HYDROLOGY F21/D3 3 PLANS

F21/D3

3 PLANS

CAMPBELL-HICKS and ASSOCIATES, Inc.
Soils Testing Laboratory
232 Muriel Street, N.E. • Phone (505) 296-7139 • Albuquerque, New Mexico 87123

June 6, 1972

Jerry H.
File

Home Planning Development Company
4201 Carlisle Blvd., N.E.
Albuquerque, New Mexico 87110

Attention: John Mendius

Re. Academy Place, Unit 2 Temporary Diversion Study - Addendum

Gentlemen:

In accordance with your request of this date, the following is furnished for your information and distribution. Enclosed are ten copies of Exhibit "B" of the subject drainage study along with a proposed profile for the diversion which calculations indicate will carry up to 1505 c.f.s. at a velocity of 23 feet per second. Since it is temporary and located on your land, there will be no need for lining at this time.

This diversion is temporary to provide protection for Unit 2 until such time as a similar diversion may be constructed east of Juan Tabo on newly acquired land. The design requirements of the channel in the eighty foot easement off Spain Road will be reduced. A redesign of this channel will be made after a master plan of your newly acquired land is furnished.

The U.S. Corps of Engineers and Gordon Herkenhoff & Associates investigated diverting the Bear Arroyo into the Bear Canyon Arroyo between 1,000 and 3,000 feet east of Juan Tabo Blvd. in July of 1970 in a study for Academy Estates. At that time they indicated it is not only feasible, but desirable.

This letter, Exhibit "B" and the proposed Bear Arroyo profile

may be included as an addendum to the drainage study of Unit 2 of Academy Place.

Respectfully submitted,

Donald L. Campbell
P.E. & L.S. No. 3633

DLC/dc
cc. Ralph K. Hicks & Associates, Inc.
Corps of Engineers
Attention: Bill Hill
Gordon Herkenhoff & Associates
Attention: Pete Phelan

Encl. 10 copies of this letter
10 copies of Exhibit "B"
10 copies of Bear Arroyo profile

INSTRUCTIONS FOR DRAINAGE STUDY REVISIONS

ACADEMY PLACE, UNIT 2

1. Page i, Drainage Study Index: Change title of Exhibit "G" to "STREETS AND MAXIMUM RUNOFFS".

2. Page 5, V. CONCLUSIONS AND RECOMMENDATIONS: Delete from recommendation "B": "as shown in Exhibit 'G'"; delete recommendation "I" and replace it with revised recommendation "I. Design streets to carry maximum runoffs contained in Exhibit 'G' through use of tables in Exhibit 'F'".

3. Pages 26 and 27, Exhibit "F": Delete "n(composite)=.006" and table "R/W TO R/W - OVERFLOW SECTIONS CAPACITIES".

4. Replace pages 30 and 31 with revised pages 30A, 30B, 30C, 30D and 31A, 31B, 31C, 31D.

5. Replace page 33 with revised page 33 entitled "STREETS AND MAXIMUM RUNOFFS".

REVISED MAY 1972

50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	15.3611	51.3731	.0050	.0707	.2990	.4472	2.8545	43.8477
.0165	15.3611	51.3731	.0100	.1000	.2990	.4472	420368	62.0100
.0165	15.3611	51.3731	.0150	.1225	.2990	.4472	4.9441	75.9464
.0165	15.3611	51.3731	.0200	.1414	.2990	.4472	5.7089	87.6954
.0165	15.3611	51.3731	.0250	.1581	.2990	.4472	6.3828	98.0464
.0165	15.3611	51.3731	.0300	.1732	.2990	.4472	6.9920	107.4045
.0165	15.3611	51.3731	.0350	.1871	.2990	.4472	7.5522	116.0101
.0165	15.3611	51.3731	.0400	.2000	.2990	.4472	8.0736	124.0200

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	18.9167	51.3569	.0050	.0707	.3683	.5138	3.2801	62.0482
.0165	18.9167	51.3569	.0100	.1000	.3683	.5138	4.6387	87.7494
.0165	18.9167	51.3569	.0150	.1225	.3683	.5138	5.6813	107.4706
.0165	18.9167	51.3569	.0200	.1414	.3683	.5138	6.5602	124.0964
.0165	18.9167	51.3569	.0250	.1581	.3683	.5138	7.3345	138.7439
.0165	18.9167	51.3569	.0300	.1732	.3683	.5138	8.0345	151.9864
.0165	18.9167	51.3569	.0350	.1871	.3683	.5138	8.6783	164.1640
.0165	18.9167	51.3569	.0400	.2000	.3683	.5138	9.2775	175.4988

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	22.4722	51.3453	.0050	.0707	.4377	.5765	3.6797	82.6903
.0165	22.4722	51.3453	.0100	.1000	.4377	.5765	5.2038	116.9417
.0165	22.4722	51.3453	.0150	.1225	.4377	.5765	6.3734	143.2238
.0165	22.4722	5123453	.0200	.1414	.4377	.5765	7.3593	165.3806
.0165	22.4722	51.3453	.0250	.1581	.4377	.5765	8.2280	184.9011
.0165	22.4722	51.3453	.0300	.1732	.4377	.5765	9.0133	202.5490
.0165	22.4722	51.3453	.0350	.1871	.4377	.5765	9.7355	218.7780
.0165	22.4722	51.3453	.0400	.2000	.4377	.5765	10.4077	233.8835

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	26.0278	51.3384	.0050	.0707	.5070	.6358	4.0585	105.6348
.0165	26.0278	51.3384	.0100	.1000	.5070	.6358	5.7396	149.3901
.0165	26.0278	51.3384	.0150	.1225	.5070	.6358	7.0296	182.9648
.0165	26.0278	51.3384	.0200	.1414	.5070	.6358	8.1171	211.2696
.0165	26.0278	51.3384	.0250	.1581	.5070	.6358	9.0752	236.2066
.0165	26.0278	51.3384	.0300	.1732	.5070	.6358	9.9414	258.7513
.0165	26.0278	51.3384	.0350	.1871	.5070	.6358	10.7379	279.4834
.0165	26.0278	51.3384	.0400	.2000	.5070	.6358	11.4793	298.7803

50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	24.3611	51.3904	.0050	.0707	.4740	.6080	3.8805	94.5336
.0165	24.3611	51.3904	.0100	.1000	.4740	.6080	5.4879	133.6907
.0165	24.3611	51.3904	.0150	.1225	.4740	.6080	6.7212	163.7370
.0165	24.3611	51.3904	.0200	.1414	.4740	.6080	7.7610	189.0672
.0165	24.3611	51.3904	.0250	.1581	.4740	.6080	8.6771	211.3836
.0165	24.3611	51.3904	.0300	.1732	.4740	.6080	9.5053	231.5591
.0165	24.3611	51.3904	.0350	.1871	.4740	.6080	10.2669	250.1124
.0165	24.3611	51.3904	.0400	.2000	.4740	.6080	10.9757	267.3814

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	27.9167	51.3742	.0050	.0707	.5434	.6659	4.2502	118.6523
.0165	27.9167	51.3742	.0100	.1000	.5434	.6659	6.0107	167.7996
.0165	27.9167	51.3742	.0150	.1225	.5434	.6659	7.3616	205.5117
.0165	27.9167	51.3742	.0200	.1414	.5434	.6659	8.5005	237.3045
.0165	27.9167	51.3742	.0250	.1581	.5434	.6659	9.5038	265.3145
.0165	27.9167	51.3742	.0300	.1732	.5434	.6659	10.4109	290.6375
.0165	27.9167	51.3742	.0350	.1871	.5434	.6659	11.2451	313.9244
.0165	27.9167	51.3742	.0400	.2000	.5434	.6659	12.0215	335.5993

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	31.4722	51.3626	.0050	.0707	.6127	.7214	4.6045	144.9124
.0165	31.4722	51.3626	.0100	.1000	.6127	.7214	6.5117	204.9371
.0165	31.4722	51.3626	.0150	.1225	.6127	.7214	7.9751	250.9957
.0165	31.4722	51.3626	.0200	.1414	.6127	.7214	9.2089	289.8248
.0165	31.4722	51.3626	.0250	.1581	.6127	.7214	10.2959	324.0340
.0165	31.4722	51.3626	.0300	.1732	.6127	.7214	11.2786	354.9615
.0165	31.4722	51.3626	.0350	.1871	.6127	.7214	12.1822	383.4022
.0165	31.4722	51.3626	.0400	.2000	.6127	.7214	13.0234	409.8742

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	35.0278	51.3557	.0050	.0707	.6821	.7748	4.9454	173.2267
.0165	35.0278	51.3557	.0100	.1000	.6821	.7748	6.9939	244.9795
.0165	35.0278	51.3557	.0150	.1225	.6821	.7748	8.5657	300.0374
.0165	35.0278	51.3557	.0200	.1414	.6821	.7748	9.8908	346.4534
.0165	35.0278	51.3557	.0250	.1581	.6821	.7743	11.0583	387.3466
.0165	35.0278	51.3557	.0300	.1732	.6821	.7748	12.1137	424.3170
.0165	35.0278	51.3557	.0350	.1871	.6821	.7748	13.0843	458.3147
.0165	35.0278	51.3557	.0400	.2000	.6821	.7748	13.9877	489.9590

50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	33.3611	51.4236	.0050	.0707	.6488	.7494	4.7822	159.5397
.0165	33.3611	51.4236	.0100	.1000	.6488	.7494	6.7631	225.6231
.0165	33.3611	51.4236	.0150	.1225	.6488	.7494	8.2830	276.3308
.0165	33.3611	51.4236	.0200	.1414	.6488	.7494	9.5644	319.0793
.0165	33.3611	51.4236	.0250	.1581	.6488	.7494	10.6933	356.7415
.0165	33.3611	51.4236	.0300	.1732	.6488	.7494	11.7140	390.7908
.0165	33.3611	51.4236	.0350	.1871	.6488	.7494	12.6525	422.1023
.0165	33.3611	51.4236	.0400	.2000	.6488	.7494	13.5261	451.2463

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	36.9167	51.4074	.0050	.0707	.7181	.8019	5.1172	188.9082
.0165	36.9167	51.4074	.0100	.1000	.7181	.8019	7.2367	267.1566
.0165	36.9167	51.4074	.0150	.1225	.7181	.8019	8.8632	327.1987
.0165	36.9167	51.4074	.0200	.1414	.7181	.8019	10.2343	377.8165
.0165	36.9167	51.4074	.0250	.1581	.7181	.8019	11.4423	422.4116
.0165	36.9167	51.4074	.0300	.1732	.7181	.8019	12.5344	462.7288
.0165	36.9167	51.4074	.0350	.1871	.7181	.8019	13.5387	499.8042
.0165	36.9167	51.4074	.0400	.2000	.7181	.8019	14.4735	534.3132

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	40.4722	51.3958	.0050	.0707	.7875	.8527	5.4414	220.2241
.0165	40.4722	51.3958	.0100	.1000	.7875	.8527	7.6953	311.4440
.0165	40.4722	51.3958	.0150	.1225	.7875	.8527	9.4247	381.4394
.0165	40.4722	51.3958	.0200	.1414	.7875	.8527	10.8827	440.4483
.0165	40.4722	51.3958	.0250	.1581	.7875	.8527	12.1673	492.4362
.0165	40.4722	51.3958	.0300	.1732	.7875	.8527	13.3286	539.4368
.0165	40.4722	51.3958	.0350	.1871	.7875	.8527	14.3965	582.6583
.0165	40.4722	51.3958	.0400	.2000	.7875	.8527	15.3905	622.8879

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	44.0278	51.3889	.0050	.0707	.8568	.9021	5.7560	253.4243
.0165	44.0278	51.3889	.0100	.1000	.8568	.9021	8.1402	358.3961
.0165	44.0278	51.3889	.0150	.1225	.8568	.9021	9.9697	438.9430
.0165	44.0278	51.3889	.0200	.1414	.8568	.9021	11.5120	506.8487
.0165	44.0278	51.3889	.0250	.1581	.8568	.9021	12.8708	566.6741
.0165	44.0278	51.3889	.0300	.1732	.8568	.9021	14.0993	620.7603
.0165	44.0278	51.3889	.0350	.1871	.8568	.9021	15.2290	670.4978
.0165	44.0278	51.3889	.0400	.2000	.8568	.9021	16.2805	716.7923

50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	37.8611	51.4461	.0050	.0707	.7359	.8151	5.2008	196.9066
.0165	37.8611	51.4461	.0100	.1000	.7359	.8151	7.3550	278.4680
.0165	37.8611	51.4461	.0150	.1225	.7359	.8151	9.0080	341.0523
.0165	37.8611	51.4461	.0200	.1414	.7359	.8151	10.4015	393.8132
.0165	37.8611	51.4461	.0250	.1581	.7359	.8151	11.6293	440.2966
.0165	37.8611	51.4461	.0300	.1732	.7359	.8151	12.7392	482.3207
.0165	37.8611	51.4461	.0350	.1871	.7359	.8151	13.7599	520.9659
.0165	37.8611	51.4461	.0400	.2000	.7359	.8151	14.7100	556.9360

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	41.4167	51.4299	.0050	.0707	.8053	.8656	5.5225	228.7225
.0165	41.4167	51.4299	.0100	.1000	.8053	.8656	7.8100	323.4624
.0165	41.4167	51.4299	.0150	.1225	.8053	.8656	9.5652	396.1589
.0165	41.4167	51.4299	.0200	.1414	.8053	.8656	11.0449	457.4449
.0165	41.4167	51.4299	.0250	.1581	.8053	.8656	12.3486	511.4390
.0165	41.4167	51.4299	.0300	.1732	.8053	.8656	13.5272	560.2533
.0165	41.4167	51.4299	.0350	.1871	.8053	.8656	14.6111	605.1428
.0165	41.4167	51.4299	.0400	.2000	.8053	.8656	15.6199	646.9248

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	44.9722	51.4184	.0050	.0707	.8746	.9146	5.8349	262.4101
.0165	44.9722	51.4184	.0100	.1000	.8746	.9146	8.2518	371.1039
.0165	44.9722	51.4184	.0150	.1225	.8746	.9146	10.1064	454.5076
.0165	44.9722	51.4184	.0200	.1414	.8746	.9146	11.6699	524.8202
.0165	44.9722	51.4184	.0250	.1581	.8746	.9146	13.0473	586.7668
.0165	44.9722	51.4184	.0300	.1732	.8746	.9146	14.2926	642.7709
.0165	44.9722	51.4184	.0350	.1871	.8746	.9146	15.4378	694.2719
.0165	44.9722	51.4184	.0400	.2000	.8746	.9146	16.5037	742.2079

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	48.5278	51.4114	.0050	.0707	.9439	.9622	6.1390	297.9142
.0165	48.5278	51.4114	.0100	.1000	.9439	.9622	8.6819	421.3143
.0165	48.5278	51.4114	.0150	.1225	.9439	.9622	10.6331	516.0025
.0165	48.5278	51.4114	.0200	.1414	.9439	.9622	12.2781	595.8284
.0165	48.5278	51.4114	.0250	.1581	.9439	.9622	13.7273	666.1564
.0165	48.5278	51.4114	.0300	.1732	.9439	.9622	15.0375	729.7377
.0165	48.5278	51.4114	.0350	.1871	.9439	.9622	16.2424	788.2068
.0165	48.5278	51.4114	.0400	.2000	.9439	.9622	17.3638	842.6286

86' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	44.5833	87.3696	.0050	.0707	.5103	.6386	3.8176	170.1994
.0176	44.5833	87.3696	.0100	.1000	.5103	.6386	5.3988	240.6983
.0176	44.5833	87.3696	.0150	.1225	.5103	.6386	6.6122	294.7940
.0176	44.5833	87.3696	.0200	.1414	.5103	.6386	7.6351	340.3988
.0176	44.5833	87.3696	.0250	.1581	.5103	.6386	8.5363	380.5774
.0176	44.5833	87.3696	.0300	.1732	.5103	.6386	9.3511	416.9017
.0176	44.5833	87.3696	.0350	.1871	.5103	.6386	10.1003	450.3053
.0176	44.5833	87.3696	.0400	.2000	.5103	.6386	10.7977	481.3966

86' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	49.9167	87.3588	.0050	.0707	.5714	.6886	4.1165	205.4823
.0176	49.9167	87.3588	.0100	.1000	.5714	.6886	5.8216	290.5958
.0176	49.9167	87.3588	.0150	.1225	.5714	.6886	7.1300	355.9057
.0176	49.9167	87.3588	.0200	.1414	.5714	.6886	8.2330	410.9645
.0176	49.9167	87.3588	.0250	.1581	.5714	.6886	9.2048	459.4723
.0176	49.9167	87.3588	.0300	.1732	.5714	.6886	10.0833	503.3267
.0176	49.9167	87.3588	.0350	.1871	.5714	.6886	10.8013	543.6550
.0176	49.9167	87.3588	.0400	.2000	.5714	.6886	11.6432	581.1916

86' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	55.2500	87.3511	.0050	.0707	.6325	.7368	4.4049	243.3729
.0176	55.2500	87.3511	.0100	.1000	.6325	.7368	6.2295	344.1812
.0176	55.2500	87.3511	.0150	.1225	.6325	.7368	7.6296	421.5342
.0176	55.2500	87.3511	.0200	.1414	.6325	.7368	8.8099	486.7457
.0176	55.2500	87.3511	.0250	.1581	.6325	.7368	9.8497	544.1983
.0176	55.2500	87.3511	.0300	.1732	.6325	.7368	10.7899	596.1393
.0176	55.2500	87.3511	.0350	.1871	.6325	.7368	11.6544	643.9041
.0176	55.2500	87.3511	.0400	.2000	.6325	.7368	12.4590	688.3624

86' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	60.5833	87.3464	.0050	.0707	.6936	.7836	4.6842	283.7825
.0176	60.5833	87.3464	.0100	.1000	.6936	.7836	6.6244	401.3290
.0176	60.5833	87.3464	.0150	.1225	.6936	.7836	8.1132	491.5257
.0176	60.5833	87.3464	.0200	.1414	.6936	.7836	9.3683	567.5650
.0176	60.5833	87.3464	.0250	.1581	.6936	.7836	10.4741	634.5569
.0176	60.5833	87.3464	.0300	.1732	.6936	.7836	11.4738	695.1223
.0176	60.5833	87.3464	.0350	.1871	.6936	.7836	12.3931	750.8179
.0176	60.5833	87.3464	.0400	.2000	.6936	.7836	13.2488	802.6581

86' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN 1.0' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	80.0833	87.4140	.0050	.0707	.9161	.9433	5.6384	451.5424
.0176	80.0833	87.4140	.0100	.1000	.9161	.9433	7.9739	638.5774
.0176	80.0833	87.4140	.0150	.1225	.9161	.9433	9.7660	782.0944
.0176	80.0833	87.4140	.0200	.1414	.9161	.9433	11.2768	903.0848
.0176	80.0833	87.4140	.0250	.1581	.9161	.9433	12.6079	1009.6795
.0176	80.0833	87.4140	.0300	.1732	.9161	.9433	13.8112	1106.0485
.0176	80.0833	87.4140	.0350	.1871	.9161	.9433	14.9178	1194.6689
.0176	80.0833	87.4140	.0400	.2000	.9161	.9433	15.9478	1277.1547

86' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN 1.0' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	85.4167	87.4032	.0050	.0707	.9773	.9848	5.8864	502.7984
.0176	85.4167	87.4032	.0100	.1000	.9773	.9848	8.3247	711.0643
.0176	85.4167	87.4032	.0150	.1225	.9773	.9848	10.1956	870.8724
.0176	85.4167	87.4032	.0200	.1414	.9773	.9848	11.7728	1005.5968
.0176	85.4167	87.4032	.0250	.1581	.9773	.9848	13.1624	1124.2914
.0176	85.4167	87.4032	.0300	.1732	.9773	.9848	14.4187	1231.5995
.0176	85.4167	87.4032	.0350	.1871	.9773	.9848	15.5740	1330.2795
.0176	85.4167	87.4032	.0400	.2000	.9773	.9848	16.6493	1422.1286

86' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN 1.0' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	90.7500	87.3955	.0050	.0707	1.0384	1.0254	6.1292	556.2293
.0176	90.7500	87.3955	.0100	.1000	1.0384	1.0254	8.6681	786.6270
.0176	90.7500	87.3955	.0150	.1225	1.0384	1.0254	10.6162	963.4173
.0176	90.7500	87.3955	.0200	.1414	1.0384	1.0254	12.2585	1112.4585
.0176	90.7500	87.3955	.0250	.1581	1.0384	1.0254	13.7054	1243.7664
.0176	90.7500	87.3955	.0300	.1732	1.0384	1.0254	15.0135	1362.4779
.0176	90.7500	87.3955	.0350	.1871	1.0384	1.0254	16.2165	1471.6443
.0176	90.7500	87.3955	.0400	.2000	1.0384	1.0254	17.3361	1573.2539

86' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN 1.0' OVERFL$W

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	96.0833	87.3908	.0050	.0707	1.0995	1.0653	6.3673	611.7888
.0176	96.0833	87.3908	.0100	.1000	1.0995	1.0653	9.0047	865.2000
.0176	96.0833	87.3908	.0150	.1225	1.0995	1.0653	11.0284	1059.6492
.0176	96.0833	87.3908	.0200	.1414	1.0995	1.0653	12.7345	1223.5775
.0176	96.0833	87.3908	.0250	.1581	1.0995	1.0653	14.2377	1368.0013
.0176	96.0833	87.3908	.0300	.1732	1.0995	1.0653	15.5966	1498.5703
.0176	96.0833	87.3908	.0350	.1871	1.0995	1.0653	16.8462	1618.6410
.0176	96.0833	87.3908	.0400	.2000	1.0995	1.0653	18.0094	1730.4000

86' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN 1.5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	115.5833	87.4915	.0050	.0707	1.3211	1.2040	7.1949	831.6155
.0176	115.5833	87.4915	.0100	.1000	1.3211	1.2040	10.1752	1176.0819
.0176	115.5833	87.4915	.0150	.1225	1.3211	1.2040	12.4620	1440.4003
.0176	115.5833	87.4915	.0200	.1414	1.3211	1.2040	14.3899	1663.2310
.0176	115.5833	87.4915	.0250	.1581	1.3211	1.2040	16.0884	1859.5487
.0176	115.5833	87.4915	.0300	.1732	1.3211	1.2040	17.6239	2037.0336
.0176	115.5833	87.4915	.0350	.1871	1.3211	1.2040	19.0360	2200.2478
.0176	115.5833	87.4915	.0400	.2000	1.3211	1.2040	20.3504	2352.1638

86' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN 1.5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	120.9167	87.4807	.0050	.0707	1.3822	1.2408	7.4151	896.6067
.0176	120.9167	87.4807	.0100	.1000	1.3822	1.2408	10.4865	1267.9934
.0176	120.9167	87.4807	.0150	.1225	1.3822	1.2408	12.8433	1552.9684
.0176	120.9167	87.4807	.0200	.1414	1.3822	1.2408	14.8302	1793.2135
.0176	120.9167	87.4807	.0250	.1581	1.3822	1.2408	16.5806	2004.8736
.0176	120.9167	87.4807	.0300	.1732	1.3822	1.2408	18.1632	2196.2290
.0176	120.9167	87.4807	.0350	.1871	1.3822	1.2408	19.6185	2372.1985
.0176	120.9167	87.4807	.0400	.2000	1.3822	1.2408	20.9730	2535.9868

86' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN 1.5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	126.2500	87.4730	.0050	.0707	1.4433	1.2771	7.6319	963.5271
.0176	126.2500	87.4730	.0100	.1000	1.4433	1.2771	10.7931	1362.6331
.0176	126.2500	87.4730	.0150	.1225	1.4433	1.2771	13.2188	1668.8779
.0176	126.2500	87.4730	.0200	.1414	1.4433	1.2771	15.2638	1927.0542
.0176	126.2500	87.4730	.0250	.1581	1.4433	1.2771	17.0654	2154.5121
.0176	126.2500	87.4730	.0300	.1732	1.4433	1.2771	18.6943	2360.1498
.0176	126.2500	87.4730	.0350	.1871	1.4433	1.2771	20.1921	2549.2531
.0176	126.2500	87.4730	.0400	.2000	1.4433	1.2771	21.5863	2725.2662

86' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN 1.5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	131.5833	87.4684	.0050	.0707	1.5044	1.3129	7.8456	1032.3454
.0176	131.5833	87.4684	.0100	.1000	1.5044	1.3129	11.0953	1459.9569
.0176	131.5833	87.4684	.0150	.1225	1.5044	1.3129	13.5889	1788.0748
.0176	131.5833	87.4684	.0200	.1414	1.5044	1.3129	15.6911	2064.6909
.0176	131.5833	87.4684	.0250	.1581	1.5044	1.3129	17.5432	2308.3946
.0176	131.5833	87.4684	.0300	.1732	1.5044	1.3129	19.2176	2528.7196
.0176	131.5833	87.4684	.0350	.1871	1.5044	1.3129	20.7574	2731.3293
.0176	131.5833	87.4684	.0400	.2000	1.5044	1.3129	22.1906	2919.9139

86' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN 2.0' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	151.0833	87.6019	.0050	.0707	1.7247	1.4381	8.5913	1297.9957
.0176	151.0833	87.6019	.0100	.1000	1.7247	1.4381	12.1499	1835.6432
.0176	151.0833	87.6019	.0150	.1225	1.7247	1.4381	14.8803	2248.1945
.0176	151.0833	87.6019	.0200	.1414	1.7247	1.4381	17.1825	2595.9914
.0176	151.0833	87.6019	.0250	.1581	1.7247	1.4381	19.2106	2902.4067
.0176	151.0833	87.6019	.0300	.1732	1.7247	1.4381	21.0442	3179.4272
.0176	151.0833	87.6019	.0350	.1871	1.7247	1.4381	22.7303	3434.1739
.0176	151.0833	87.6019	.0400	.2000	1.7247	1.4381	24.2997	3671.2863

86' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN 2.0' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	156.4167	87.5911	.0050	.0707	1.7858	1.4719	8.7928	1375.3456
.0176	156.4167	87.5911	.0100	.1000	1.7858	1.4719	12.4349	1945.0324
.0176	156.4167	87.5911	.0150	.1225	1.7858	1.4719	15.2296	2382.1685
.0176	156.4167	87.5911	.0200	.1414	1.7858	1.4719	17.5857	2750.6912
.0176	156.4167	87.5911	.0250	.1581	1.7858	1.4719	19.6614	3075.3663
.0176	156.4167	87.5911	.0300	.1732	1.7858	1.4719	21.5380	3368.8949
.0176	156.4167	87.5911	.0350	.1871	1.7858	1.4719	23.2636	3638.8224
.0176	156.4167	87.5911	.0400	.2000	1.7858	1.4719	24.8699	3890.0648

86' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN 2.0' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	161.7500	87.5834	.0050	.0707	1.8468	1.5053	8.9920	1454.4556
.0176	161.7500	87.5834	.0100	.1000	1.8468	1.5053	12.7166	2056.9109
.0176	161.7500	87.5834	.0150	.1225	1.8468	1.5053	15.5746	2519.1911
.0176	161.7500	87.5834	.0200	.1414	1.8468	1.5053	17.9840	2908.9113
.0176	161.7500	87.5834	.0250	.1581	1.8468	1.5053	20.1067	3252.2617
.0176	161.7500	87.5834	.0300	.1732	1.8468	1.5053	22.0258	3562.6742
.0176	161.7500	87.5834	.0350	.1871	1.8468	1.5053	23.7906	3848.1279
.0176	161.7500	87.5834	.0400	.2000	1.8468	1.5053	25.4332	4113.8218

86' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN 2.0' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0176	167.0833	87.5788	.0050	.0707	1.9078	1.5382	9.1888	1535.3020
.0176	167.0833	87.5788	.0100	.1000	1.9078	1.5382	12.9950	2171.2449
.0176	167.0833	87.5788	.0150	.1225	1.9078	1.5382	15.9155	2659.2210
.0176	167.0833	87.5788	.0200	.1414	1.9078	1.5382	18.3777	3070.6039
.0176	167.0833	87.5788	.0250	.1581	1.9078	1.5382	20.5469	3433.0396
.0176	167.0833	87.5788	.0300	.1732	1.9078	1.5382	22.5080	3760.7064
.0176	167.0833	87.5788	.0350	.1871	1.9078	1.5382	24.3114	4062.0272
.0176	167.0833	87.5788	.0400	.2000	1.9078	1.5382	25.9900	4342.4897

EXHIBIT G

STREETS AND MAXIMUM RUNOFFS

DESCRIPTION	MAXIMUM RUNOFF (in c.f.s.)
A. Six streets extending NW from Spain Road, N.E. - 50' R/W, 32' f. to f.	14
B. East-west street about 775' north of Spain Road, N.E. - 50' R/W, 32' f. to f.	52
C. Spain Road, N.E. - from Eubank Blvd., N.E. to 1350' east of Eubank Blvd., N.E. - 86' R/W, 48' f. to f.	78
D. Spain Road, N.E. - from about 1750' east of Eubank Blvd., N.E. 86' R/W, 48' f. to f.	870
E. Eubank Blve., N.E. - from 600' south of the Bear Canyon Arroyo to Juan Tabo Blvd., N.E. - 108' R/W, two 21.5' f. to f.	285

REVISED MAY 1972
AP #2

ACADEMY PLACE
UNIT 2

Ralph K. Hicks and Associates, Inc.

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STORM DRAINAGE STUDY RELATIVE TO THE DEVELOPMENT OF ACADEMY PLACE, UNIT 2 ALBUQUERQUE, NEW MEXICO

FEBRUARY 1972

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STORM DRAINAGE STUDY RELATIVE TO THE DEVELOPMENT OF ACADEMY PLACE, UNIT 2

I. GENERAL

This report has been prepared to present findings of a study of storm drainage conditions in an area proposed for development as Academy Place, Unit 2, and to describe proposed methods for providing adequate storm drainage in the area.

II. LOCATION

The area considered in this report is bounded on the West and Northwest by Eubank Blvd.; on the Northeast and East by Juan Tabo Blvd.; on the South by the Bear Canyon Arroyo and the Elena Gallegos Grant boundary. It is situated mainly in Section 33 and the south central one-fourth (1/4) of Section 28, Township 11 North, Range 4 East, N.M.P.M.

III. EXISTING DRAINAGE CONDITIONS

A. General

The presently undeveloped area proposed for this development lies within the watersheds of the Bear Canyon Arroyo and the Bear Arroyo. There are also four other smaller watersheds with well defined channels within the subdivision. A "Preliminary Investigation of Storm Drainage Lands in the Elena Gallegos Grant" by Mr. Pete Phelan of Gordon Herkenhoff and Associates from a study made by the Corps of Engineers furnishing information considering a possible channel change was studied.

The existing runoff conditions of the Bear Canyon Arroyo and Bear Arroyo have been determined at the eastern limits of the property by the Corps of Engineers. The values of 5588 c.f.s. for the Bear Canyon Arroyo and 870 c.f.s. for the Bear Arroyo were obtained from the Corps of Engineers' "Flood Plain Information, Albuquerque Arroyos, Part I," dated June 1970.

B. Topography

The area of the proposed development, a nine to ten miles wide clinoplain known as the Sandia Mesa, slopes gradually upward toward the Sandia Mountains at a

nearly uniform rate of about 125' per mile. This mesa was built by deposits of gravels and clays from the Rio Grande, intermixed with sand and gravels carried from the mountains by smaller streams. The mesa is crossed by sandy arroyos or usually dry stream channels which carry large volumes of water runoff for a few hours once or twice each summer.

Arroyo cutting is a problem in the area and is most acute during the rainy season. Peculiarities of drainage, differences in erodability of the soils, or variation in the density of protective vegetation allows the feeders of one arroyo to cut into and capture the headwaters of adjacent arroyos, leading to the concentration of runoff in the second arroyo. Concomintantly, the amount of flow in the first arroyo, the headwaters of which were "pirated"* away, is diminished.

The above seems to warrant lining of channels, but due to its excessive cost ($8.00/sy in 1971) it appears economically advisable only to channelize the major arroyos and line the out side of curves.

C. Drainage Areas and Channels

At the present time there are six separate drainage areas contributing runoff from the East. However, there appears to be only two major, one semi-major, and several minor channels flowing from East to West. The major and semi-major channels are well defined. The largest incoming drainage area, known as the Bear Canyon Arroyo, contributes about 5588 c.f.s. at the Southeastern limit, and the second largest, known as the Bear Arroyo, contributes about 870 c.f.s. at the eastern limit of Academy Place.

The runoff from the semi-major and minor drainage areas can be carried by aligning master planned streets in such a way (set property lines high enough) as to either carry water to proposed channels, drainage easements or across the development, redepositing it in its original channel.

IV. PROPOSED DRAINAGE PLANS

A. General

In order to provide an adequate system of storm drainage for the proposed development it was necessary to:

(1) Determine the drainage areas which can contribute storm runoff affecting the development.

(2) Determine the amounts of runoff which could be

*See reference no. 1 of this report

expected from each area.

(3) Determine the points at which the various runoffs would converge and then the runoff quantities to be expected at each of these points.

(4) Determine the ability of each of the proposed channels or structures to handle the quantities.

(5) Determine and recommend the means by which the expected runoff can be safely carried across the subdivision in the same proportion as it now exists.

(6) Design additional channels and structures adequate to handle the runoff in the area to be developed.

(7) Determine the current cost of all capital improvements and recommend a suitable sequence of development for both the developer and the City of Albuquerque.

B. Drainage Areas

A study was made by this firm to ascertain that no conflicting drainage studies had been made. Also studied was the Drainage Study of the Albuquerque Arroyos, Part I, prepared by the U.S. Army, Corps of Engineers for the Albuquerque Metropolitan Arroyo Flood Control Authority in June 1970 and the previously mentioned preliminary investigation prepared by Gordon Herkenhoff and Associates in July 1971 (section III, A of this report). Next, a study of the photograph, Exhibit "A", to determine the areas which could conceivably contribute runoff to the proposed development was made for which a copy of cor utations is shown in Exhibit "E". The Master Plan of Drainage, Exhibit "B", was prepared showing the entire area with direction of flow as well as runoff quantities. Finally, the internal areas of Unit 2 are shown on Exhibit "C" along with expected runoff quantities and water blocks indicated.

C. Runoff Quantities

The quantity of runoff to be expected from each drainage area was determined using the Rational Formula, $Q=CIA$, where: Q=quantity of runoff in cubic feet per second; C=coefficient of runoff dependent upon the type of surface drained; I=intensity of rainfall in inches per hour for a duration equal to the time of accumulation in minutes; A=area of contributing watershed in acres.

The area (A) of each separate area was determined by

outlining the watersheds on either a scaled photograph or a contour map and measuring the areas by planimeter.

The intensity of rainfall (I) was determined by assuming a 100 year frequency rainfall, then utilizing Intensity Duration Frequency Curves from Reference 3 together with the expected times of accumulation of runoff from each of the areas. The times of accumulation were determined using probable future streets and drainage channel alignments and grades, as shown, assuming the overland flows to be across either poor grass, asphalt pavement, or bare soil surfaces, depending upon the probable type of development in each area and estimating the probable type of grading to be done in each area; assuming future streets to be asphalt paved with concrete curbs and either 8", 6", 4" or 2" crowned sections; and determining the times of flow by utilizing the tables on pages 5.00, 5.04, and 5.05 of Reference 4.

The coefficient of runoff (C) was determined by assuming the maximum possible development in the areas under consideration. A coefficient of 0.65 was used where dense residential development was most probable. A coefficient of 0.70 was used in probable commercial developments or areas that will likely have considerable of the surfaces paved by either roofs or parking areas.

The quantities of runoff expected from each area, and the points of concentration with the runoff quantities at each of these points are indicated in Exhibits "B" and "C" and tabulated in Exhibit "E" along with the runoff computation sheets.

D. Drainage Channels and Facilities

All existing structure capacities, as well as any proposed structures, were verified from computer output sheets (see Exhibit "F" for a summary of street carrying capacities) which utilizes Manning's Equation, Q=AV, where $V=\frac{1.486}{n} R^{2/3} S^{1/2}$ when A=cross-sectional area of channel or pipe in square feet; R=hydraulic radius or area divided by wetted perimeter; S=slope of channel or facility in feet per foot; and "n" values of 0.015 for concrete and asphalt, .013 for concrete pipes, .0225 for earth lined channels, and a composite "n" value based on proportional wetted surfaces for overland flow sections.

V. CONCLUSIONS AND RECOMMENDATIONS

On the basis of this study and its calculations, it is

concluded that the development of this area can be accomplished satisfactorily provided adequate storm drainage is done as recommended below:

A. The Bear Canyon Arroyo and Spain Road East of Unit 2 must be realigned to intersect Juan Tabo Blvd. about 190' North of its master planned location.

B. The Bear Canyon Arroyo should be constructed as shown by typical section A-A to a point about 240' East of the eastern limit of Unit 2 where a temporary dike must be constructed at an angle of about 38° along an existing dike to channelize this arroyo.

C. From about 240' East of Unit 2 to a point about 500' East section B-B should be used. The South side of this section should be graded to drain the Bear Canyon Arroyo into the channel.

D. From about 500' from the East boundary of Tract "AA" to the eastern limit of Unit 2 the Bear Canyon Arroyo proceeds through two curves and two short tangents to align it parallel with Spain Road. Typical section C-C is recommended with 6 inch lining on the outer slopes of the curves. This lining should extend to a depth of about three feet below the bottom of the designed channel and to a point one foot below the top where it will extend two feet into the sides.

E. Two temporary dikes as shown on Exhibit "B" must be constructed to provide adequate channelization of the Bear Arroyo just East of the eastern limit of Unit 2.

F. A suggested profile of Eubank Blvd., N.E., is shown in Exhibit "D".

G. As indicated by the above recommendations, two channels as well as the required drainage easements shown on Exhibit "C" presupposes that Unit 2 will be constructed prior to the remainder of the master planned area. Typical channel sections for drainage easements are also shown on Exhibit "C".

H. Recommended street grades are contained in Exhibit "G" of this report.

I. The following structures are recommended to properly drain the area:

(1) On Eubank Blvd., N.E., over Bear Canyon Arroyo, 7-10X4 CBC, special design, normal, with four wingwalls and rip-rap.*

*See N.M. State Highway Dept. current standard plans CB-34, W.C.B.-0, and EC-61 for typical designs and quantities.

(2) On Eubank Blvd., N.E., about 700 feet North of Spain Road, N.E., a single 6X4, 45° skew CBC, with wingwalls and rip-rap at both ends* (Ref: Drainage Study Relative to the Development of Academy Estates, dated August 1971.)

(3) The above structure over Bear Canyon Arroyo would have a cost of about $70,000 based on estimated concrete steel and wire enclosed rip-rap quantities and using the 1970 New Mexico State Highway Department Average Unit Bid Prices.

(4) In lieu of either of these structures, an open dip section with four percent grades on either side of the channel with cutoff walls to protect the pavement and at least twenty feet of wire enclosed rip-rap at the downstream end may be used to reduce the C.I.P. costs.

Since this master planned area requires revision, a complete study is not offered at this time. Unit 2, however, may be constructed using the above recommendations. When Spain Road is realigned and the street pattern in the proposed mobile home tracts is completed Exhibit "B" will be revised. Development of the remaining units may then be accomplished.

In general, existing division lines and arroyos should be adhered to in order to prevent changing the existing runoff conditions.

Respectfully Submitted,

Donald L. Campbell
P.E. & L.S. No. 3633

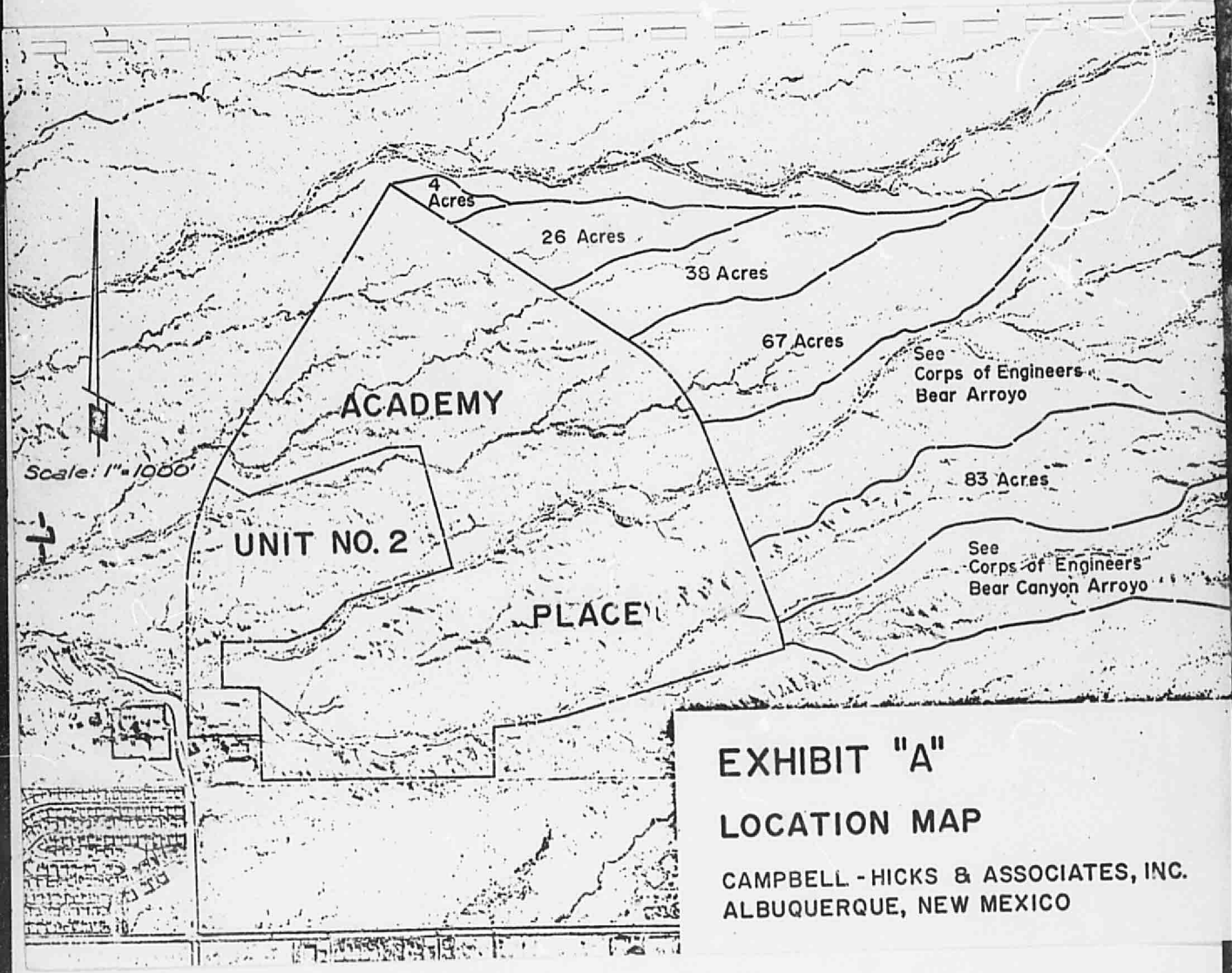

EXHIBIT "A"

LOCATION MAP

CAMPBELL - HICKS & ASSOCIATES, INC.
ALBUQUERQUE, NEW MEXICO

EXHIBIT E

SUMMARY OF RUNOFF COMPUTATIONS

Sheet No.	Area Number	Area (in acres)	Expected Runoff (in c.f.s.) Individual	Total
1	4 acres	4	14	
2	26 acres	26	67	
3	38 acres	38	86	
4	67 acres	67	150	
5	Bear Arroyo (E boundary)		870*	
6	83 acres	83	236	
7	Bear Canyon Arroyo (South-eastern boundary)		5588*	
8	1	7	20	
9	2	54	136	
10	3	109	220	
11	3A	32	91	
12	3B	4	13	324
13	4	26	69	
14	Bear Canyon (Southwestern boundary)		5740*	

*See Reference No. 2

RUNOFF COMPUTATIONS

Sheet No. 1

Job No. Academy Place

Drainage Area No. 4 Acres

Area = 4 acres

Maximum Overland Flow: L = 60' S = 3.3

Maximum Channel Flow:

Channel No. 1 L = 890' S = 3.2

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 7.4 min.

Channel No. 1 Flow:

Velocity= 4.0 ft/sec; Time= $\frac{890}{4.0 \times 60}$ = 3.7 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 11.1 min.

$I = \frac{189}{T+25} = \frac{189}{36.1} = 5.24$

$Q = CIA = (.65)(5.24)(4) = 14$ c.f.s.

Date: 1-26-72

Comp. by: HEP

Checked by: C.B.

RUNOFF COMPUTATIONS

Sheet No. 2

Job No. Academy Place

Drainage Area No. 26 Acres

Area = 26 acres

Maximum Overland Flow: L = 760' S = 3.8

Maximum Channel Flow:

Channel No. 1 L = 1750' S = 3.3

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 20.0 min.

Channel No. 1 Flow:

Velocity= 12.4 ft/sec; Time= $\frac{1750}{12.4 \times 60}$ = 2.4 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 22.4 min.

$$I = \frac{189}{T+25} = \frac{189}{47.4} = 3.987$$

$$Q = CIA = (.65)(3.987)(26) = 67 \text{ c.f.s.}$$

Date: 1-13-72

Comp. by: MEP

Checked by: PB

RUNOFF COMPUTATIONS

Sheet No. 3

Job No. Academy Place

Drainage Area No. 38 Acres

Area = 38 acres

Maximum Overland Flow: L = 1160' S = 3.0

Maximum Channel Flow:

Channel No. 1 L = 680' S = 5.1

Channel No. 2 L = 2050' S = 2.9

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 23.2 min.

Channel No. 1 Flow:

Velocity= 3.2 ft/sec; Time= $\frac{680}{3.2 \times 60}$ = 3.5 min.

Channel No. 2 Flow:

Velocity= 12.1 ft/sec; Time= $\frac{2050}{12.1 \times 60}$ = 2.8 min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 29.5 min.

$$I = \frac{189}{T+25} = \frac{189}{54.5} = 3.468$$

$$Q = CIA = (.65)(3.468)(38) = 86 \text{ c.f.s.}$$

Date: 1-13-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 4

Job No. Academy Place

Drainage Area No. 67 Acres

Area = 67 acres

Maximum Overland Flow: L = 250' S = 3.6

Maximum Channel Flow:

Channel No. 1 L = 2650' S = 3.7

Channel No. 2 L = 1310' S = 3.1

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.1 min.

Channel No. 1 Flow:

Velocity= 2.7 ft/sec; Time= $\frac{2650}{2.7 \times 60}$ = 16.2 min.

Channel No. 2 Flow:

Velocity= 16.0 ft/sec; Time= $\frac{1310}{16.0 \times 60}$ = 1.4 min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 29.7 min.

$I = \frac{189}{T + 25} = \frac{189}{54.7} = 3.45$

$Q = CIA = (.65)(3.45)(67) = 150$ c.f.s.

Date: 1-13-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 5

Job No. Academy Place

Drainage Area No. Bear Arroyo - East boundry

Area = _____ acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: _____ min.

Channel No. 1 Flow:

Velocity= _____ ft/sec; Time= _____ X 60 = _____ min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= _____ X 60 = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= _____ X 60 = _____ min.

Total Accumulation Time: T = _____ min.

I = _____ = _____ = _____

Q = CIA = ( )( )( ) = 870 * c.f.s.

* C of E Report

Date: 2-2-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 6

Job No. Academy Place

Drainage Area No. 83 Acres

Area = 83 acres

Maximum Overland Flow: L = 150' S = 2.0

Maximum Channel Flow:

Channel No. 1 L = 2850' S = 2.8

Channel No. 2 L = 2400' S = 5.4

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 11.3 min.

Channel No. 1 Flow:

Velocity= 11.1 ft/sec; Time= $\frac{2850}{11.1 \times 60}$ = 4.3 min.

Channel No. 2 Flow:

Velocity= 16.9 ft/sec; Time= $\frac{2400}{16.9 \times 60}$ = 2.4 min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 18.0 min.

$I = \frac{189}{T+25} = \frac{189}{43.0} = 4.395$

Q = CIA = (.65)(4.395)(83) = 236 c.f.s.

Date: 1-13-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 7

Job No. Academy Place

Drainage Area No. Bear Canyon Arroyo - Southeastern boundary

Area = _____ acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: _____ min.

Channel No. 1 Flow:

Velocity= _____ ft/sec; Time= _____ / X 60 = _____ min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= _____ / X 60 = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= _____ / X 60 = _____ min.

Total Accumulation Time: T = _____ min.

I = _____ = _____ = _____

Q = CIA = ( )( )( ) = 5588 c.f.s.*

* C of E Report

Date: 2-2-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 8

Job No. Academy Place

Drainage Area No. 1

Area = 7 acres

Maximum Overland Flow: L = 540' S = 4.4

Maximum Channel Flow:

Channel No. 1 L = 600' S = 2.3

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 16.8 min.

Channel No. 1 Flow:

Velocity= 5.6 ft/sec; Time= $\frac{600}{5.6 \times 60}$ = 1.8 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 18.6 min.

$$I = \frac{189}{T+25} = \frac{189}{43.6} = 4.33$$

$$Q = CIA = (.65)(4.33)(7) = 20 \text{ c.f.s.}$$

Date: 1-24-72

Comp. by: [illegible]

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. 9

Job No. Academy Place

Drainage Area No. 2

Area = 54 acres

Maximum Overland Flow: L = 440 S = 5.4

Maximum Channel Flow:

Channel No. 1 L = 2850' S = 3.3

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 15.1 min.

Channel No. 1 Flow:

Velocity= 5.4 ft/sec; Time= $\frac{2850}{5.4 \times 60}$ = 8.8 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 23.9 min.

$I = \frac{189}{T+25} = \frac{189}{48.9} = 3.87$

Q = CIA = (.65)(3.87)(54) = 136 c.f.s.

Date: 1-24-72

Comp. by: HEP

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. 10

Job No. Academy Place

Drainage Area No. 3

Area = 109 acres

Maximum Overland Flow: L = 250' S = 3.6

Maximum Channel Flow:

Channel No. 1 L = 2650' S = 3.7

Channel No. 2 L = 1310' S = 3.1

Channel No. 3 L = 2680' S = 3.2

Accumulation Time

Overland Flow: 12.1 min.

Channel No. 1 Flow:

Velocity= 2.7 ft/sec; Time= $\frac{2650}{2.7 \times 60}$ = 16.2 min.

Channel No. 2 Flow:

Velocity= 16.0 ft/sec; Time= $\frac{1310}{16.0 \times 60}$ = 1.4 min.

Channel No. 3 Flow:

Velocity= 7.1 ft/sec; Time= $\frac{2680}{7.1 \times 60}$ = 6.3 min.

Total Accumulation Time: T = 36.0 min.

$I = \frac{189}{T+25} = \frac{189}{61.0} = 3.10$

Q = CIA = (.65)(3.10)(109) = 220 c.f.s.

Date: 2-2-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 10

Job No. Academy Place

Drainage Area No. 3

Area = 109 acres

Maximum Overland Flow: L = 250' S = 3.6

Maximum Channel Flow:

Channel No. 1 L = 2650' S = 3.7

Channel No. 2 L = 1310' S = 3.1

Channel No. 3 L = 2680' S = 3.2

Accumulation Time

Overland Flow: 12.1 min.

Channel No. 1 Flow:

Velocity= 2.7 ft/sec; Time= $\frac{2650}{2.7 \times 60}$ = 16.2 min.

Channel No. 2 Flow:

Velocity= 16.0 ft/sec; Time= $\frac{1310}{16.0 \times 60}$ = 1.4 min.

Channel No. 3 Flow:

Velocity= 7.1 ft/sec; Time= $\frac{2680}{7.1 \times 60}$ = 6.3 min.

Total Accumulation Time: T = 36.0 min.

$I = \frac{189}{T+25} = \frac{189}{61.0} = 3.10$

Q = CIA = (.65)(3.10)(109) = 220 c.f.s.

Date: 2-2-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 11

Job No. Academy Place

Drainage Area No. 3-A

Area = 32 acres

Maximum Overland Flow: L = 150' S = 2.4

Maximum Channel Flow:

Channel No. 1 L = 2100 S = 1.8

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 11.2 min.

Channel No. 1 Flow:

Velocity= 5.0 ft/sec; Time= $\frac{2100}{5.0 \times 60}$ = 7.0 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 18.2 min.

$I = \frac{189}{T+25} = \frac{189}{43.2} = 4.37$

Q = CIA = (.65)(4.37)(32) = 91 c.f.s.

Date: 1-21-72

Comp. by: [illegible]

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 12

Job No. Academy Place

Drainage Area No. 3-B

Area = 4 acres

Maximum Overland Flow: L = 220' S = 3.2

Maximum Channel Flow:

Channel No. 1 L = 370' S = 3.8

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 11.8 min.

Channel No. 1 Flow:

Velocity= 6.6 ft/sec; Time= $\frac{370}{6.6 \times 60}$ = 1.0 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 12.8 min.

$I = \frac{189}{T+25} = \frac{189}{37.8} = 5.00$

Q = CIA = (.65)(5.00)(4) = 13 c.f.s.

Total Q = 220 + 91 + 13 = 324

Date: 1-24-92

Comp. by: HET

Checked by: _____

RUNOFF COMPUTATIONS

Sheet No. 13

Job No. Academy Place

Drainage Area No. 4

Area = 26 acres

Maximum Overland Flow: L = 370' S = 2.9

Maximum Channel Flow:

Channel No. 1 L = 2200' S = 3.0

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 15.6 min.

Channel No. 1 Flow:

Velocity= 6.1 ft/sec; Time= $\frac{2200}{6.1 \times 60}$ = 6.0 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 21.6 min.

$I = \frac{189}{T+25} = \frac{189}{46.6} = 4.06$

Q = CIA = (.65)(4.06)(26) = 69 c.f.s.

Date: 2-2-72

Comp. by: HEP

Checked by: [illegible]

RUNOFF COMPUTATIONS

Sheet No. 14

Job No. Academy Place

Drainage Area No. Bear Canyon Arroyo - Southwestern Boundry

Area = _____ acres

Maximum Overland Flow: L = _____ S = _____

Maximum Channel Flow:

Channel No. 1 L = _____ S = _____

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: _____ min.

Channel No. 1 Flow:

Velocity= _____ ft/sec; Time= _____ / X 60 = _____ min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= _____ / X 60 = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= _____ / X 60 = _____ min.

Total Accumulation Time: T = _____ min.

I = _____ = _____ = _____

Q = CIA = ( )( )( ) = 5740 c.f.s.*

* C of E. Report

Date: 2-2-72

Comp. by: [illegible]

Checked by: [illegible]

EXHIBIT F

STREET CARRYING CAPACITIES
AT VARIOUS GRADES
IN CFS

n(conc)=.015 n(soil)=.0225 n(composite)=.006

STREET WIDTH	TYPE CROWN	CURB HT	.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400
32'	8"	8"	18	25	31	36	40	44	47	50
	6"	8"	35	49	61	70	78	86	92	99
	4"	8"	56	80	98	113	126	138	149	160
	2"	8"	82	116	142	164	183	201	217	232
40'	8"	8"	22	32	39	45	50	55	59	63
	6"	8"	44	62	76	88	98	108	116	124
	4"	8"	71	100	123	142	159	174	188	201
	2"	8"	103	146	178	206	230	252	272	291
44'	8"	8"	25	35	43	49	55	60	65	70
	6"	8"	48	68	84	97	108	119	128	137
	4"	8"	78	111	135	156	175	192	207	221
	2"	8"	113	160	196	227	254	278	300	321
48'	8"	8"	27	38	47	54	60	66	71	76
	6"	8"	53	75	92	106	118	130	140	150
	4"	8"	85	121	148	171	191	209	226	242
	2"	8"	124	175	215	248	277	304	328	351

R/W TO R/W

OVERFLOW SECTIONS CAPACITIES

R/W	ST WD	HT CURB DEPTH	.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400
50'	32'	0.1	14	19	23	27	30	33	36	38
		0.2	43	61	75	86	96	105	114	122
		0.4	137	193	237	273	305	335	361	386

R/W TO R/W
OVERFLOW SECTIONS CAPACITIES

R/W	ST WD	HT CURB DEPTH	.0050	.0100	.0150	.0200	.0250	.0300	.0350	.0400
60'	40'	0.1	17	24	29	33	37	41	44	47
		0.2	53	75	92	106	119	130	140	150
		0.4	168	238	292	337	376	412	445	476
		0.6	331	468	573	662	740	810	875	936
60'	44'	0.1	18	25	31	36	40	44	47	50
		0.2	57	80	98	113	127	139	150	160
		0.4	180	254	311	359	402	440	475	508
		0.6	353	499	612	706	790	865	934	999
64'	48'	0.1	19	27	33	39	43	47	51	55
		0.2	61	87	106	123	137	150	162	174
		0.4	195	275	337	390	436	477	515	551
		0.6	383	541	663	766	856	938	1013	1083
86'	48'	0.1	21	30	37	43	48	52	57	61
		0.2	68	96	118	136	152	166	180	192
		0.4	215	305	374	431	482	528	571	610
		0.6	424	600	734	848	948	1039	1122	1199

09/21/71. 09.48.14.
PROGRAM KARLAN

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 8

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	7.1111	33.3703	.0050	.0707	.2131	.3568	2.4998	17.7719
.0150	7.1111	33.3703	.0100	.1000	.2131	.3568	3.5344	25.1333
.0150	7.1111	33.3703	.0150	.1225	.2131	.3568	4.3287	30.7819
.0150	7.1111	33.3703	.0200	.1414	.2131	.3568	4.9984	35.5439
.0150	7.1111	33.3703	.0250	.1581	.2131	.3568	5.5883	39.7392
.0150	7.1111	33.3703	.0300	.1732	.2131	.3568	6.1217	43.5322
.0150	7.1111	33.3703	.0350	.1871	.2131	.3568	6.6122	47.0201
.0150	7.1111	33.3703	.0400	.2000	.2131	.3568	7.0687	50.2666

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 6

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	10.6667	33.3542	.0050	.0707	.3198	.4676	3.2759	34.9430
.0150	10.6667	33.3542	.0100	.1000	.3198	.4676	4.6328	49.4169
.0150	10.6667	33.3542	.0150	.1225	.3198	.4676	5.6740	60.5231
.0150	10.6667	33.3542	.0200	.1414	.3198	.4676	6.5518	69.8860
.0150	10.6667	33.3542	.0250	.1581	.3198	.4676	7.3252	78.1350
.0150	10.6667	33.3542	.0300	.1732	.3198	.4676	8.0243	85.5926
.0150	10.6667	33.3542	.0350	.1871	.3198	.4676	8.6672	92.4505
.0150	10.6667	33.3542	.0400	.2000	.3198	.4676	9.2657	98.8338

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 4

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	14.2222	33.3426	.0050	.0707	.4265	.5666	3.9694	56.4537
.0150	14.2222	33.3426	.0100	.1000	.4265	.5666	5.6136	79.8375
.0150	14.2222	33.3426	.0150	.1225	.4265	.5666	6.8752	97.7806
.0150	14.2222	33.3426	.0200	.1414	.4265	.5666	7.9388	112.9073
.0150	14.2222	33.3426	.0250	.1581	.4265	.5666	8.8758	126.2342
.0150	14.2222	33.3426	.0300	.1732	.4265	.5666	9.7230	138.2827
.0150	14.2222	33.3426	.0350	.1871	.4265	.5666	10.5020	149.3623
.0150	14.2222	33.3426	.0400	.2000	.4265	.5666	11.2272	159.6751

FACE TO FACE = ? 32
CURB = ? 8
CROWN = ? 8

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	17.7778	33.3356	.0050	.0707	.5333	.6576	4.6067	81.8972
.0150	17.7778	33.3356	.0100	.1000	.5333	.6576	6.5149	115.8201
.0150	17.7778	33.3356	.0150	.1225	.5333	.6576	7.9791	141.8501
.0150	17.7778	33.3356	.0200	.1414	.5333	.6576	9.2134	163.7944
.0150	17.7778	33.3356	.0250	.1581	.5333	.6576	10.3009	183.1277
.0150	17.7778	33.3356	.0300	.1732	.5333	.6576	11.2841	200.6064
.0150	17.7778	33.3356	.0350	.1871	.5333	.6576	12.1788	216.6796
.0150	17.7778	33.3356	.0400	.2000	.5333	.6576	13.0298	231.6403

FACE

0.640 / 1.198 / 3

RNH

FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 8

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	10.6667	49.3580	.0050	.0707	.2161	.3601	2.5227	26.9084
.0150	10.6667	49.3580	.0100	.1000	.2161	.3601	3.5676	38.0543
.0150	10.6667	49.3580	.0150	.1225	.2161	.3601	4.3694	46.6068
.0150	10.6667	49.3580	.0200	.1414	.2161	.3601	5.0453	53.8169
.0150	10.6667	49.3580	.0250	.1581	.2161	.3601	5.6409	60.1691
.0150	10.6667	49.3580	.0300	.1732	.2161	.3601	6.1792	65.9120
.0150	10.6667	49.3580	.0350	.1871	.2161	.3601	6.6743	71.1931
.0150	10.6667	49.3580	.0400	.2000	.2161	.3601	7.1352	76.1086

FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 6

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	16.0000	49.3472	.0050	.0707	.3242	.4720	3.3061	52.8978
.0150	16.0000	49.3472	.0100	.1000	.3242	.4720	4.6755	74.8088
.0150	16.0000	49.3472	.0150	.1225	.3242	.4720	5.7264	91.6216
.0150	16.0000	49.3472	.0200	.1414	.3242	.4720	6.6122	105.7955
.0150	16.0000	49.3472	.0250	.1581	.3242	.4720	7.3927	118.2830
.0150	16.0000	49.3472	.0300	.1732	.3242	.4720	8.0983	129.5726
.0150	16.0000	49.3472	.0350	.1871	.3242	.4720	8.7471	139.9544
.0150	16.0000	49.3472	.0400	.2000	.3242	.4720	9.3511	149.6175

FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 4

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	21.3333	49.3395	.0050	.0707	.4324	.5718	4.0055	85.4504
.0150	21.3333	49.3395	.0100	.1000	.4324	.5718	5.6646	120.8451
.0150	21.3333	49.3395	.0150	.1225	.4324	.5718	6.9377	148.0044
.0150	21.3333	49.3395	.0200	.1414	.4324	.5718	8.0110	170.9007
.0150	21.3333	49.3395	.0250	.1581	.4324	.5718	8.9565	191.0728
.0150	21.3333	49.3395	.0300	.1732	.4324	.5718	9.8114	209.3098
.0150	21.3333	49.3395	.0350	.1871	.4324	.5718	10.5975	226.0804
.0150	21.3333	49.3395	.0400	.2000	.4324	.5718	11.3292	241.6901

FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 2

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	26.6667	49.3349	.0050	.0707	.5405	.6636	4.6482	123.9532
.0150	26.6667	49.3349	.0100	.1000	.5405	.6636	6.5736	175.2953
.0150	26.6667	49.3349	.0150	.1225	.5405	.6636	8.0510	214.6932
.0150	26.6667	49.3349	.0200	.1414	.5405	.6636	9.2965	247.9064
.0150	26.6667	49.3349	.0250	.1581	.5405	.6636	10.3938	277.1678
.0150	26.6667	49.3349	.0300	.1732	.5405	.6636	11.3858	303.6221
.0150	26.6667	49.3349	.0350	.1871	.5405	.6636	12.2981	327.9493
.0150	26.6667	49.3349	.0400	.2000	.5405	.6636	13.1472	350.5926

0.663 / 1.289 /

ft above HI CURB

50' R.O.W. 32' F to F

	n	A	P	S	R	R2/3	S1/2	V	Q=AV
	.0060	4.1000	50.0000	.0050	.0820	.1887	.0707	3.3054	13.5522
	.0060	4.1000	50.0000	.0100	.0820	.1887	.1000	4.6745	19.1658
	.0060	4.1000	50.0000	.0150	.0820	.1887	.1224	5.7251	23.4732
0.1	.0060	4.1000	50.0000	.0200	.0820	.1887	.1414	6.6108	27.1045
	.0060	4.1000	50.0000	.0250	.0820	.1887	.1581	7.3911	30.3038
	.0060	4.1000	50.0000	.0300	.0820	.1887	.1732	8.0966	33.1961
	.0060	4.1000	50.0000	.0350	.0820	.1887	.1870	8.7453	35.8559
	.0060	4.1000	50.0000	.0400	.0820	.1887	.2000	9.3491	38.3316
	.0060	8.2000	50.0040	.0050	.1639	.2995	.0707	5.2467	43.0235
	.0060	8.2000	50.0040	.0100	.1639	.2995	.1000	7.4200	60.8444
	.0060	8.2000	50.0040	.0150	.1639	.2995	.1224	9.0876	74.5189
	.0060	8.2000	50.0040	.0200	.1639	.2995	.1414	10.4935	86.0470
0.2	.0060	8.2000	50.0040	.0250	.1639	.2995	.1581	11.7321	96.2034
	.0060	8.2000	50.0040	.0300	.1639	.2995	.1732	12.8519	105.3856
	.0060	8.2000	50.0040	.0350	.1639	.2995	.1870	13.8816	113.8295
	.0060	8.2000	50.0040	.0400	.1639	.2995	.2000	14.8401	121.6888
	.0060	16.4000	50.0160	.0050	.3278	.4755	.0707	8.3273	136.5692
	.0060	16.4000	50.0160	.0100	.3278	.4755	.1000	11.7767	193.1381
	.0060	16.4000	50.0160	.0150	.3278	.4755	.1224	14.4234	236.5449
	.0060	16.4000	50.0160	.0200	.3278	.4755	.1414	16.6547	273.1385
0.4	.0060	16.4000	50.0160	.0250	.3278	.4755	.1581	18.6206	305.3781
	.0060	16.4000	50.0160	.0300	.3278	.4755	.1732	20.3978	334.5250
	.0060	16.4000	50.0160	.0350	.3278	.4755	.1870	22.0322	361.3283
	.0060	16.4000	50.0160	.0400	.3278	.4755	.2000	23.5534	386.2762

02/03/72. 17.55.30.
PROGRAM MANCAM

R.O.W.=86 FT., FACE-TO-FACE=48 FT., OVERFLOW= ? 0.1

N	A	P	R	R2/3
.0060	6.7000	86.0005	.0779	.1824

S	S1/2	V	Q
.005	.0707	3.1945	21.4031
.010	.1000	4.5177	30.2685
.015	.1225	5.5330	37.0712
.020	.1414	6.3890	42.8062
.025	.1581	7.1431	47.8588
.030	.1732	7.8249	52.4267
.035	.1871	8.4518	56.6273
.040	.2000	9.0354	60.5371
.045	.2121	9.5835	64.2093
.050	.2236	10.1019	67.6825

R.O.W.=86 FT., FACE-TO-FACE=48 FT., OVERFLOW= ? 0.2

N	A	P	R	R2/3
.0060	13.4000	86.0021	.1558	.2896

S	S1/2	V	Q
.005	.0707	5.0709	67.9497
.010	.1000	7.1713	96.0955
.015	.1225	8.7830	117.6924
.020	.1414	10.1418	135.8995
.025	.1581	11.3388	151.9403
.030	.1732	12.4211	166.4422
.035	.1871	13.4163	179.7781
.040	.2000	14.3426	192.1909
.045	.2121	15.2126	203.8492
.050	.2236	16.0355	214.8760

R.O.W.=86 FT., FACE-TO-FACE=48 FT., OVERFLOW= ? 0.4

N	A	P	R	R2/3
.0060	26.8000	86.0084	.3116	.4596

S	S1/2	V	Q
.005	.0707	8.0491	215.7164
.010	.1000	11.3832	305.0691
.015	.1225	13.9415	373.6318
.020	.1414	16.0982	431.4329
.025	.1581	17.9984	482.3566
.030	.1732	19.7162	528.3952
.035	.1871	21.2960	570.7320
.040	.2000	22.7664	610.1382
.045	.2121	24.1474	647.1493
.050	.2236	25.4536	682.1553

R.O.W.=86 FT., FACE-TO-FACE=48 FT., OVERFLOW= ? 0.6

N	A	P	R	R2/3
.0060	40.2000	86.0189	.4673	.6022

S	S1/2	V	Q
.005	.0707	10.5465	423.9682
.010	.1000	14.9150	599.5815
.015	.1225	18.2670	734.3344
.020	.1414	21.0929	847.9363
.025	.1581	23.5826	948.0216
.030	.1732	25.8335	1038.5057
.035	.1871	27.9033	1121.7143
.040	.2000	29.8299	1199.1631
.045	.2121	31.6394	1271.9045
.050	.2236	33.3509	1340.7051

KAP KOMP
KAP KOMP
KAP KOMP
NUMEX FORMS COMPANY, ALBUQUERQUE, NEW MEXICO 4310

MANNING'S EQUATION
Street Carrying Capacities
0.5' above high curb; 106' R/W; 2-21.5' streets with 43' median

```
n =        0.0188  S
A =          56.2  S
P =        108.69  S
S =         0.005  S
S½=     0.0707106  A↑
R =     0.5170668  C↑

R⅔ =    0.6442121  A↑
V =     3.6005904  A↑
Q=    202.3531804  A↑

                   V
        0.0188     S
          56.2     S
        108.69     S
          0.01     S
     0.1000000     A↑
     0.5170668     C↑

     0.6442121     A↑
     5.0920159     A↑
   286.1712935     A↑

                   V
        0.0188     S
          56.2     S
        108.69     S
         0.015     S
     0.1224744     A↑
     0.5170668     C↑

     0.6442121     A↑
     6.2364095     A↑
   350.4862139     A↑

                   V
        0.0188     S
          56.2     S
        108.69     S
          0.02     S
     0.1414213     A↑
     0.5170668     C↑

     0.6442121     A↑
     7.2011914     A↑
   404.7069566     A↑
```



```
        0.0188     S
          56.2     S
        108.69     S
         0.025     S
     0.1581138     A↑
     0.5170668     C↑

     0.6442121     A↑
     8.0511755     A↑
   452.4760631     A↑

                   S
                   V
        0.0188     S
          56.2     S
        108.69     S
          0.03     S
     0.1732050     A↑
     0.5170668     C↑

     0.6442121     A↑
     8.8196223     A↑
   495.6627732     A↑

                   V
        0.0188     S
          56.2     S
        108.69     S
         0.035     S
     0.1870828     A↑
     0.5170668     C↑

     0.6442121     A↑
     9.5262872     A↑
   535.3773406     A↑

                   V
        0.0188     S
          56.2     S
        108.69     S
          0.04     S
     0.2000000     A↑
     0.5170668     C↑

     0.6442121     A↑
    10.1883319     A↑
   572.3425927     A↑
```

olivetti underwood programma 101 olivetti underwood programma 101 olivetti underwood programma 101 olivetti underwood programma 101 olivetti underwood

EXHIBIT G

RECOMMENDED STREET GRADES

STREET DESCRIPTION & LOCATION	MIN. % GRADE	CROWN HEIGTH	PROPERTY LINE ABOVE HIGH CURB
Unit 2			
A. Six streets extending NW from Spain Road, N.E. - 50' R.O.W., 32' face to face	0.5	8"	0.0'
B. East-west street about 775' North of Spain Road, N.E. - 50' R.O.W., 32' face to face	1.5	8"	0.2'
C. Spain Road, N.E. - from Eubank Blvd., N.E. to East boundary of Unit 2 - 86' R.O.W., 48' face to face	1.0	8"	0.1'
D. Eubank Blvd., N.E. - from 600' South of Bear Canyon Arroyo to Juan Tabo Blvd., N.E. - 106' R.O.W., 2 - 21.5' face to face	1.0	0"	0.5'

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1. Quality in Environment by David A. Crane and Associates, February 1970.

2. Albuquerque Arroyos - Part 1 by Corps of Engineers, June 1970 and supplement.

3. Master Plan of Drainage - City of Albuquerque, New Mexico and Environs by Gordon Herkenhoff and Associates, Consulting Engineers, 1963.

4. Design by Elwyn E. Seelye, Volume 1, 2nd edition, 1945.

5. Miscellaneous Publication No. 204, U.S. Department of Agriculture, by David L. Yarnell.

6. Handbook of Hydraulics by Horace W. King and Ernest F. Brater.

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