10.24	54" SD	24.40	8.00	26.4	27
4	NMBA-3B	0.032	20.48	36" SD	86.95	2.00	88.7	89
5	NMBA-3C	0.017	10.88	30"SD	46.66	2.00	47.6	48
6	NMBA-3D	0.013	8.32	IMPERATA STREET	35.40	2.00	36.1	36
7	NMBA-4A	0.012	7.68	24" SD	22.95	7.00	24.6	25
8	NMBA-4B	0.009	5.76	24" SD	26.46	2.00	27.0	27
9	NMBA-4C	0.038	24.32	42" SD	111.28	2.00	113.5	114
10	NMBA-5	0.016	10.24	EXISTING 60" SD	29.46	7.00	31.5	32
11	NMBA-6	0.006	3.84	EXISTING 60" SD	11.21	10.00	12.3	13
12	NBA-1	0.042	26.88	EXISTING 60" SD	113.51	2.00	115.8	120
13	NBA-2	0.005	3.20	EXISTING 60" SD	9.34	10.00	10.3	10
14	SMBA-1	0.024	15.36	BASIN 21	53.77	2.00	54.8	55
15	SMBA-2	0.041	26.24 (19.0)	54" SD	90.29	2.00	92.1	92
16	SMBA-3	0.012	7.68	42" SD (48" SD)	26.43	2.00	27.0	27
17	SBA-1	0.017	10.88	EXISTING 36" CULVERT		2.00	47.0	47
18	SBA-2	0.021	13.44(6.6)	EXISTING 36" CULVERT		2.00	28.0	28(57)
19	SBA-3	0.0107	6.85(3.1)	EXISTING 36" CULVERT		2.00	30.0	30
20	SBT-1	0.1386	88.7	BASIN 21	244.00		268.0	
21	SBT-2	0.096	61.4	54" SD	195.00		244.0	
22	SBT-3	0.037	23.7	42" SD	94.00		96.0	
23	SBT-4	0.024	15.4	EXISTING 84" CULVERT	65.00		66.0	
24	NBT-1	0.07	44.8	36" SD	118.00		130.0	
25	NBT-2A	0.023	14.7	30" CULVERT	42.00		45.0	
26	NBT-2B	0.033	21.1	60" SD	89.00		90.0	
27	NBT-3A	0.014	9	EXISTING 96" CULVERT	27.00		29.0	
28	NBT-3B	0.027	17.3	EXISTING 96" CULVERT	73.00		74.0	
29	NBT-4	0.003	1.9	EXISTING 96" CULVERT	6.00		6.0	
30	SPT-1	0.208	133.1	BASIN 33	401.00		442.0	
31	SPT-2	0.236	151	BASIN 34	563.00		620.0	
32	SPT-3	0.08	51.2	BASIN 36	118.00		130.0	
33	SPT-4	0.127	81.3	BASIN 35	147.00		162.0	
34	SPT-5	0.162	103.7	BASIN 33	241.00		265.0	
35	SPT-6A	0.037	23.7	BASIN 37	71.00		78.0	
36	SPT-6B	0.14	89.6	BASIN 37	213.00		235.0	
37	SPT-7A	0.06	38.4	96"SD	109.00		120.0	
38	SPT-7B	0.046	29.4	96"SD	84.00		92.0	
39	SPT-8A	0.027	17.3	120"SD	47.00		50.0	
40	SPT-8B	0.036	23	120"SD	97.00		100.0	
41	SPT-9	0.03	19.2	EXISTING 60" CULVERT	51.00		56.0	
42	BCA-2B	0.0186	119	BEAR CANYON ARROYO	189.00		208.0	
				BRIDGE AT TRAMWAY				
43	BCA-2B	0.012	7.7	BASIN 42	25.00		27.0	
44	BCA-2C	0.091	58.2	BASIN 42	171.00		188.0	
45	BCA-2D	0.016	10.2	BASIN 42	34.00		37.0	
46	BCA-2E	0.016	10.2	BASIN 42	37.00		40.0	
47	BCA-2F	0.064	41	BASIN 42	138.00		152.0	
48	BCA-2G	0.005	3.2	BASIN 42	12.00		13.0	
49	EM-1A	0.018	11.5	BASIN 52	27.00		30.0	
50	EM-1B	0.0224	14.3	BASIN 52	44.00		48.0	
51	EA-1C	0.0186	11.7	GLENWOOD HILLS STORM DRAIN	36.00		40.0	
52	EM-2A	0.047	30.1	BEAR CANYON ARROYO	59.00		65.0	

EXAMPLE:

The highlighted areas indicate the errors that were found in the '93 HDDMMP.

28(57)

The items in the ( ) is what I believe the '93 HDDMMP should have produced. The items outside the ( ) is what was given in the '93 report.

PLATE 4
ULTIMATE DEVELOPED CONDITIONS
PER THE APPROVED HIGH DESERT DRAINAGE MANAGEMENT MASTER PLAN
DATED DECEMBER 1993

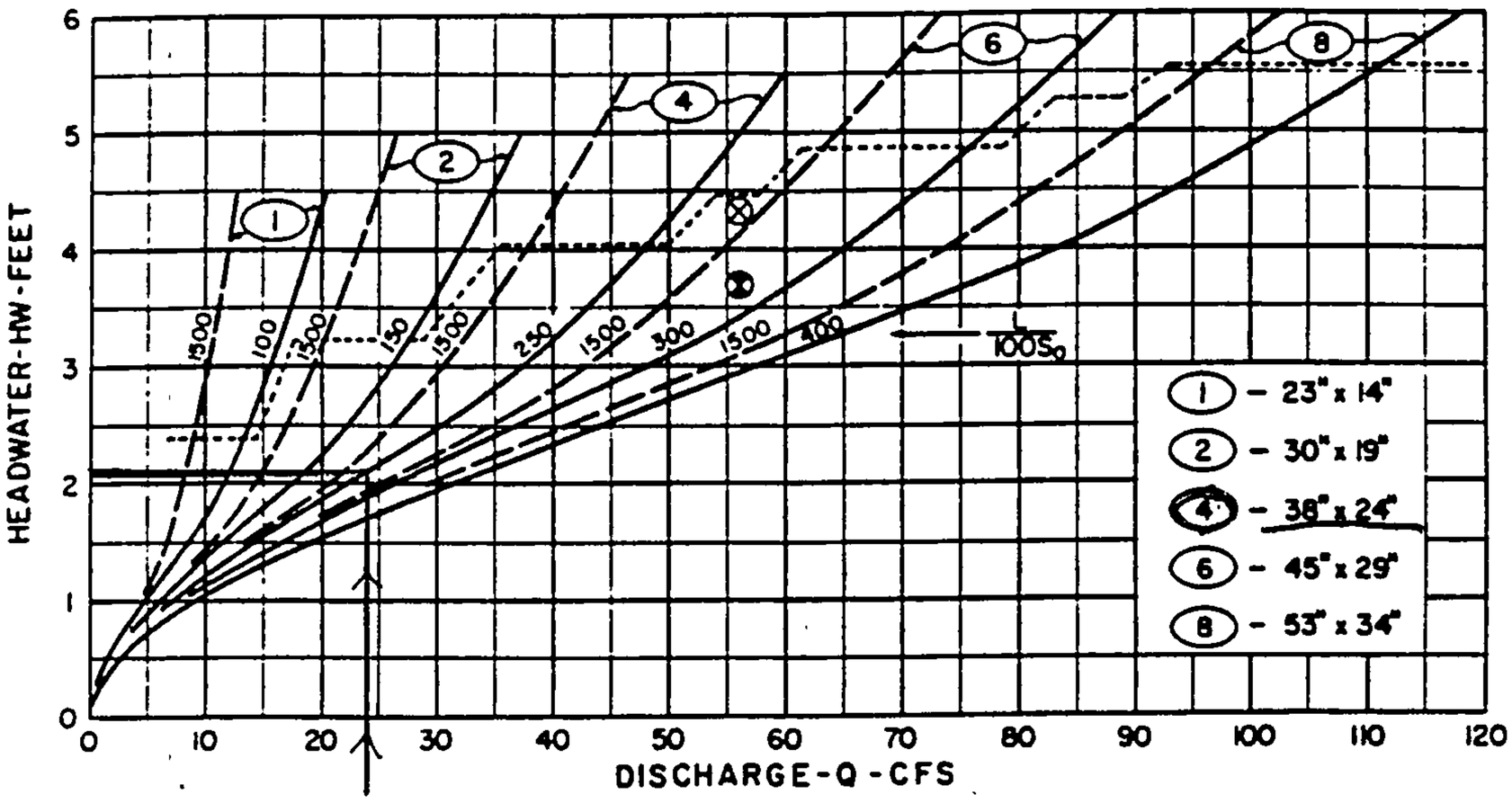
ANALYSIS POINT (AP)	CONTRIBUTING BASINS	COMBINED Q (CFS)	STORM DRAIN SIZE (INCHES)	Minimum Pipe slope (%)	Storm Drain Capacity*	COMMENTS
1	1	88	30	5.5	89	Flow in storm drain below permanent proposed pond #1.
2	2	59	36	1.75	82	Flow in storm drain below permanent proposed pond #2.
3	1, 2	146	42	3.6	177	Total flow in storm dain at confluence of strom drains from ponds 1 & 2.
4	6	36	N/A	N/A	N/A	Flows from basin 6 discharge into Imperata Street.
5	6, 5	81	42	0.75	81	Flow in storm drain from basins 5 & 6.
6	6, 5, 4	166	54	0.75	158	Flow in storm drain from basins 4 - 6.
7	1 - 6 (3 - 6)	193	66	1.25	349	Total flow in storm drain from basins 3 - 6.
7A	1 - 6	340	60	2.85	408	Total flow in storm drain from basins 1 - 6.
8	8	27	24	2	30	Flow in storm drain from basin 8.
9	1 - 6, 8	366	60	4.6	519	Total flow in strom drain below storm drain confluence. Flow from basins 1 - 6 and 8.
9A	1 - 6, 8, 14, 15	510	60	4.2	495	Total flow in strom drain below storm drain confluence. Flow from basins 1 - 6, 8, 14 & 15.
10	7, 9	114	42	3	162	Flow in storm drain from basin 9.
11	1 - 9, 14, 15	642	66	5.2	711	Total flow in strom drain below storm drain confluence. Flow from basins 1 - 9, 14 & 15.
12	1 - 9, 14 - 16	668	72	3.1	692	Total flow in strom drain below storm drain confluence. Flow from basins 1 - 9 & 14 - 16.
13	AP12 ROUTED	668	two existing 60" culverts	5.2	1102	Flow in storm drain at pipe to pipe connection at east side of Tramway Blvd.
14	12 (12 &13)	126	existing 60" culvert	N/A	230	Flow at existing Tramway culvert, capacity based on allowable headwater depth.
15	17	47	existing 36" culvert	N/A	42	Flow at existing Tramway culvert, capacity based on allowable headwater depth. See plan note 5.
16	18	28	existing 36" culvert	N/A	24	Flow at existing Tramway culvert, capacity based on allowable headwater depth. See plan note 5.
17	19	30	existing 36" culvert	N/A	37	Flow at existing Tramway culvert, capacity based on allowable headwater depth. See plan note 5.
18	20	268	N/A	N/A	N/A	Flow from basin 20
19	21	466	66"	2.7	512	Flow in storm drain below permanent pond #3
20	24	130	36"	4.4	130	Flow in storm drain below permanent pond #4
20A	20, 21, 24	584	66"	4.2	639	Total flow in storm drain at confluence of storm drains from pond #'s 3 $ 4.
21	20 - 22, 24 - 26	788	78"	3.1	857	Total flow in storm drain at Academy and Cortaderia.
22	21 - 29	948	existing 96" culvert	1.94	**1269	Total flow at Tramway. Pipe to pipe connection required.
23	30, 31, 33, 35	1335	N/A	N/A	N/A	Flow from basins 33 & 34 and upstream off-site basins.
24	30, 31, 33 - 35	1380	N/A	N/A	N/A	Flow from basins 34-35 and upstream off-site basins.
25	32, 36	235	N/A	N/A	N/A	Flow from basin 36 and upstream off-site basins.
26	30 - 37	1730	96"	4.2	1736	Flow in storm drain beneath permanent pond #5.
27	30 - 38	1795	96"	4.5	1796	Total flow in storm drain below storm drain confluence.
28	30 - 39	1835	120"	1.57	1924	Total flow in storm drain from basins 33-38 and upstream off-site basins.
29	40	100	42"	1.57	117	Flow in storm drain basin 40.
30	30 - 40	1895	120"	1.44	**1984	Total flow in storm drain below storm drain confluence. RCP required.
31	30 - 41	1930	6 existing 60" culverts	1.84	**2120	Total flow at Tramway. Pipe to pipe connection required.

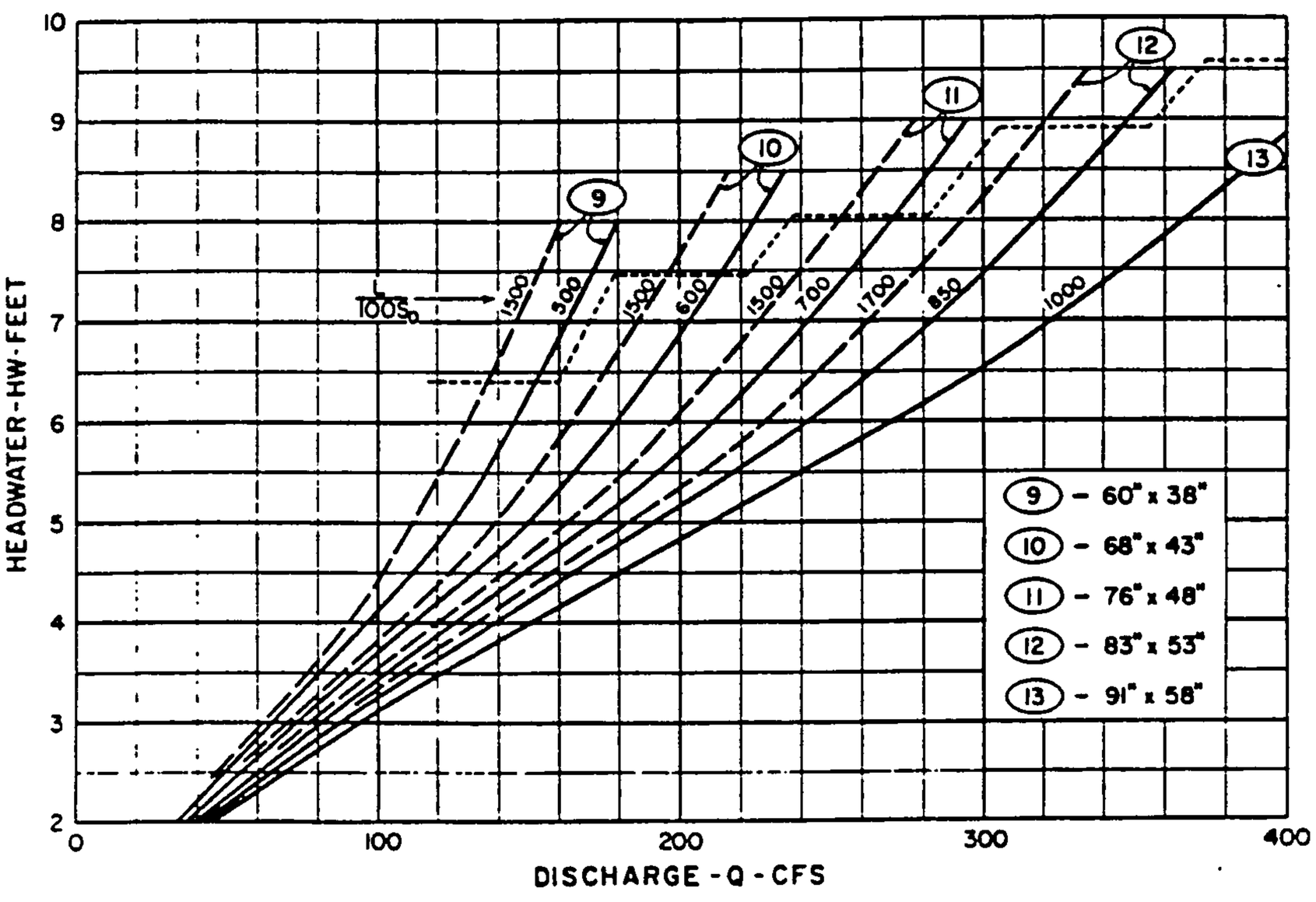
*Storm drain capacity based on non-pressurized full pipe flow, unless otherwise noted, and mannings "n" of 0.014
**n = 0.013

CHART 16

GIVEN:
$Q_{100} = 47$ CFS
$L = 63$ FT
$S_o = 0.047$
USE TWO CULVERTS

TRY No. 4 (38"x24")
23.5 CFS
HW = 2.2 FT OK





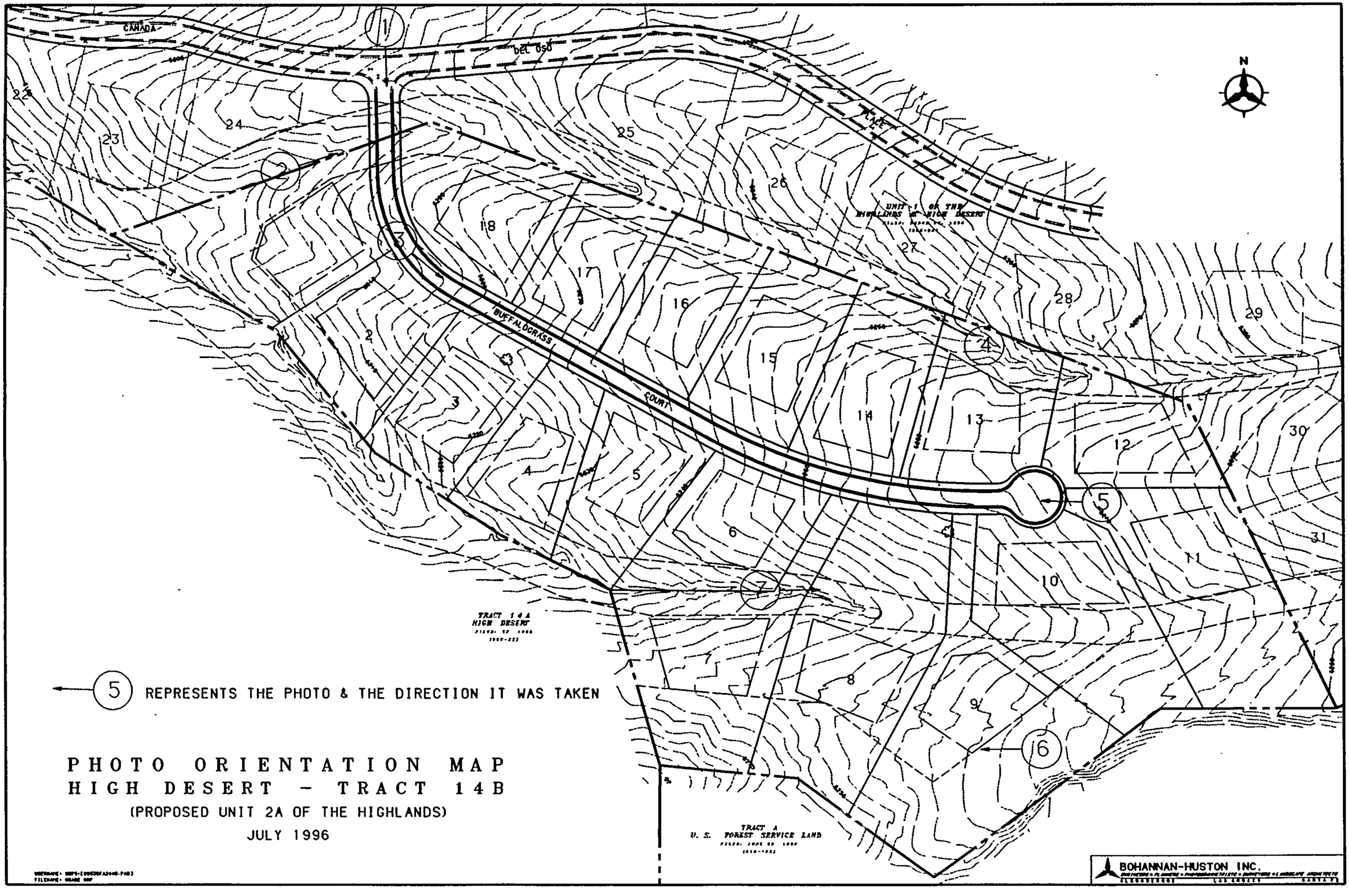
EXAMPLE

⊗ GIVEN:
56 CFS, AHW = 4.3 FT.
L = 109 FT.; S_o = 0.0018

⊗ SELECT NO. 6, 45" x 29"
HW = 3.7 FT.

BUREAU OF PUBLIC ROADS JAN. 1963

CULVERT CAPACITY
OVAL CONCRETE PIPE-HORIZONTAL
GROOVE-EDGED ENTRANCE
23" x 14" TO 91" x 58"



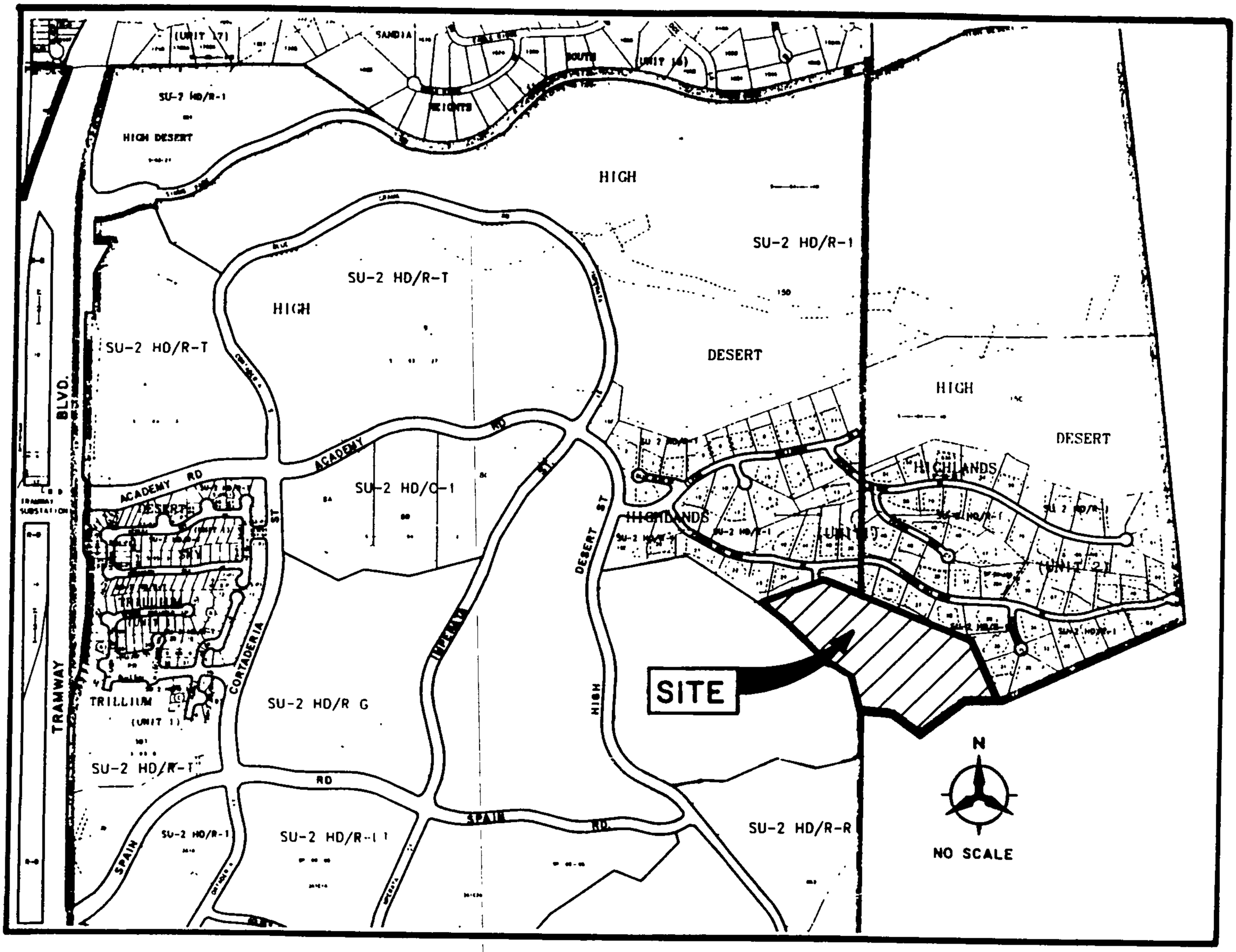
5 REPRESENTS THE PHOTO & THE DIRECTION IT WAS TAKEN

PHOTO ORIENTATION MAP
HIGH DESERT - TRACT 14B

(PROPOSED UNIT 2A OF THE HIGHLANDS)

JULY 1996

BOHANNAN-HUSTON INC.



LOCATION MAP

ZONE ATLAS E-23-Z

LEGAL DESCRIPTION

HIGH DESERT, TRACT 14

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