City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

May 21, 2004

James Topmiller, PE
Bohannan Huston, Inc
7500 Jefferson NE
Albuquerque, NM 87109

Re: Sivage Residence, Tract N-6-A, Tanoan Properties Grading Plan
Engineer's Stamp dated 3-28-04 (E22/D20A)

Dear Mr. Topmiller,

Based upon the information provided in your submittal dated 4-1-04, the above referenced plan is approved for Building Permit. Please attach a copy of this approved plan to the construction sets prior to sign-off by Hydrology.

If I can be of further assistance, please contact me at 924-3986.

Sincerely,

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

C: Lynn Mazur, AMAFCA
file

DRAINAGE REPORT AND GRADING PLANS
FOR
TRACT N-6-A, TANOAN PROPERTIES

JUNE 10, 2003

PREPARED BY:

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

PREPARED FOR:

SIVAGE THOMAS HOMES
7445 PAN AMERICAN FREEWAY
ALBUQUERQUE, NM 87109

JAMES R. TOPMILLER NEW MEXICO 9354 REGISTERED PROFESSIONAL ENGINEER

PREPARED BY:

James R. Topmiller, P.E. Date

BRADLEY T. DIXON NEW MEXICO 16163 LICENSED PROFESSIONAL ENGINEER

Brad Dixon 6/10/03

Brad Dixon, P.E. Date

I. INTRODUCTION

This report presents the drainage management plan and grading plans for building permit approval for a single family residence (one residence only) on Tract N-6-A, Tanoan Properties. The property is 2.76 acres, zoned R-D and located within the Academy-Tramway-Eubank Sector Development Plan area. As the proposed residence complies with the proposed zoning of the property, no additional entitlement or zoning effort is required prior to building on the property. As shown on the Drainage Basin Maps, Tramway Dam bounds the property on the east, and Tanoan Golf Course on the west, north and south.

II. PURPOSE OF REPORT

This report outlines the hydrological methods used, and summarizes the existing and proposed drainage conditions. Calculations and supporting data are presented in the appendices. Drainage basin maps, a grading plan, storm drain plans, profiles, details, street profiles, and a copy of the preliminary plat are included at the end of this report. The purpose of this report is to obtain a drainage report, grading plan and building permit approval from AMAFCA and the City of Albuquerque.

From previous conversations with Mr. Fred Aguirre (COA Hydrology) and Mr. John Kelly (AMAFCA), AMAFCA will take part in the hydrological/hydraulic review of this plan.

III. METHODOLOGIES AND REFERENCES

Existing undeveloped conditions and proposed developed conditions were analyzed for an approximate 100-year, 6-hour storm event consistent with the City of Albuquerque Design Process Manual (DPM), including the January, 1997 revision of Chapter 22 Drainage, Flood Control, and Erosion Control, Section A.6. RiverCAD was used to model both existing and proposed conditions. The analysis also references, and is consistent with, the previously submitted and approved report named "Application for CLOMR for Arroyo del Pino Arroyo, Adjacent to the Enclave at Tanoan Subdivision," dated April 1993, by Bohannan Huston, Inc.

IV. SITE LOCATION AND CHARACTERISTICS

This site currently consists of undeveloped vacant land with slopes ranging from 3% to 9% generally downhill in a westerly direction. Soils are highly absorptive sandy soils with occasional clay lenses. Vegetation is light, consisting of grasses and small sagebrush.

The site is to be accessed from Lowell Street by a private road and easement crossing adjacent golf course lands. The golf course lands have pop-up sprinklers and paved golf course paths. The Lowell Street Right of Way has existing wet and dry utilities, and irrigated grasses on the surface. The City of Albuquerque has determined that public Lowell Street surface access rights are to be vacated, or already have been vacated.

A portion of the site is found within a FEMA floodplain, as shown on the floodplain map provided in the rear of this report. The floodplain is created by the projected outfall flows of the Pino Dam principal spillway.

V. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

The existing drainage conditions are shown graphically on the Existing Drainage Conditions Basin Map and are summarized as follows (calculations are also shown in the Appendix B):

The bulk of the existing site is treated as a single basin, Basin E-1, for comparison purposes to the developed condition.

A. Onsite Conditions

Basin E-1 consists of the site itself, Tract N-6-A. Existing conditions generate 7.2 cfs for an approximate 100-year 6-hour storm event. The runoff flows to a shallow swale and is conveyed offsite and into the Tanoan Golf Course.

The Pino Dam principal spillway outlets in the southeastern portion of the site. The 100-year, 6-hour discharge from the outlet is 206.1 cfs, as described in the "CLOMR Application for Arroyo del Pino" report. (See Appendix D) The discharge from the Dam proceeds at first westerly, and then is diverted by Golf Course berms to the north across the site before flowing out onto the Golf Course.

The FEMA floodplain and the existing conditions inundation line are illustrated in Hydraulic Analysis Exhibit #1. The RiverCAD cross sections which were used in the model are also shown. For Cross Sections 10 through 60, the Manning's n value in the RiverCAD model was representative of a grass lined channel. Cross Sections 70 through 180 were modeled as earth lined. The inundation line was calculated using a subcritical flow regime for comparison with the FEMA floodplain boundary. The design 100-year flow rate of 206.1 cfs was taken from the "Revised Drainage Report for the Traditions at Tanoan Subdivision," which was dated 1/26/2000. Appendix **C** contains the existing conditions hydraulic model results.

B. Offsite Conditions

Basin E-2 is made up of the western sloped side of the dam, immediately upstream of the site, and generates 10.0 cfs peak in the 100-year 6-hour storm event. The runoff from this basin travels in sheet flow in a westerly sheet flow manner across the site into the Golf Course or the existing irrigation pond.

Basin E-3 consists of the area draining to the proposed road crossing of the irrigation pond spillway swale. This basin includes the 100 year discharge of 117.5 cfs from the existing 54" storm drain exiting the Lalique Subdivision. The discharge from the basin is 139.2 cfs. (obtained from the "Enclave at Tanoan Drainage Report, April 1993).

VI. PROPOSED HYDRAULIC AND HYDROLOGIC CONDITIONS

The proposed drainage conditions are shown graphically on the Proposed Conditions Drainage Basins Map located in the rear pockets of this report and are summarized as follows:

A. Proposed Development Scheme

The proposed development is a single-family residence on 2.76 acres. Its proposed location within an existing, active golf course requires sensitivity to the golf course concerns. Grading and other disturbances will be minimized.

The basic development plan for the lot includes:

- Extension of a private driveway in Lowell Street ROW
- Construction of a private road w/l private access easement to residence
- Associated storm drainage infrastructure and utility lines
- Minimal regrading on Tract N-6-A and the Golf Course
- Minimize grading and other disturbance in the existing floodplain such that the floodplain limits as defined on the FEMA maps are not altered. The FEMA floodplain shall remain in place.
- Provide all weather access to the residence, as defined by typical City allowances in City streets (i.e., Velocity x Depth equal to/less than 6.5 where flow occurs in the street at dip sections).

B. Onsite Drainage Conditions

`There are two "onsite" basins, ON-1 (private drive) and ON-2 (the site itself and dam runoff). Their combined flow is 18.0 cfs (1.9+16.1). A detailed analysis of how the flows were derived is in Appendix B. The flows converge on the private access drive and are permitted to cross the street in a surface flow manner (the street has estate type curb- not a raised curb).

The lot will be graded as shown on the grading plan for the residence.

The FEMA floodplain and the proposed conditions inundation line are shown in Hydraulic Analysis Exhibit #2. Additional RiverCAD cross sections were added where the

proposed driveway crosses the arroyo. The driveway was modeled as 12 feet wide with 4:1 cut slopes and 6:1 fill slopes to connect with the existing ground. The driveway alignment was modified to cross the arroyo more perpendicularly in order to minimize the impact to the arroyo. The driveway was graded to reduce cut and fill at the cross sections on either side of the arroyo and to slope evenly between those cross sections. RiverCAD was used to calculate the water depth and velocity across the driveway at these cross sections. The results can be found in Appendix **C**. All cross sections meet the 6.5 rule for velocity x depth. The Appendix C HEC RAZ results at River Station 30 (the road crossing) show a water surface of 12.12', while the road surface is at 11.4'- a depth of 0.7'. Velocity is at 9.22 fps, giving a Velocity X Depth factor of 6.5.

The Erosion Envelope Method from the AMAFCA Sediment and Erosion Design Guide was utilized to establish the lateral erosion envelope (LEE line) as shown in Hydraulic Analysis Exhibit #2. The results show that the residence lies outside the LEE line and is thus aptly protected. The LEE line calculations can be found in Appendix **C**.

As shown by the inundation line in Hydraulic Analysis Exhibit #1, under existing conditions, a portion of the 100-year flow is leaving the arroyo and flowing into the irrigation pond between cross sections 120 and 140. In this area, the berm will be raised to contain all of the 100-year flow within the arroyo and existing FEMA floodplain. In addition, high velocities of 8 to 17 ft/s are found below the outlet of the spillway, between cross sections 150 and 180. Riprap will be installed between cross sections 135 and 160 as shown on Hydraulic Analysis Exhibit #2. Appendix **C** shows the riprap sizing calculations.

C. Management of Offsite Drainage Basin Flows

The following describes how the basins' flows are to be managed and integrated within the site development.

Historically, flows of 10.0 cfs run off the western slope of the dam embankment (E-2), drained over the site. Proposed conditions allow for historical flows to pass through the lot and around the house into the existing floodplain.

The Pino Dam out fall flows for the 100 year storm are 206.1 cfs. These flows from this outlet will be maintained in a near historical condition, as shown on Exhibit #2. The flows will continue down historical drainage easement paths beyond the proposed driveway crossing.

The exiting flow from the irrigation pond (139 cfs) crosses the proposed driveway just as the driveway extends easterly away from Lowell Street. The existing ground/proposed road cross section is sufficient to allow an all-weather crossing without any special grading or channelizing by complying with the "velocity x depth equal to or less than 6.5 rule. The STREAM program was used to analyze the capacity of the existing cross section. Refer to Appendix **C** for STREAM output. That output shows velocity of flow at 7.09 fps and depth at 0.91' (VXD = 6.46< 6.5).

Offsite Basin 1 (OFF-1) is the basin covering the proposed Lowell Street extension to the private drive. It is generating approximately 9.1 cfs in the 100-year storm event. These flows will be discharged westerly onto the Golf Course, in a semi-sheet flow manner, by sloping the road at a 3% gradient to the west. Since no curb (or an asphalt curb with spaced curb openings) will be constructed on the road's west side, flows will not be concentrated, and flow depths and velocities will be minimized to the point there will be no adverse impacts.

AMAFCA will be provided a revised Filing Sheet for the Pino Dam Facility to reflect the new storm drain pipe extension and verification of no impact to the storm event water surface elevations in the dam.

VII. CONCLUSION

The drainage management plan presented in this report for Traditions at Tanoan (formerly Tanoan Properties Tract N-6-A) provides a workable solution to the drainage issues created by the development of this property and should be approved as satisfying the requirements for Draiange Report, grading Plan and Building Permit Approval.

The proposed private driveway will provide all-weather access to the residence without causing the 100-year inundation limits with the arroyo (the spillway channel) to fall outside of the existing FEMA floodplain boundary. The west embankment of the Pino Arroyo below the primary spillway for the Pino Dam will be raised to contain the 100-year flow. In addition, riprap will be added to the western bank of the arroyo, just downstream of the dam outlet, to provide bank protection against high velocities.

EXISTING DRAINAGE / BASIN E-1

TANOAN: TRACT N-6-A
ON-SITE, EXISTING DRAINAGE BASINS
Qmax CALCULATIONS

Source: DPM

Zone 3: Between San Mateo and Eubank, North of I-40; and between San Mateo and the East boundary of Range 4 East, South of I-40

Treatments:

A. Soil uncompacted by human activity with 0 to 10% slopes. native grasses, weeds and shrubs in typical densities with minimal disturbance to grading, ground cover and infilteration capacity.

B. Irrigated lawns, parks, and golf courses with 0 to 10% slopes. Native grasses, weeds, and shrubs and soil uncompacted by human activity with slopes greater than 10% and less than 20%.

C. Soil compacted by human activity. Minimal vegetation. Unpaved parking, roads, trails. Most vacant lots. Gravel or rock on plastic. Irrigated lawns and parks with slopes greater than 10% and < 20%.

D. Impervious areas, pavement and roofs.

TABLE A-6: Qmax = (Qmax1*A1)+(Qmax2*A2)+(Qmax3*A3)...

Basin and Treatment Disbursement	Area (acres)	% of Total	Treatment	Q/ACRE peak
E-1	3.24			
native grasses w/ slopes <10%		50	A	1.87
irrigated lawns w/ slopes < 10%		50	B	2.60

Peak Discharge (CFS):

Table A-9

1.87*(0.5*3.24)+2.60*(0.5*3.24)

	Qmax (CFS)
BASIN E-1	7.2 cfs

* % Treatment D = 7*((N*N)+(5*N))^.5
where N = units/acre = 1.98
% Treatment D = 26

EXISTING DRAINAGE BASIN E-2

TANOAN: TRACT N-6-A
OFF-SITE, EXISTING DRAINAGE BASINS
Qmax CALCULATIONS

Source: DPM

Zone 3: Between San Mateo and Eubank, North of I-40; and between San Mateo and the East boundary of Range 4 East, South of I-40

Treatments:

A. Soil uncompacted by human activity with 0 to 10% slopes. native grasses, weeds and shrubs in typical densities with minimal disturbance to grading, ground cover and infilteration capacity.

B. Irrigated lawns, parks, and golf courses with 0 to 10% slopes. Native grasses, weeds, and shrubs and soil uncompacted by human activity with slopes greater than 10% and less than 20%.

C. Soil compacted by human activity. Minimal vegetation. Unpaved parking, roads, trails. Most vacant lots. Gravel or rock on plastic. Irrigated lawns and parks with slopes greater than 10% and < 20%.

D. Impervious areas, pavement and roofs.

TABLE A-6: Qmax = (Qmax1*A1)+(Qmax2*A2)+(Qmax3*A3)...

Area and Treatment Disbursement	Area (acres)	Treatment	Q/ACRE peak
E-2: Dam Run-Off Above Subdivision	2	D	5.02

Peak Discharge:

Table A-6

		Qmax (CFS)
5.02*2.0	BASIN E-2	10.0

A-2/2

PROPOSED DRAINAGE

TANOAN: TRACT N-6-A
ON-SITE, PROPOSED DRAINAGE BASINS
Q 100 CALCULATIONS

Source: Per DPM Requirements

Zone 3: Between San Mateo and Eubank, North of I-40; and between San Mateo and the East boundary of Range 4 East, South of I-40

Treatments:

A. Soil uncompacted by human activity with 0 to 10% slopes. Native grasses, weeds and shrubs in typical densities with minimal disturbance to grading, ground cover and infilteration capacity

B. Irrigated lawns, parks, and golf courses with 0 to 10% slopes. Native grasses, weeds, and shrubs and soil uncompacted by human activity with slopes greater than 10% and less than 20%

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D. Impervious areas, pavement and roofs.

TABLE A-6: Q100 = (Q100' x A1)+(Q100" x A2)+(Q100"' x A3)...

Basin and Treatment Disbursement	Area (acres)	Treatment	Q/ACRE peak
ON-1: 30' Easement to Culverts	**0.48**		
Paving	0.16	D	5.02
Grass to the south of Tradition Lane	0.32	C	3.45
ON-2:	**4.71**		
Lots: pavement and roofs*	0.63	D	5.02
Lots: irrigated lawns w/ slopes < 10%	1.86	B	2.60
Cul de Sac and Street to 30' Easement	0.27	D	5.02
Dam run-off above subdivision	1.95	C	3.45

Peak Discharge (CFS):

5.02 X (0.16)+3.45 X (0.32) **Qmax ON-1 = 1.9 CFS**

0.63*(5.02)+1.86*(2.6)+0.27*(5.02)+1.95*(3.45) **Qmax ON-2 = 16.1 CFS**

Q100 Onsite Basins = 18.0 CFS
Total from ON-1, ON-2

*** % Treatment D = 7*((N*N)+(5*N))^.5**
where N = units/acre = 1.98
% Treatment D = 26% = 0.63 acres

TANOAN: TRACT N-6-A
OFF-SITE, PROPOSED DRAINAGE BASINS
Qmax CALCULATIONS

Source: Per DPM Requirements

Zone 3: Between San Mateo and Eubank, North of I-40; and between San Mateo and the East boundary of Range 4 East, South of I-40

Treatments:

A. Soil uncompacted by human activity with 0 to 10% slopes. native grasses, weeds and shrubs in typical densities with minimal disturbance to grading, ground cover and infilteration capacity.

B. Irrigated lawns, parks, and golf courses with 0 to 10% slopes. Native grasses, weeds, and shrubs and soil uncompacted by human activity with slopes greater than 10% and less than 20%.

C. Soil compacted by human activity. Minimal vegetation. Unpaved parking, roads, trails. Most vacant lots. Gravel or rock on plastic. Irrigated lawns and parks with slopes greater than 10% and < 20%.

D. Impervious areas, pavement and roofs.

TABLE A-6: Q100 = (Q100' x A1)+(Q100" x A2)+(Q100"' x A3)...

Area and Treatment Disbursement	Area (acres)	Treatment	Q/ACRE peak
E-3: Pond and Surrounding Area*			
OFF-1: Drainage from Lowell	1.81	D	5.02

* Source = Arroyo Del Pino Adjacent to the Enclave at Tanoan Subdivision, May 1993
Case No: 93-06-288R, Report # D-20, HYMO SUMMARY and Pino Arroyo Drainage Map (Exhibit 2)
Basin 206 less Sub-Basin 106 and Pino Dam Spillway: Qmax = 366.8 CFS - (21.5 +206.1 CFS) = 139.2 CFS

Peak Discharge (CFS):

Table A-6	BASIN	Q100 (CFS)
*** 366.8 - 21.5-206.1**	**E-3**	**139.2**
5.02 x (1.81)	**OFF-1**	**9.1**

STREAM PROGRAM

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

SWALE CROSSING - AT ROADWAY

MANNING'S N= .025 SLOPE= .0406

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	5900.00	3	80.30	5900.00	5	130.80	5900.00
2	62.10	5898.30	4	113.50	5900.80	6	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
5898.40	0.10	0.24	0.4	4.73	1.62	4.72	0.04	0.14
5898.50	0.20	0.94	2.4	9.46	2.58	9.45	0.10	0.30
5898.60	0.30	2.13	7.2	14.19	3.38	14.17	0.18	0.48
5898.70	0.40	3.78	15.5	18.92	4.09	18.89	0.26	0.66
5898.80	0.50	5.90	28.0	23.65	4.75	23.61	0.35	0.85
5898.90	0.60	8.50	45.6	28.37	5.36	28.34	0.45	1.05
5899.00	0.70	11.57	68.8	33.10	5.94	33.06	0.55	1.25
5899.10	0.80	15.11	98.2	37.83	6.50	37.78	0.66	1.46
5899.20	0.90	19.13	134.4	42.56	7.03	42.51	0.77	1.67
5899.30	1.00	23.61	178.0	47.29	7.54	47.23	0.88	1.88
5899.40	1.10	28.57	229.5	52.02	8.03	51.95	1.00	2.10
5899.50	1.20	34.01	289.5	56.75	8.51	56.68	1.13	2.33
5899.60	1.30	39.91	358.4	61.48	8.98	61.40	1.25	2.55
5899.70	1.40	46.29	436.7	66.21	9.43	66.12	1.38	2.78
5899.80	1.50	53.13	524.9	70.94	9.88	70.84	1.52	3.02
5899.90	1.60	60.45	623.4	75.66	10.31	75.57	1.65	3.25
5900.00	1.70	68.25	732.8	80.39	10.74	80.29	1.79	3.49

at 139 cfs

$V = 7.09$ fps

$d = 0.911$

$V \cdot d = 6.46 < 6.5$, OK

TANOAN DUMPED RIPRAP (BASALT) BANK PROTECTION

XS	V (fps)	Savg (ft/ft)	Ss	d50 (ft)	d50 (in)
135	3.21	0.006	2.6	0.05	0.6
140	2.67	0.006	2.6	0.03	0.4
145	2.66	0.006	2.6	0.03	0.4
150	8	0.011	2.6	0.37	4.4
160	9.78	0.045	2.6	0.88	10.6

1. Savg=final grade slope.
2. d50 equation from Urban Storm Drainage Criteria Manual, eqn. 5-4.
3. Ss=specific gravity of basalt based on conversation w. Charlie @ GeoTest.
4. Velcoity from RiverCAD

RIPRAP SIZING

Tract N-6-A

~~Traditions at Tanoan~~

Lateral Erosion Envelope

RiverCAD Cross Section		Q100 (cfs)	Qd (cfs)	S (ft/ft)	Sc (ft/ft)	Sub or Super	Δmax (feet)	Wd (feet)	λ/Wd	Lv (feet)	Total Erosion Width (LEE)	Is Qd>2000 cfs? (fine if no)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
180		206.1	41.2	0.180	0.023	super	50.9	20.4	10.0	102	122	no
170		206.1	41.2	0.067	0.023	super	50.9	20.4	10.0	102	122	no
160		206.1	41.2	0.045	0.023	super	50.9	20.4	10.0	102	122	no
150		206.1	41.2	0.011	0.023	sub	58.4	23.2	10.0	116	140	no
145		206.1	41.2	0.006	0.023	sub	65.4	26.0	10.0	130	157	no
140		206.1	41.2	0.006	0.023	sub	65.4	26.0	10.0	130	157	no
135		206.1	41.2	0.006	0.023	sub	65.4	26.0	10.0	130	157	no
130		206.1	41.2	0.006	0.023	sub	65.4	26.0	10.0	130	157	no
120		206.1	41.2	0.006	0.023	sub	65.4	26.0	10.0	130	157	no
110		206.1	41.2	0.006	0.023	sub	65.4	26.0	10.0	130	157	no
100		206.1	41.2	0.016	0.023	sub	54.5	21.6	10.0	108	131	no
90		206.1	41.2	0.030	0.023	super	50.9	20.4	10.0	102	122	no
80		206.1	41.2	0.033	0.023	super	50.9	20.4	10.0	102	122	no
70		206.1	41.2	0.037	0.023	super	50.9	20.4	10.0	102	122	no
60		206.1	41.2	0.040	0.023	super	50.9	20.4	10.0	102	122	no
50		206.1	41.2	0.052	0.023	super	50.9	20.4	10.0	102	122	no
40		206.1	41.2	0.050	0.023	super	50.9	20.4	10.0	102	122	no
30		206.1	41.2	0.042	0.023	super	50.9	20.4	10.0	102	122	no
20		206.1	41.2	0.043	0.023	super	50.9	20.4	10.0	102	122	no
10		206.1	41.2	0.046	0.023	super	50.9	20.4	10.0	102	122	no

Note: Formulas from AMAFCA Sediment Erosion Design Guide (see pgs. 3-68 through 3-75)

Column (1) - RiverCAD Cross Section Labels
Column (2) -
Column (3) - 100 year return event developed conditions peak discharge with no ponding assumed
Column (4) - Dominant Discharge based on the formula Qd= 0.2*Q100
Column (5) - Average slope of channel bed
Column (6) - Critical Slope based on the flow having a froude number of 1
Column (7) - Describes whether the flow regime is subcritical or supercritical
Column (8) - Δmax is the distance from edge of the Wd (Channel width) to the maximum extent of the meander bend
- Δmax is computed based on the following formulas
  - For Supercritical flow
    - If Qd is less than or equal to 200 cfs — Δmax = 11.5*Qd^0.4
    - If Qd is greater than 200 cfs but less than 2000 cfs — Δmax = [0.92 + 4.6*log(Qd)]*Qd^0.4
    - If Qd greater than 2000 cfs — Δmax = 16.1*Qd^0.4
  - For Subcritical flow
    - If Qd is less than or equal to 200 cfs — Δmax = 6.2*Qd^0.375*S^-0.188
    - If Qd is greater than 200 cfs but less than 2000 cfs — Δmax = [0.45 + 2.5*log(Qd)]*Qd^0.375*S^-0.188
    - If Qd greater than 2000 cfs — Δmax = 8.6*Qd^0.375*S^-0.188

Column (9) - Channel Width (Wd) computed as follows:
- For Supercritical Flow — Wd = 4.6*Qd^0.4
- For Subcritical Flow — Wd = 2.46*Qd^0.375*S^-0.188

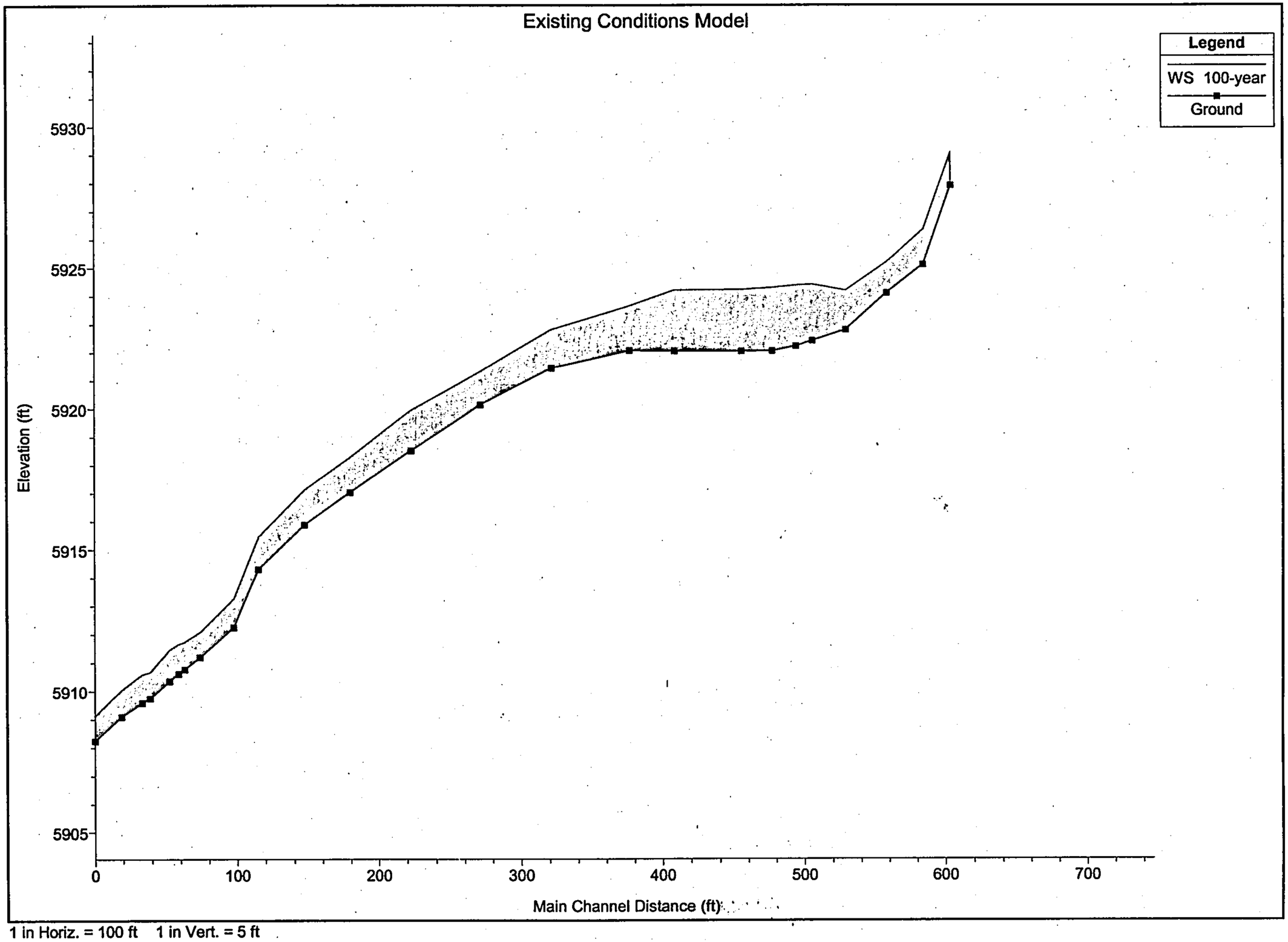
Column (10) λ is the meander wavelength
λ/Wd is computed as follows:
- If Qd is less than or equal to 200 cfs — λ/Wd = 10
- If Qd is greater than 200 cfs but less than 2000 cfs — λ/Wd = 0.8 + 4*log(Qd)
- If Qd greater than 2000 cfs — λ/Wd = 14

Column (11) - Lv is 1/2 the wavelength
Lv = λ/Wd*Wd*.5

Column (12) Total Erosion Width (LEE) is the expected total meander width of the arroyo with respect to the downvalley direction
LEE = 2*Dmax + Wd rounded to the nearest foot
Down Valley Direction is the assumed centerline around which the arroyo will meander

Column (13) Check to determine if Q100 is greater or less than 2000 cfs

LATERAL EROSION ENVELOPE



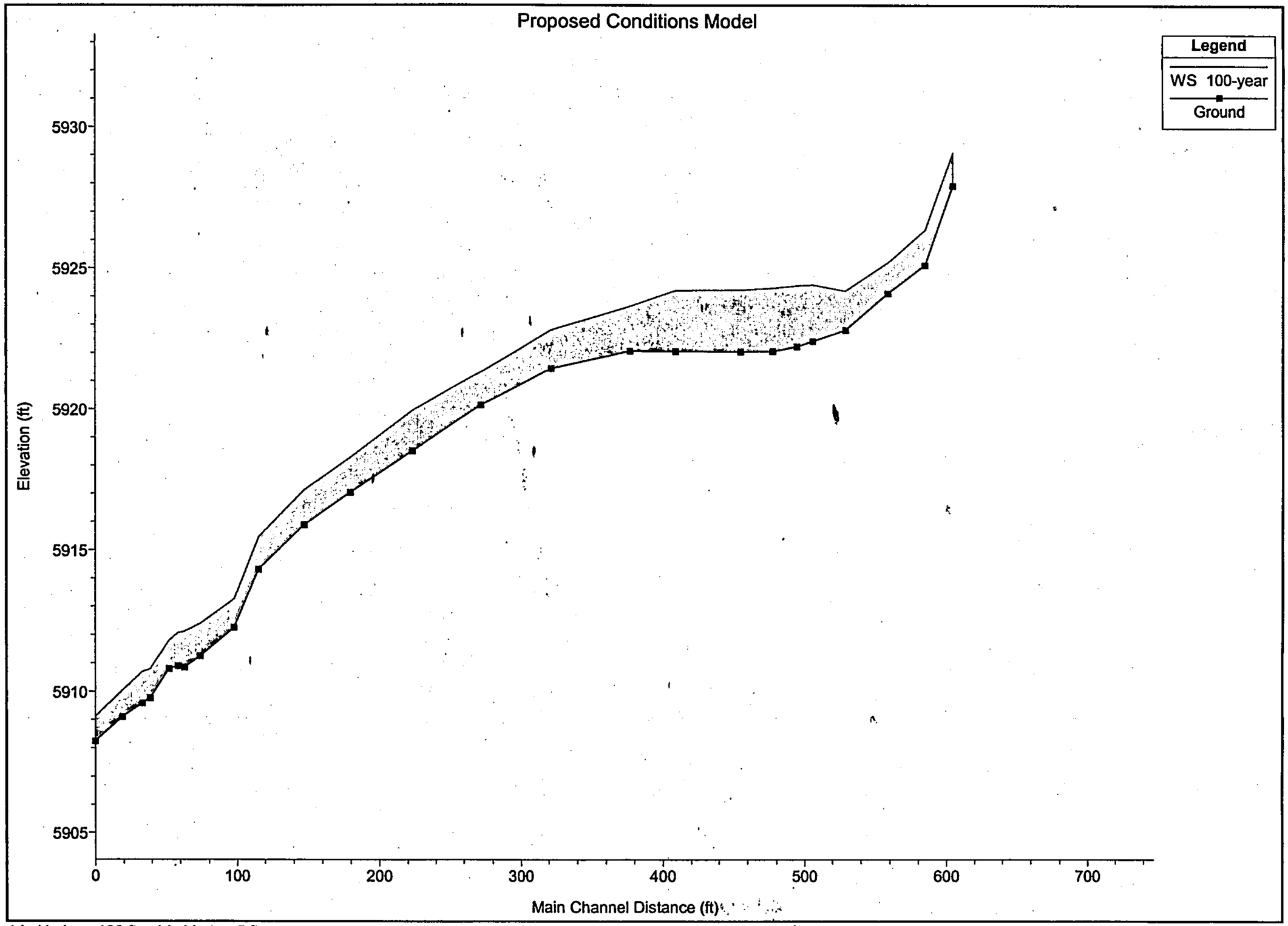
HEC-RAS OUTPUT
(EXISTING CONDITIONS)

HEC-RAS Plan: Existing River: Reach #1 Reach: Reach #1 Profile: 100-year

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach #1	180	100-year	206.10	5927.91	5929.09	5930.04	5933.69	0.180012	17.21	11.97	15.84	3.49
Reach #1	170	100-year	206.10	5925.10	5926.35	5927.19	5930.15	0.156194	15.71	13.35	20.04	3.25
Reach #1	160	100-year	206.10	5924.10	5925.19	5925.64	5926.74	0.075652	10.42	20.87	34.61	2.24
Reach #1	150	100-year	206.10	5922.80	5924.19	5924.50	5925.22	0.030765	8.22	25.82	32.04	1.51
Reach #1	145	100-year	206.10	5922.41	5924.41	5923.78	5924.52	0.001793	2.87	77.47	56.11	0.40
Reach #1	140	100-year	206.10	5922.22	5924.38	5923.68	5924.50	0.001715	2.93	77.09	56.42	0.39
Reach #1	135	100-year	206.10	5922.05	5924.29	5923.70	5924.46	0.002823	3.25	64.03	51.75	0.49
Reach #1	130	100-year	206.10	5922.04	5924.23	5923.64	5924.40	0.002884	3.29	63.07	49.09	0.49
Reach #1	120	100-year	206.10	5922.05	5924.21	5923.42	5924.28	0.001244	2.36	94.73	75.28	0.33
Reach #1	110	100-year	206.10	5922.07	5923.65	5923.65	5924.15	0.013493	5.68	36.26	36.74	1.01
Reach #1	100	100-year	206.10	5921.44	5922.82	5922.87	5923.36	0.015202	6.15	35.29	38.43	1.08
Reach #1	90	100-year	206.10	5920.14	5921.32	5921.61	5922.31	0.029676	8.18	26.35	30.76	1.49
Reach #1	80	100-year	206.10	5918.52	5919.95	5920.27	5921.03	0.023097	8.70	26.28	28.43	1.37
Reach #1	70	100-year	206.10	5917.03	5918.28	5918.73	5919.68	0.042266	10.07	22.44	28.60	1.78
Reach #1	60	100-year	206.10	5915.88	5917.13	5917.57	5918.52	0.029922	9.85	22.22	27.66	1.79
Reach #1	50	100-year	206.10	5914.31	5915.45	5916.01	5917.28	0.049219	10.86	18.99	25.26	2.21
Reach #1	40	100-year	206.10	5912.25	5913.26	5913.97	5916.06	0.084886	13.44	15.34	22.28	2.85
Reach #1	35	100-year	206.10	5911.20	5912.09	5912.58	5913.94	0.069656	10.92	18.88	32.45	2.52
Reach #1	30	100-year	206.10	5910.77	5911.74	5912.15	5913.16	0.052784	9.56	21.56	36.75	2.20
Reach #1	29	100-year	206.10	5910.62	5911.66	5912.03	5912.90	0.044614	8.94	23.06	38.33	2.03
Reach #1	25	100-year	206.10	5910.36	5911.46	5911.83	5912.63	0.036104	8.74	24.15	40.85	1.87
Reach #1	21	100-year	206.10	5909.75	5910.67	5911.04	5911.99	0.061813	9.21	22.37	45.39	2.31
Reach #1	20	100-year	206.10	5909.58	5910.60	5910.92	5911.64	0.037696	8.21	25.10	41.77	1.87
Reach #1	19	100-year	206.10	5909.10	5910.04	5910.33	5911.03	0.044948	8.00	25.79	51.47	1.98
Reach #1	10	100-year	206.10	5908.24	5909.12	5909.43	5910.17	0.045191	8.27	25.23	49.96	2.00

HEC-RAS Plan: Existing River: Reach #1 Reach: Reach #1 Profile: 100-year

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Reach #1	180	100-year	5933.69	5929.09	4.60				206.10		15.84
Reach #1	170	100-year	5930.15	5926.35	3.80	3.30	0.24	1.03	203.80	1.27	20.04
Reach #1	160	100-year	5926.74	5925.19	1.55	2.74	0.68	61.25	144.64	0.21	34.61
Reach #1	150	100-year	5925.22	5924.19	1.03	1.36	0.15	0.28	201.03	4.79	32.04
Reach #1	145	100-year	5924.52	5924.41	0.11	0.02	0.00	49.51	156.32	0.27	56.11
Reach #1	140	100-year	5924.50	5924.38	0.12	0.04	0.00	29.95	175.92	0.23	56.42
Reach #1	135	100-year	5924.46	5924.29	0.16	0.06	0.00	0.48	205.46	0.16	51.75
Reach #1	130	100-year	5924.40	5924.23	0.17	0.08	0.03	0.18	205.84	0.08	49.09
Reach #1	120	100-year	5924.28	5924.21	0.08	0.09	0.04	22.88	183.17	0.05	75.28
Reach #1	110	100-year	5924.15	5923.65	0.50	0.73	0.00		206.10		36.74
Reach #1	100	100-year	5923.36	5922.82	0.54	0.78	0.00	37.00	169.10		38.43
Reach #1	90	100-year	5922.31	5921.32	0.98	1.02	0.04	22.93	183.17		30.76
Reach #1	80	100-year	5921.03	5919.95	1.08	1.27	0.01	8.94	182.43	14.73	28.43
Reach #1	70	100-year	5919.68	5918.28	1.40	1.31	0.03	50.25	154.87	0.98	28.60
Reach #1	60	100-year	5918.52	5917.13	1.40	1.16	0.00	29.27	176.71	0.12	27.66
Reach #1	50	100-year	5917.28	5915.45	1.83	1.20	0.04		206.10		25.26
Reach #1	40	100-year	5916.06	5913.26	2.80	1.12	0.10		206.10		22.28
Reach #1	35	100-year	5913.94	5912.09	1.85	1.84	0.29		206.10		32.45
Reach #1	30	100-year	5913.16	5911.74	1.42	0.66	0.13		206.10		36.75
Reach #1	29	100-year	5912.90	5911.66	1.24	0.21	0.05		206.10		38.33
Reach #1	25	100-year	5912.63	5911.46	1.17	0.25	0.02	1.78	203.71	0.61	40.85
Reach #1	21	100-year	5911.99	5910.67	1.32	0.63	0.01		206.10		45.39
Reach #1	20	100-year	5911.64	5910.60	1.05	0.26	0.08		206.10		41.77
Reach #1	19	100-year	5911.03	5910.04	0.99	0.59	0.02	0.01	206.09		51.47
Reach #1	10	100-year	5910.17	5909.12	1.05	0.86	0.01		203.86	2.24	49.96



HEC-RAS OUTPUT
(PROPOSED CONDITIONS MODEL)

HEC-RAS Plan: River: Reach #1 Reach: Reach #1 Profile: 100-year

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach #1	180	100-year	206.10	5927.91	5929.09	5930.04	5933.69	0.180012	17.21	11.97	15.84	3.49
Reach #1	170	100-year	206.10	5925.10	5926.35	5927.19	5930.15	0.156194	15.71	13.35	20.04	3.25
Reach #1	160	100-year	206.10	5924.10	5925.19	5925.64	5926.74	0.075652	10.42	20.87	34.61	2.24
Reach #1	150	100-year	206.10	5922.80	5924.19	5924.50	5925.22	0.030765	8.22	25.82	32.04	1.51
Reach #1	145	100-year	206.10	5922.41	5924.41	5923.78	5924.52	0.001793	2.87	77.47	56.11	0.40
Reach #1	140	100-year	206.10	5922.22	5924.38	5923.68	5924.50	0.001715	2.93	77.09	56.42	0.39
Reach #1	135	100-year	206.10	5922.05	5924.29	5923.70	5924.46	0.002823	3.25	64.03	51.75	0.49
Reach #1	130	100-year	206.10	5922.04	5924.23	5923.64	5924.40	0.002884	3.29	63.07	49.09	0.49
Reach #1	120	100-year	206.10	5922.05	5924.21	5923.42	5924.28	0.001244	2.36	94.73	75.28	0.33
Reach #1	110	100-year	206.10	5922.07	5923.65	5923.65	5924.15	0.013493	5.68	36.26	36.74	1.01
Reach #1	100	100-year	206.10	5921.44	5922.82	5922.87	5923.36	0.015202	6.15	35.29	38.43	1.08
Reach #1	90	100-year	206.10	5920.14	5921.32	5921.61	5922.31	0.029676	8.18	26.35	30.76	1.49
Reach #1	80	100-year	206.10	5918.52	5919.95	5920.27	5921.03	0.023097	8.70	26.28	28.43	1.37
Reach #1	70	100-year	206.10	5917.03	5918.28	5918.73	5919.68	0.042266	10.07	22.44	28.60	1.78
Reach #1	60	100-year	206.10	5915.88	5917.13	5917.57	5918.52	0.029922	9.85	22.22	27.66	1.79
Reach #1	50	100-year	206.10	5914.31	5915.45	5916.01	5917.28	0.049219	10.86	18.99	25.26	2.21
Reach #1	40	100-year	206.10	5912.25	5913.26	5913.97	5916.06	0.084886	13.44	15.34	22.28	2.85
Reach #1	35	100-year	206.10	5911.25	5912.40	5912.92	5914.19	0.052496	10.74	19.18	27.23	2.26
Reach #1	30	100-year	206.10	5910.85	5912.12	5912.49	5913.44	0.059238	9.22	22.43	45.32	2.27
Reach #1	29	100-year	206.10	5910.90	5912.08	5912.40	5913.15	0.045094	8.32	24.82	47.67	2.00
Reach #1	25	100-year	206.10	5910.80	5911.80	5912.13	5912.88	0.041193	8.67	25.57	50.11	1.96
Reach #1	21	100-year	206.10	5909.77	5910.79	5911.15	5912.10	0.074527	9.19	22.45	53.18	2.48
Reach #1	20	100-year	206.10	5909.58	5910.70	5911.00	5911.70	0.043855	8.06	25.59	49.22	1.97
Reach #1	19	100-year	206.10	5909.10	5910.05	5910.37	5911.07	0.042916	8.15	25.40	48.00	1.96
Reach #1	10	100-year	206.10	5908.24	5909.11	5909.43	5910.21	0.048395	8.46	24.67	49.73	2.07

ROAD →

Water Surface @ 12.12
Road @ 11.41
Depth = 0.7'
Vel. = 9.22 fps
V x D = 6.5, OK

HEC-RAS Plan: River: Reach #1 Reach: Reach #1 Profile: 100-year

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Reach #1	180	100-year	5933.69	5929.09	4.60				206.10		15.84
Reach #1	170	100-year	5930.15	5926.35	3.80	3.30	0.24	1.03	203.80	1.27	20.04
Reach #1	160	100-year	5926.74	5925.19	1.55	2.74	0.68	61.25	144.64	0.21	34.61
Reach #1	150	100-year	5925.22	5924.19	1.03	1.36	0.15	0.28	201.03	4.79	32.04
Reach #1	145	100-year	5924.52	5924.41	0.11	0.02	0.00	49.51	156.32	0.27	56.11
Reach #1	140	100-year	5924.50	5924.38	0.12	0.04	0.00	29.95	175.92	0.23	56.42
Reach #1	135	100-year	5924.46	5924.29	0.16	0.06	0.00	0.48	205.46	0.16	51.75
Reach #1	130	100-year	5924.40	5924.23	0.17	0.08	0.03	0.18	205.84	0.08	49.09
Reach #1	120	100-year	5924.28	5924.21	0.08	0.09	0.04	22.88	183.17	0.05	75.28
Reach #1	110	100-year	5924.15	5923.65	0.50	0.73	0.00		206.10		36.74
Reach #1	100	100-year	5923.36	5922.82	0.54	0.78	0.00	37.00	169.10		38.43
Reach #1	90	100-year	5922.31	5921.32	0.98	1.02	0.04	22.93	183.17		30.76
Reach #1	80	100-year	5921.03	5919.95	1.08	1.27	0.01	8.94	182.43	14.73	28.43
Reach #1	70	100-year	5919.68	5918.28	1.40	1.31	0.03	50.25	154.87	0.98	28.60
Reach #1	60	100-year	5918.52	5917.13	1.40	1.16	0.00	29.27	176.71	0.12	27.66
Reach #1	50	100-year	5917.28	5915.45	1.83	1.20	0.04		206.10		25.26
Reach #1	40	100-year	5916.06	5913.26	2.80	1.12	0.10		206.10		22.28
Reach #1	35	100-year	5914.19	5912.40	1.79	1.58	0.30		206.10		27.23
Reach #1	30	100-year	5913.44	5912.12	1.32	0.60	0.14	0.22	205.88		45.32
Reach #1	29	100-year	5913.15	5912.08	1.07	0.22	0.07	0.06	206.01	0.03	47.67
Reach #1	25	100-year	5912.88	5911.80	1.08	0.27	0.00	15.87	181.12	9.11	50.11
Reach #1	21	100-year	5912.10	5910.79	1.31	0.76	0.02		206.08	0.02	53.18
Reach #1	20	100-year	5911.70	5910.70	1.01	0.31	0.09	0.01	206.09		49.22
Reach #1	19	100-year	5911.07	5910.05	1.03	0.62	0.00	0.89	205.21		48.00
Reach #1	10	100-year	5910.21	5909.11	1.10	0.87	0.01		204.00	2.10	49.73

forms the existing flood hazard as shown on the FIRM, and is the basis for this analysis.

2. The North Branch of the Pino Arroyo, which conveys runoff through the north portion of the Tanoan Golf Course, including flows collected on San Antonio Avenue, through the Enclave Subdivision site and to the Lower Tanoan Irrigation Pond. This flow, which is conveyed interior to the site, is discharged independently into the lower Tanoan irrigation pond, and does not affect the floodplain limits for the purposes of the CLOMR. It is therefore not analyzed in detail within this report.

DAM OUTFLOW AND COMPARISON OF DISCHARGES

The upstream limit of this analysis is the Tramway Dam, constructed by AMAFCA in the late 1970's. The outflow hydrograph from the Tramway Dam that was generated by the analysis prepared by Tom Mann and Associates for the SAD-205 diversion structures from the Bear Arroyo Tributary to the Pino Arroyo has been utilized as input to the AHYMO model. This hydrograph identifies the recognized maximum discharge during the 100-year storm event as approved by AMAFCA and the State Engineer. The recognized peak discharge is 206 CFS, compared to a peak discharge of approximately 384 CFS, as shown in the existing FIS. A copy of the original dam design hydrology and hydraulic sheets prepared by Bovay Engineers in 1977, as amended by Tom Mann in 1984, and as approved by AMAFCA and the State Engineer's Office, are enclosed as Exhibit 7.

Discharge from Pino Dam

Analysis of the dam and verification of the dam outflow discharge rate was outside the scope of this study. However, a sensitivity analysis was performed in order to test the significance of potential differences in the outflow hydrograph of the dam upon the downstream hydrology of the watershed. The following narrative summarizes that analysis:

> According to the stage/storage/discharge chart provided in Appendix 1 and on Exhibit 7 that was originally performed in 1977 by Bovay Engineers for the design of the Tramway Dam, and updated by Tom Mann in 1984, the maximum discharge from the dam prior to an uncontrolled spill is 218 CFS. Although this analysis of the dam was not performed utilizing the hydrologic methods currently accepted by FEMA, under the assumption that an uncontrolled spill will not occur during the 100 year storm event, the difference between the maximum possible discharge and the peak discharge identified in the analysis is only 6%, which is within an acceptable margin of error.
>
> Considering the timing of the peak discharge identified within the analysis, the peak of 206 CFS occurs at approximately 2 hours after the storm begins. This discharge hydrograph was obtained from an analysis that utilized a rainfall distribution that reached its peak within the first hour, as did all hydrologic analysis methods previously utilized within the Albuquerque area. The hydrologic methods currently accepted by FEMA utilize a rainfall distribution that is loaded into the second hour of the storm. It would follow that, if a current analysis were to be performed, the peak discharge from the dam would occur later in the storm than the peak within the current analysis. This would generate a peak dam discharge that would occur later on the trailing end of the local hydrograph, thus reducing the local peak discharge. Therefore, it can be concluded that the assumptions used in this analysis are conservative.

The flow within the South Branch of the Pino Arroyo from the Tramway Dam is conveyed under Sky Valley through four 48-inch culverts. These culverts are analyzed in more detail in the bridge/culvert section of the hydraulic analysis section. Short sections of slotted drain were placed

on either side of the low point of the Sky Valley street crossing to intercept nuisance flow from the Inverness at Tanoan Subdivision. These inlets convey daily nuisance runoff within a 12-inch private storm sewer within Sky Valley, creating a minor diversion to the north branch public storm sewer, which conveys runoff to the lower irrigation pond through the internal streets within the subdivision.

After passing through the Sky Valley culvert crossing, the flow within the South Branch passes the project along the south boundary, and is conveyed into the Lower Tanoan Irrigation Pond via a reinforced concrete rundown/drop structure. The irrigation pond forms the downstream limit of the analysis. The total discharge into the pond from the arroyo is 482 CFS. There is no discharge rate within the FIS for comparison of this discharge.

2. HYDROLOGIC ANALYSIS

HYDROLOGIC COMPUTATIONS

The hydrologic calculations which appear herein analyze the proposed developed discharge for the 100-year, 6-hour rainfall event. The peak discharge of runoff has been calculated using the computerized hydrologic model HYMO (Problem-Oriented Computer Language for Hydrologic Modeling, by J.R. Williams and R.W. Hann Jr., ARS-S-9, 1973) with subsequent modifications by AMAFCA. This program utilizes the initial abstraction/uniform infiltration method as identified within the City of Albuquerque's recently promulgated revision to the Development Process Manual (DPM Update), and is referred to as the AHYMO model. Another modification is computation of hydrographs by the split hydrograph method. A hydrograph is computed for the impervious portion and a separate one is computed for the pervious portion. The two hydrographs are then added to form the complete basin hydrograph. The AHYMO computer output is included within Appendix I. Please refer to page A1.8 in Appendix I for a detailed summary of hydrologic parameters and basin characteristics.

The original FIS utilized the MITCAT hydrologic model that was prepared for the Leonard Rice Study of the Far Northeast Heights. Most of the parameters utilized within that analysis are unknown.

CHANGED WATERSHED CONDITIONS

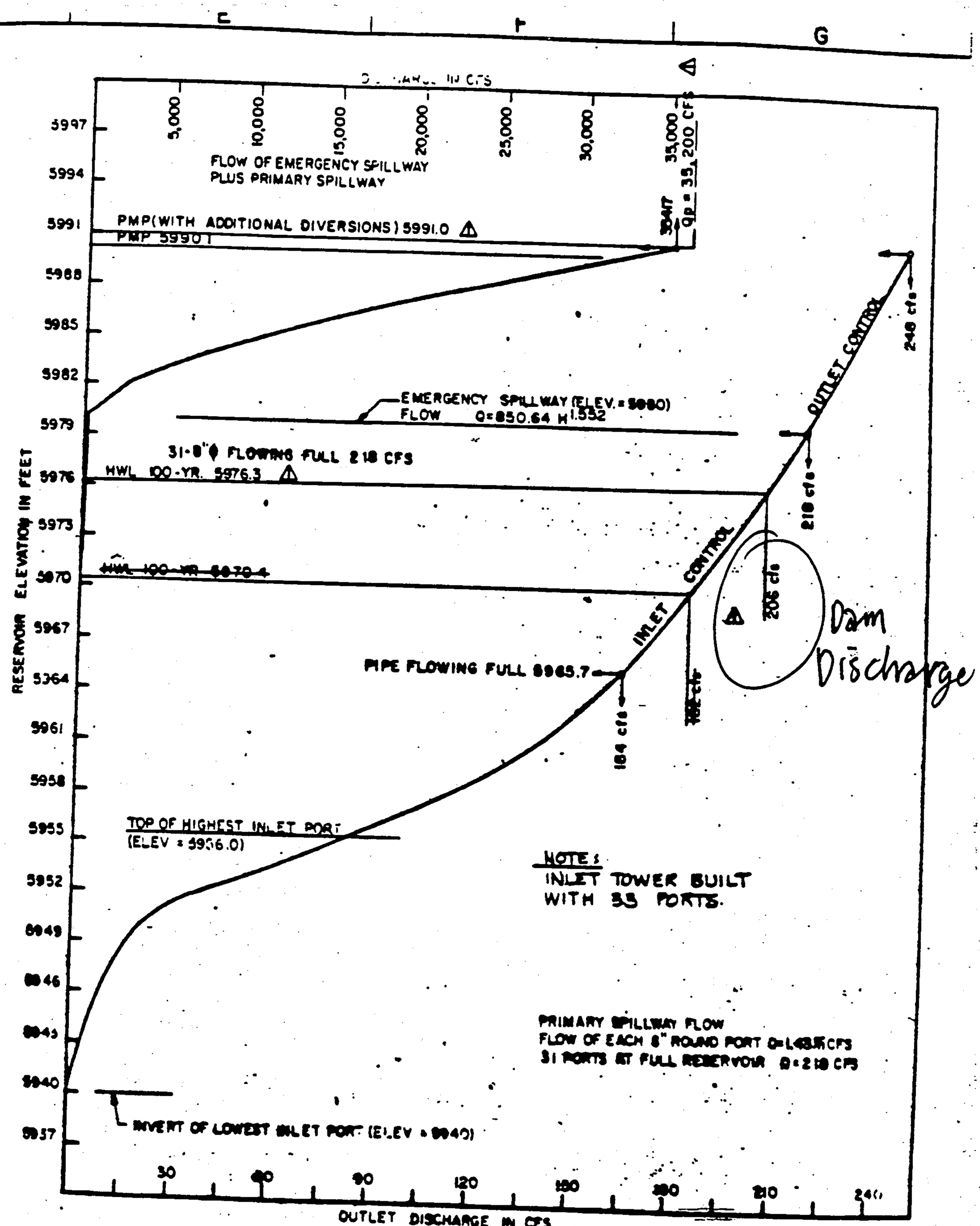
Additional development within the watershed has occurred since the date of the original FIS (please refer to Exhibit 2). This development includes several subdivisions which contribute to the total runoff generated offsite to the proposed Enclave at Tanoan Subdivision, including the Antelope Run Subdivision, the Lalique at Tanoan Subdivision, the Inverness at Tanoan Subdivision, and the proposed Sauvignon Subdivision. The proposed development of the Enclave at Tanoan Subdivision has no effect upon the peak discharge rate within the arroyo.

Another change to the upstream watershed is a storm sewer diversion that has been constructed within the Lowell Street corridor adjacent to the Lalique at Tanoan Subdivision through an existing 54" storm sewer which discharges into the upper Tanoan irrigation pond. This diversion adds approximately 119 CFS to the watershed from the Lalique development and the Antelope Run Subdivision to the south. Without the diversion, these developments would have discharged runoff to the south toward Academy Road and the Bear Tributary Arroyo. Excerpts from the drainage and grading plans for these projects are included in Appendix I. Overflow from the pond is conveyed through golf course fairways to the Sky Valley private roadway. For the purposes of this analysis, a reservoir routing analysis was performed for the upper irrigation pond, but was later removed from the model, in order to assure conservatism due to the inability to accurately ensure the existing level of the pond at the start of the 100-year storm event.

BASIN HYDROLOGY AND DRAINAGE PATTERNS

For the purposes of this analysis, the site falls within two general drainage basins within the Pino Arroyo Watershed as shown on Exhibit 2:

1. The South Branch of the Pino Arroyo, which conveys runoff from the Tramway Dam through the Tanoan Golf Course, across Sky Valley through a crossing structure that was constructed in the Spring of 1992 under the Sky Valley and Lowell Street Private Street and Public Waterline Extension project (City Project 2921.90), and adjacent to the site along the south boundary. It is this basin that



DISCHARGE VS. RESERVOIR ELEVATION

Reference: Tramway Floodwater Retaining Structure Design Drawings Dated 12/77

△ Modified by Ton Mann Assoc. 2/84

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

July 16, 2003

James Topmiller
Bohannan-Huston, Inc.
7500 Jefferson NE - Courtyard I
Albuquerque New Mexico 87109

RE: Grading and Drainage Plan for Tract N-6-A Tanoan Properties (E22-D20A) Dated June 10, 2003

Dear Mr. Topmiller:

The above referenced drainage plan is approved for Building Permit. Prior to Certificate of Occupancy release please submit the drainage easement to AMAFCA for their review and approval.

If you have any questions please call me at 924-3982.

Sincerely,

Carlos A. Montoya
City Floodplain Administrator

C: Lynn Mazur, AMAFCA

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT N.E. - ALBUQUERQUE, NM 87107
TELEPHONE (505) 884-2215 FAX (505) 884-0214

June 20, 2003

Mr. James R. Topmiller, P.E.
Bohannan Huston, Inc.
7500 Jefferson St. NE, Courtyard I
Albuquerque, New Mexico 87109

Re: Drainage Report for Tract N-6-A, Tanoan Properties, ZAP E-22

Dear Mr. Topmiller:

Following is a compilation of AMAFCA comments from our meeting on June 12 and from our review of the referenced report.

1. Clearly label the AMAFCA easement for the Pino Dam on the Grading and Drainage Plan (G&D). The area will be staked before construction begins. No equipment or grading will be allowed on the slope of the dam.

2. A Drainage Easement will be granted to AMAFCA for the principal spillway outlet flows. The limits will be to the energy grade line or the FEMA floodplain, whichever is greater, and may be a combination of the two. Enclosed is a standard Grant of Easement form to be signed and notarized by the owner.

3. The existing 100-foot AMAFCA Drainage Easement will remain.

4. An Encroachment Permit will be required for the driveway within the AMAFCA easement. Enclosed is a standard form to be signed and notarized by the owner.

5. On the G&D, "fan out" the riprap at the end of the Section C-C rundown to dissipate concentrated flows. See attached detail.

If you have any questions, please call me at 884-2215.

Sincerely,
AMAFCA

Lynn M. Mazur

Lynn M. Mazur, P.E.
Development Review Engineer

Cc: Carlos Montoya, COA Hydrology (w/out forms)

ZAP_____

GRANT OF EASEMENT
FLOODWAY AND STORM DRAINAGE WORKS

Michael D. Sivage, Trustee of the Michael D. Sivage Revocable Trust
_____ (name(s)) _____ (marital status), Grantor(s), being the owner(s) of the property described herein, for good and valuable consideration, the receipt of which is hereby acknowledged, hereby grants, bargains, sells and conveys to the ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY, a political subdivision of the State of New Mexico, (AMAFCA), its successors and assigns, the permanent right and easement for drainage, flood control and the conveyance and storage of storm water, and for the construction, reconstruction, operation and maintenance of, and access to, such appurtenant facilities as may be necessary on, in, under, over and across the following described real estate:

The land in which the foregoing rights and easement are granted is located within Lot(s) _____, Block_____, TractN-6-A_, Unit_____ of Tanoan Properties _____ subdivision in Bernalillo County, New Mexico, being more particularly described in Exhibit "A" attached hereto and incorporated herein by reference.

Except with the written approval of AMAFCA, no fence, wall, building, or other obstruction may be placed or maintained in said easement, and there shall be no alteration of the grades or contours in said easement. The granting of this easement shall not obligate AMAFCA to maintain any arroyo, drainage channel or other facility, nor shall this easement require AMAFCA to provide for the protection of property lying outside of the easement granted. AMAFCA shall only maintain property and/or improvements that it specifically agrees, by written agreement filed for public record, to maintain. Unless AMAFCA specifically so agrees to maintain property and/or improvements, all maintenance responsibility shall remain with the Grantor. Landscaping or maintenance work by the Grantor, within the easement hereby conveyed, shall not alter the present flowline, capacity, or permeability of the present flood way area, except in an emergency. If emergency work is performed, Grantor shall notify AMAFCA as soon as practical thereafter. AMAFCA will then determine if the emergency work can remain or must be removed or modified. Safe locations for structures built on lands adjacent to the easement described herein may be substantially outside of the described area.

Grantors covenant and warrant that they are the owners in fee simple of the property and that they have a good and lawful right to grant the easement described herein. The grant and other provisions of this easement constitute covenants running with the land for the benefit of AMAFCA and its successors and assigns until terminated.

TO HAVE AND TO HOLD the said right and easement for the uses and purposes aforesaid, unto AMAFCA, its successors and assigns, to run with the land forever. However, to the extent any portion of the above granted easement area is declared unnecessary for flood

control or drainage by the Board of Directors of the Albuquerque Metropolitan Arroyo Flood Control Authority, said portion of the easement shall revert to the Grantor. Any such reversion shall be accomplished by way of a quitclaim deed to Grantor, its successors or assigns.

THERE IS RESERVED to the Grantors, their successors and assigns, the right to use said lands for open space and landscaping. Such open space and landscaping shall not interfere with the rights and easements granted to AMAFCA. Other purposes, which will not interfere with the rights and easements hereby granted, may be permitted, provided that Grantor obtains AMAFCA's written licensed approval for such use, not to be unreasonably withheld.

WITNESS _____ hand__ and seal__ this _____ day of_____, 200___.

GRANTORS: Michael D. Sivage, Trustee of the Michael D. Sivage Revocable Trust

_____ _____

ACKNOWLEDGMENT FOR NATURAL PERSONS

STATE OF NEW MEXICO)
)s.s.
COUNTY OF BERNALILLO)

OFFICIAL SEAL
Susan A. Skaggs
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 7/12/06

This instrument was acknowledged before me on Aug. 25, 2003 by MICHAEL SIVAGE.

My commission expires:
7-12-06

_____
Notary Public

ACKNOWLEDGMENT FOR CORPORATIONS/PARTNERSHIPS

STATE OF NEW MEXICO)
)s.s.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on _____, 200__ by _____, the _____ of _____.

My commission expires:

_____

_____
Notary Public

Revised
April 2, 2001

AMAFCA
[illegible] NE
[illegible] 87107

EXHIBIT "A"

SCALE: 1" = 100'

NE CORNER
TRACT N-6-A

OPEN SPACE 5-B-2
THIRD REVISION PLAT OF TANOAN PROPERTIES
FILED: JUNE 20, 1986
(C30-155)

(TIE) S74°11'46"E
123.85'

ACS ALUMINUM CAP "ACS 7-E22 1986"
GEOGRAPHIC POSITION (NAD 1927)
NM STATE PLANE COORDINATES (CENTRAL ZONE)
X = 424,431.28 Y = 1,512,773.86
GROUND TO GRID FACTOR = 0.9996199
DELTA ALPHA = -00°08'44"
TRIGONOMETRIC ELEVATION = 5993

N-6-A
TRACT N-6-A AND TRACT N-6-B TANOAN PROPERTIES
FILED: NOVEMBER 20, 1995
(95C-422)

(TIE) N01°58'45"W 480.37'

N85°56'58"E 164.02'

T5

C1

T4

S81°54'18"W 151.45'

35671 Sq. Ft.
0.8189 Acres

S16°56'14"E 118.14'

N45°32'57"W 346.99'

100'

100' DRAINAGE EASEMENT
FILED: JULY 27, 1979
(BK. 706, PGS. 536-542)
DOCUMENT NO. 79-56024

C2

POINT OF BEGINNING

T1

T2

T3

OPEN SPACE 5-B-2
THIRD REVISION PLAT OF TANOAN PROPERTIES
FILED: JUNE 20, 1986
(C30-155)

TOM KL INGENHAGEN
NEW MEXICO
5978
REGISTERED PROFESSIONAL SURVEYOR

8-20-03

CURVE DATA

ID	DELTA	TANGENT	ARC	RADIUS	CHORD	CHORD BRG
C1	77°06'48"	119.56'	201.88'	150.00'	186.99'	S55°29'38"E
C2	12°09'26"	26.62'	53.05'	250.00'	52.95'	S84°57'04"E

TANGENT DATA

ID	BEARING	DISTANCE
T1	S01°58'45"E	32.10'
T2	S15°45'59"E	29.26'
T3	S54°18'40"W	25.71'
T4	N15°21'32"W	50.00'
T5	N45°45'50"E	24.90'

RECEIVED
DEC 28 2004
DRAINAGE HYDROLOGY SECTION

Bohannan ▲ Huston INC.
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

JOB NUMBER 040049 003

P:\040049\survey\003\graphics\040049exhibit.dgn
20-AUG-2003
12:47

DESCRIPTION

A certain tract of land situate within the Elena Gallegos Grant, and also within the northeast one-quarter of projected Section 27, T11N, R4E, N.M.P.M., Bernalillo County, New Mexico. Said tract also being a portion of TRACT N-6-A, as the same is shown and designated on the plat of TRACT N-6-A AND TRACT N-6-B, TANOAN PROPERTIES, recorded in the office of the County Clerk of Bernalillo County, New Mexico on November 20, 1995 in Volume 95C, folio 422, and now being more particularly described by New Mexico State Plane Grid Bearings (Central Zone) and ground distances as follows:

Beginning at a point on the easterly boundary line of said TRACT N-6-A, whence the City of Albuquerque survey monument "7-E22", having New Mexico State Plane Grid Coordinates of the Center Zone: X=424,431.28; Y=1,512,773.86; bears N01°58'45"W a distance of 480.37 feet to the northeast corner of said TRACT N-6-A, and thence S74°11'46"E a distance of 123.85; thence from said point of beginning along the said easterly boundary line of said TRACT N-6-A,
S01°58'45"E a distance of 32.10 feet; thence,
S15°45'59"E a distance of 29.26 feet; thence,
S54°18'40"W a distance of 25.71 feet to a point on the westerly boundary line of said TRACT N-6-A, thence along the said westerly boundary line,
N45°32'57"W a distance of 346.99 feet; thence,
S81°54'18"W a distance of 151.45 feet; thence,
N15°21'32"W a distance of 50.00 feet; thence,
N45°45'50"E a distance of 24.90 feet; thence along the northerly boundary line of the tract herein described,
N85°56'58"E a distance of 164.02 feet to a point of curvature; thence,
201.88 feet along the arc of a curve to the right having a radius of 150.00 feet and a chord bearing S55°29'38"E a distance of 186.99 feet to a point of tangency; thence,
S16°56'14"E a distance of 118.14 feet to a point on curve on the northerly boundary line of a 100 foot wide Drainage Easement recorded July 27, 1975 in Book 706, pages 536-542, Document No. 79-56024; thence along said northerly boundary line,
53.05 feet along the arc of a curve to the left having a radius of 250.00 feet and a chord bearing S84°57'04"E a distance of 52.95 feet to the point and place of beginning

This tract contains 0.8189 of an acre (35,671 square feet), more or less.

SURVEYOR'S CERTIFICATION

I, Thomas G. Klingenhagen, registered Land Surveyor No. 5978 in the State of New Mexico, hereby certify that the above description and the attached site map was prepared by me and is true and correct to the best of my knowledge and belief.

BOHANNAN-HUSTON INC.
Courtyard I
7500 Jefferson St. NE
Albuquerque, NM 87109
(505) 823-1000

Thomas G. Klingenhagen
New Mexico Surveyor No. 5978

Date 8-20-03

TOM KLINGENHAGEN NEW MEXICO 5978 REGISTERED PROFESSIONAL SURVEYOR

RECEIVED
JAN 28 2004
HYDROLOGY SECTION