HYDROLOGY E21/D26 11 PLANS 1 of 2

E21/D26

11 Plans

RECEIVED
APR 11 1984
HYDROLOGY SECTION

TABLE I

SUMMARY OF HYDROLOGICAL PARAMETERS AND PEAK FLOW RATES

Area/Point Designation	Area (acres)	Individual Runoff Ratio	Individual C	Areas Contributing	Gross Area (acres)	Overall Runoff Ratio	Total Area Running Off (acres)	C Composite	Ch	Tc (hr.)	Q c.f.s.	Required Ponding Volume (acre ft.)
ANALYSIS WITH BEAR TRIBUTARY DIVERSION												
A1	50.2	0.52	0.8	A1	50.2	0.52	26.1	0.8	96	0.10	120	-
A2	25.6	0.52	0.8	A1, A2	75.8	0.52	39.4	0.8	96	0.13	168	-
B1	30.7	0.52	0.8	B1	30.7	0.52	16.0	0.8	96	0.20	60	-
B2	35.3	1.0	0.67	B2	30.2	1.0	30.2	0.67	92	0.15	107	-
B3	2.6	1.0	0.8	B2, B3	32.8	1.0	32.8	0.68	92	0.20	107	-
B4	NA	NA	NA	B1-3	63.5	0.77	48.9	0.72	94	0.20	169	-
C1	38.0	1.0	0.65	C1	38.0	1.0	38.0	0.65	91	0.12	139	-
C2	34.6	0.52	0.8	C2	34.6	0.52	1.8	0.8	96	0.15	74	-
C3	69.3	0.52	0.8	C1-3	141.9	0.65	92.2	0.74	94	0.18	329	-
C4	37.7	0.75	0.8	-	-	-	-	-	-	-	-	-
C5	71.2	0.62	0.8	C5	71.2	0.62	44.1	0.8	96	0.28	147	4.5
C6	26.2	0.75	0.8	-	-	-	-	-	-	-	-	-
C7	60.4	0.52	0.8	C1-7	337.4	0.64	215.9	0.77	95	0.31	664	-
D	39.1	1.0	0.67	D	39.1	1.0	39.1	0.67	92	0.10	155	6.10
E	5.3	1.0	0.67	E	5.3	1.0	5.3	0.67	92	0.04	25	0.83
F1	13.5	0.57	0.8	F1	13.5	0.57	7.7	0.8	96	0.04	40	1.26
F2	49.7	1.0	0.8	F2	49.7	1.0	49.7	0.8	96	0.19	189	-
F3	NA	NA	NA	F1, F2	63.2	0.91	57.4	0.8	96	0.19	218	-
ANALYSIS WITH A & B WATERSHED JOINED												
A2	25.6	0.52	0.8	B1-4, A1-2	139.3	0.63	87.8	0.76	95	0.28	280	-
ANALYSIS WITHOUT BEAR TRIBUTARY DIVERSION												
C0	814.0	0.52	0.8	C0	814.0	0.52	423.0	0.8	96	0.33	1308	-
C3	-	-	-	C0-3	955.9	0.54	515.5	0.79	96	0.51	1308	-
C7	-	-	-	C0-7	1151.4	0.56	639.2	0.79	96	0.64	1424	-

(100 %)

AmeriWest Corporation

LD #264

RECEIVED
MAR 05 1985
HYDROLOGY SECTION

March 5, 1985

Mr. Billy Goolsby
City Hydrology
City of Albuquerque
PO Box 1297
Albuquerque, NM 87103

Re: Service Drainage Rundowns to Academy Road from Country Club Estates Subdivision at Tanoan

Dear Billy:

The purpose of this letter is to confirm that the surface drainage rundowns from Country Club Estates at Tanoan Subdivision to Academy Road are private drainage rundowns.

If there are any questions, please contact me at 883-3580.

Sincerely,

AMERIWEST CORPORATION

Cleve E. Matthews
Area Manager

lc

City Center: 6400 Uptown Boulevard NE, P.O. Box 25625, Suite 300E, Albuquerque, NM 87125
(505) 883-3450 toll free outside New Mexico: 1-800-545-5088 New Mexico: 1-800-432-6664

E21-D26

RECEIVED

NOV 09 1984

CITY ENGINEER

October 31, 1984

Mr. Fred Aguirre
Design Hydrology Section
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

RE: Replat of Lot 50 and Tract H - Country Club Estates

Dear Fred:

Per your request enclosed please find one copy of a portion of plate 2A from the Drainage Report for Country Club Estates with the proposed replatting of Lot 50 and Tract H superimposed. As you can see this replatting has no material effect upon the drainage plan, but is intended only to transfer the drainage outfall for subcatchment H1 from an individual, private easement to an association controlled tract/easement.

I hope this information will allow you to feel comfortable with the proposed replat.

Sincerely yours,

Kent M. Whitman

Kent M. Whitman, P.E.
Vice President
KMW/tlk

Enclosure

Copy to: Cleve Matthews

PO Box 1328
Corrales, New Mexico 87048
(505) 897-0000

SURVEYING
LAND PLANNING
CIVIL ENGINEERING
DEVELOPMENT CONSULTANTS

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

DESIGN HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

September 27, 1984

Mr. Kent Whitman
Community Sciences Corporation
P.O. Box 1328
Corrales, New Mexico 87048

RE: COUNTRY CLUB ESTATES (E21-D26) RECEIVED SEPTEMBER 21, 1984

Dear Kent:

The above referenced plan, dated September 15, is approved.

Please attach a copy of this approved plan to the construction set prior to Hydrology sign-off.

If I can be of further assistance, please contact me at 766-7644.

Sincerely yours,

Billy J. Goolsby

Billy J. Goolsby
Civil Engineer/Hydrology

BJG/bm

INFORMATION SHEET

PROJECT TITLE COUNTRY CLUB ESTATES TYPE OF SUBMITTAL FOR INFORMATION

ZONE ATLAS PAGE NO. E21-D26 CITY ADDRESS

LEGAL DESCRIPTION

ENGINEERING FIRM COMMUNITY SCIENCES CORP CONTACT

ADDRESS CORRALES, NM PHONE

OWNER AMERIWEST CONTACT

ADDRESS PHONE

ARCHITECT CONTACT

ADDRESS PHONE

SURVEYOR CONTACT

ADDRESS PHONE

CONTRACTOR CONTACT

ADDRESS PHONE

PRE-DESIGN MEETING:

___ YES
___ NO
___ COPY OF CONFERENCE RECAP SHEET PROVIDED

PLEASE CHECK TYPE OF APPROVAL EXPECTED WITH THIS SUBMITTAL:

___ SKETCH PLAT APPROVAL
___ PRELIMINARY PLAT APPROVAL
___ SITE DEVELOPMENT PLAN APPROVAL
___ FINAL PLAT APPROVAL
___ BUILDING PERMIT APPROVAL
___ CERTIFICATE OF OCCUPANCY APPROVAL
___ ROUGH GRADING PERMIT APPROVAL
___ GRADING/PAVING PERMIT APPROVAL
___ OTHER _____ (SPECIFY)

RECEIVED
SEP 24 1984
HYDROLOGY SECTION

DATE SUBMITTED: _____

BY: _____

9/13/84

Fred/Billy

Mr. Larry Lidster
Ameriwest

RE: Country Club Estates (# 2177)

Dear Larry:

I Appreciate your patience in getting my review comments for subject project. I've marked up the attached set of plans with concerns I feel should be addressed prior to final approval of the revisions. The cover sheet lists the sheet numbers on which I've noted concerns. Generally the concerns are mino. drafting corrections or cross references. A couple of them are details that were missed on earlier reviews, ~~[illegible]~~ relatio to clarity of the plan set. The only substan. items ~~[illegible]~~ I've noted are:

Fred & Billy

1. The revised grading plan appears to be routing private drainage from one lot to the next in several locations, however the revised plat does not provide "Private Drainage Easements" for this, the way the original plat did provide them.
2. Coordinate SAS service to lots 95A-97A with previous SAS project.

Fred?

3. Resolve Private vs. Public St. Dem. issue @

Tract F-1 with DRB & Hydrology. Adjust affected sheets accordingly.

Call me if you or Consultant have any reservations or questions over my notes.

Sincerely,

Greg Olson

Gregory R. Olson
Assist. City Engr.-Design

Attachment (1 Roll of Prints)
cc: Kent Whitman, CSC
Fred Aguirre/Billy Goolsby, Hydro.
File #2177

AGREEMENT

THIS AGREEMENT dated this 16th day of July, 1980, is entered into between the CITY OF ALBUQUERQUE, a minicipal corporation (the "City"), the TANOAN COMMUNITY ASSOCIATION, a New Mexico non-profit corporation (the "Community Association") and AFFILIATED MORTGAGE & DEVELOPMENT COMPANY, a New Mexico corporation ("AMDeC").

WHEREAS, Tanoan, a planned community development within the City of Albuquerque, has been Master Planned and the Environmental Planning Commission has adopted the Tanoan Master Plan as part of the Comprehensive Plan of the City by approval of the Academy-Tramway-Eubank Sector Development Plan,

WHEREAS, the Environmental Planning Commission has given subdivision approval to Village Greens, Fairway Estates and the Masters subdivisions (the "Approved Subdivisions") within the Sector Development and AMDeC intends to develop additional subdivisions within the Sector Development,

WHEREAS, the Sector Development Plan provides that the Tanoan Community shall have community streets owned and maintained by the Community Association, with easements for water and sewer lines, and the Approved Subdivisions have such community streets,

WHEREAS, the parties are desirous of defining and clarifying the responsibilities, obligations and liabilities of the parties with respect to the community streets and the municipal utilities within the Approved Subdivisions and any future subdivisions within the Tanoan Communities which are approved by the Environmental Planning Commission for community streets, and

WHEREAS, AMDeC is the developer of the Tanoan Communities and will own the community streets until such time as they are conveyed to the Community Association.

NOW, THEREFORE, it is agreed:

1. This Agreement shall govern the community-owned streets in the Approved Subdivisions and in any future subdivisions within the Tanoan Communities which are approved by the Environmental Planning Commission for community streets (herein the "Subdivisions").

2. The City is the owner of all water meters and distribution and service lines, sanitary sewer lines (except for lateral sewer lines and connections), storm sewer lines, and other appurtenances of those systems located within existing easements dedicated to public use within the Subdivisions (the City Systems).

3. The Community Association or AMDeC is the owner of the community streets, sidewalks, curb and gutter, landscaping and the irrigation water system which are located within the community street right-of-way (the Association Systems).

4. The City shall exercise complete dominion and control over the City Systems, to the exclusion of the Community Association and shall be solely responsible for the operation, repair and maintenance of the City Systems.

5. The Community Association or AMDeC shall exercise complete dominion and control over the Association Systems, to the exclusion of the City, and shall be solely responsible for the operation, repair and maintenance of the Association Systems.

6. Where the City, in fulfilling its performance obligations under the Agreement, damages the Association Systems, without negligence on the part of the City, the City shall bear no obligation to the Community Association for repair and restoration of those Association Systems, and will be held harmless for damages to the Community Association due to waterline breaks or sewer backups. HOWEVER, the City shall have the obligation to:

A. barricade potentially dangerous conditions as a result of the repair work, and

B. immediately notify the Community Association of such damage to their system.

7. Where the Community Association or AMDeC damages the City Systems either with or without negligence, they shall be liable to the City for repair of that system, to the extent that the City's negligence does not contribute to the damage to the City System. The Community Association or AMDeC shall:

A. grant complete access to its facilities at all times,

B. pay the City the cost of repair of the City Systems,

C. prohibit the placement of obstructions in the public easements that could increase the cost and difficulty to the City for operation, maintenance, and repair of the City Systems over those of standard public right-of-way costs, and

D. pay for any barricades at work sites after City has completed repair on City Systems.

8. In the event the Community Association is dissolved, or is unwilling or unable to comply with the terms of this Agreement and AMDeC does not assume the obligations under this Agreement, master meters shall be installed and the operation and maintenance requirements of the Tanoan Community water and sewer systems shall become the responsibility of the property owners within the Subdivisions unless the utility easements are dedicated and accepted as public rights-of-way.

9. This Agreement shall be binding upon AMDeC for only those obligations or claims relating to an Association System of which

AMDeC is the owner and has not conveyed to the Community Association.

CITY OF ALBUQUERQUE

By _____
Mayor

ATTEST

_____
CITY ATTORNEY

_____
SECRETARY

TANOAN COMMUNITY ASSOCIATION, INC.

By _____
President

AFFILIATED MORTGAGE & DEVELOPMENT COMPANY

By _____
Exec. V.P.

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

DESIGN HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

May 17, 1984

Mr. Kent Whitman
Community Sciences Corp.
P.O. Box 1328
Corrales, NM 87048

REF: DRAINAGE REPORT FOR COUNTRY CLUB ESTATES (E21-D26) RECEIVED APRIL 11, 1984

Dear Kent:

First off, I would sincerely like to apologize for the lateness of responding to this submittal. I do hope it has not caused you or your client any undue delays. We will try to process your future submittal on a more timely turn around.

The above referenced report is approved.

The following will be some of the requirements for final sign-off:

1. An approved, detailed grading plan for inclusion in the construction set.

2. You will need to co-ordinate with the engineer for the tie-in of the SAD 205 project.

3. The subdivision's agreement will need to be approved and processed prior to final plat approval.

4. You will need to co-ordinate with Greg Olson at City Design with regard to the design of the rundowns into Academy. These outfalls will need to be angled with the flow in the street and not be perpendicular.

Should you have any questions or comments, please contact me at 766-7644.

Yours truly,

Billy J. Goolsby

Billy J. Goolsby, PE
City/County Flood Plain Admin.

BJG:mrk

CDS 3730
KC (Fred)
JNH
Denise's File

City of Albuquer

P.O. BOX 1293 ALBUQUERQUE, NEW MEX

August 3, 1984

RECEIVED
AUG 0 8 1984
CITY ENGINEER

AmeriWest Corporation Land Development
P.O. Box 25625
Albuquerque, N.M. 87125

RE: COUNTRY CLUB ESTATES - PROJECT 2177 CONDITIONAL

Dear Mr. Lidster:

As we have discussed over the past few days, there exist problems with the subject project that could continue to delay issuance of Work Authorization. In the interest of avoiding delay, we are willing to release the Work Authorization conditional on the understanding that AmeriWest will work with the City of Albuquerque to resolve the following concerns within 30 days of Work Authorization.

1. Until storm water runoff enters Public Right of Way, it has been City policy to classify it and associated drainage facilities as private. The plat and construction drawings must be ammended to support this policy.

2. The design drawings for this project do not coincide with the adjacent project plans for SAD 205. The interface of the storm sewer in Tract F with the SAD 205 facilities in Academy Road must be coordinated with appropriate, approved drawing revisions provided at no cost to the City.

3. Private storm drainage enters the Public Right of Way as described in "2" above, and then exits the Right of Way via facilities proposed by SAD 205. This results in overland flow of "Public Drainage Waters" across private property from Academy Road to the Bear Tributary Arroyo. A temporary drainage easement should have been granted to the City for maintenance of these flows with the SAD 205 design. AmeriWest being the current owner of the private lands in question will work with the City Hydrology Section to draft and grant an appropriate temporary easement to expire upon development of the land and dedication of permanent public easement.

file copy

The concurrance of your firm is requested on this letter and the above issues prior to Work Authorization.

Sincerely,

Gregory R. Olson

Gregory R. Olson, P.E.
Assistant City Engineer

GRO/tsl

AGREED:

AmeriWest Corporation

INFORMATION SHEET

PROJECT TITLE Country Club Estates TYPE OF SUBMITTAL Rough Grading Permit

ZONE ATLAS PAGE NO. E21 D26 CITY ADDRESS N/A

LEGAL DESCRIPTION Tract J of Amended Summary Plat - Tanoan Properties

ENGINEERING FIRM Community Sciences Corp. CONTACT KMW

ADDRESS P.O. Box 1328 - Corrales, NM PHONE 897-0000

OWNER AmeriWest Corporation CONTACT Cleve Matthews

ADDRESS P.O. Box 25000 - Albuquerque PHONE 883-3501

ARCHITECT N/A CONTACT

ADDRESS PHONE

SURVEYOR Community Sciences Corporation CONTACT

ADDRESS P.O. Box 1328-Corrales, NM PHONE

CONTRACTOR To be selected CONTACT

ADDRESS PHONE

PRE-DESIGN MEETING:

X YES
___ NO
___ COPY OF CONFERENCE RECAP SHEET PROVIDED

PLEASE CHECK TYPE OF APPROVAL EXPECTED WITH THIS SUBMITTAL:

___ SKETCH PLAT APPROVAL
___ PRELIMINARY PLAT APPROVAL
___ SITE DEVELOPMENT PLAN APPROVAL
___ FINAL PLAT APPROVAL
___ BUILDING PERMIT APPROVAL
___ CERTIFICATE OF OCCUPANCY APPROVAL
X ROUGH GRADING PERMIT APPROVAL
___ GRADING/PAVING PERMIT APPROVAL
___ OTHER _____ (SPECIFY)

DATE SUBMITTED: 5/14/84

BY: Kent M. Whitmore

RECEIVED
MAY 15 1984
HYDROLOGY SECTION

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

HYDROLOGY SECTION PROJ. NO._____ DATE: 3/16/84

PLANNING DIVISION NO. E21 (DRB 84-187)

CONFERENCE RECAP

SUBJECT: Country Club Estates

ATTENDANCE: WHO	REPRESENTING
Kent Whitman	
Larry Collins	
Cleve Matthews	
Fred J. Aguirre	
Billy Goolsby	

FINDINGS:

1. Drainage Report required for preliminary plat approval in accordance with the DPM
2. Coordination with SAD 205 required to insure that the required public infrastructures are constructed to facilitate this development. A subdivision improvements agreement may be required if this development precedes SAD 205
3. Sketch plat approval granted
4. Method of discharging into Academy Rd must be coordinated with traffic engineer.

The undersigned agrees that the above findings are summarized accurately and are only subject to change if further investigation reveals that they are not reasonable or that they are based on inaccurate information.

SIGNED: Kent M. Whitman SIGNED: Fred J. Aguirre

TITLE: V.P. CSC - agent for Owner TITLE: Design Hydrologist

DATE: 3/16/84 DATE: 3/16/84

COUNTRY CLUB ESTATES SUBDIVISION

DRAINAGE REPORT

PREPARED BY:

COMMUNITY SCIENCES CORPORATION

FOR:

AMERIWEST CORPORATION

APRIL, 1984

#21-026

KENT M. WHITMAN, P.E.

RECEIVED
APR 11 1984
HYDROLOGY SECTION

KENT M. WHITMAN
NEW MEXICO
6170
REGISTERED PROFESSIONAL ENGINEER

P.O. Box 1126
Corrales, New Mexico 87048
(505) 897-0000

SURVEYING
ENGINEERING
LAND PLANNING

INFORMATION SHEET

PROJECT TITLE Country Club Estates TYPE OF SUBMITTAL Drainage Report

ZONE ATLAS PAGE NO. E21 CITY ADDRESS N/A

LEGAL DESCRIPTION Tract J, Tanoan Properties

ENGINEERING FIRM Community Sciences Corp. CONTACT Kent Whitman

ADDRESS P. O. Box 1328, Corrales PHONE 897-0000

OWNER AmeriWest CONTACT Cleve Matthews

ADDRESS Uptown Blvd., Albuquerque PHONE 883-3501

ARCHITECT N/A CONTACT

ADDRESS PHONE

SURVEYOR Community Sciences Corporation CONTACT

ADDRESS Same as above PHONE

CONTRACTOR N/A CONTACT

ADDRESS PHONE

DATE SUBMITTED 4/9/84

BY

RECEIVED
APR 11 1984
HYDROLOGY SECTION

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B)	Site Location and Topography	1
C)	Design Criteria	2
D)	Computational Procedures	3
E)	Offsite Drainage	7
F)	Onsite Drainage	8
G)	Erosion Control	10

Table 1 - Hydrological Flow Parameters

Table 2 - Street Flow Characteristics

Table 3 - Flow Characteristics of Key Intersections

Plate 1 - Location Map

Plate 2 - Drainage Plan and Basin Map

Plate 3 - Erosion Control Berm

Appendix A - MODSCS Output

Appendix B - Sample Calculations

A) Purpose and Scope

AmeriWest Corporation is currently planning development of their 41 acre Country Club Estates subdivision in northeast Albuquerque. The development will consist of approximately 85, one quarter acre, R1 lots and 55, one eighth acre, townhouse lots intended for the custom home market. The purpose of this report is to present an overall drainage management plan for the project which is based in sound engineering practice and which is acceptable to both the City of Albuquerque and the Albuquerque Metropolitan Arroyo Flood Control Authority.

B) Site Location and Topography

Country Club Estates is located in northeast Albuquerque just east of the Tanoan Clubhouse and north of the proposed extension of Academy Road (See Plate 1).

The land slopes generally from east to west at an average rate of 3.5%, however the site is dotted with several, small arroyo beds which have created a rather rugged surface topography with slope gradients as high as 10% in various directions. Soils consist largely of alluvial sands and silts, and decomposed granite is the major soil constituent.

C) Design Criteria

1) Engineering Parameters

In accordance with AMAFCA and City of Albuquerque Drainage Criteria all hydrological analysis is based on the 100 year frequency - 6 hour duration storm as represented in the NOAA atlas for New Mexico.

10 year, six hour values were also used for some subcatchments in accordance with City drainage policies regarding 10 year street flow in collector and arterial streets. The four rainfall values pertinent to the study are as follows:

	10 Year	100 Year
One Hour	1.35"	2.2"
6 Hour	1.85"	2.8"

Fractions impervious of 0.38 and 0.65 were assumed for R1 and RT lots respectively, and a curve number of 70 was selected for the balance of pervious areas. A fraction impervious of 0.38 was also assumed for developable offsite watersheds, while fairways were assigned a curve number of 61.

2) Flood Control Regulations

The drainage plan presented in this report has been designed to comply with the current City of Albuquerque Drainage Ordinance (and associated technical criteria as published in the Development Process Manual) except as superceded by the previously approved Master Conveyance Study for the Academy/Tramway/Eubank Sector Development Plan published in July, 1978. This Conveyance Study established restrictions regarding flows in Academy Road and requirements for storm sewer facilities to intercept said flows. These storm sewer improvements (as well as Academy Road itself) have been designed as part of the current, City SAD 205 project. All runoff discharges from Country Club Estates will be within the limits established in the aforementioned Master Conveyance Study.

D) Computational Procedures

The analysis approach utilized follows standard engineering practice. Key points of confluence were selected, and subsequently the associated individual and aggregate contributing basins were defined.

Hydrological computations were accomplished by means of our MODSCS computer model. This model is based upon the Soil Conservation Service triangular unit hydrograph method, but the method has been modified to be more applicable to developed watershed conditions. The model avoids the common pitfall of grappling for an appropriate developed curve number by including percent impervious as an input variable. This fraction of the watershed is then modeled at a curve number of 95. An assigned curve number is applied to the balance of the watershed, and the runoffs are combined to yield the composite hydrograph. In addition the model has the capacity to route hydrographs through reservoirs and channels, or to translate hydrographs in time for summation with other sub basins.

For basins with a mix of subcatchments and corresponding variations in fractions impervious, a composite value was calculated.

Times of concentration were estimated by using a combination of approximated street flow velocities and overland flow velocities (as applicable) from the upper subcatchment reaches to the confluence point of interest. A convenient formula for overland flow velocity takes the form:

$$Vo = KY^{0.5}$$

where Vo = overland flow velocity

Y = average ground slope in percent

K = a ground cover factor

Street velocities were estimated by use of the Manning equation for uniform flow.

For some watersheds with well defined stream beds the California Highways formula for time of concentration was used to estimate the parameter directly. The equation takes the form

$$Tc = \left[\frac{11.9\ L^3}{H}\right]^{.385}$$

where

Tc is time of concentration in hours

L is reach length in miles

H is differential elevation in feet

All the characteristic hydrological parameters for each subcatchment of interest and each key point of confluence are contained in Appendix A as part of the computer model output, and a summary of parameters and peak flow rates are given in Table 1.

Following hydrological modeling street flow characteristics were analyzed by various methods. For uniform flow conditions the Manning equation with an n of 0.017 was used supplemented by DPM street capacity charts. At intersections the worst of two conditions was assumed. The theoretical hydraulic jump depth for upstream flow conditions was computed followed by the theoretical pool depth to accelerate the flow from 0 velocity head to downstream conditions. Whichever value was higher was assumed to be the potential flood depth, and this value was used to decide upon the necessity of storm sewer improvements. It should be noted that this approach is valid only for incoming supercritical flow conditions at tee intersections. Subcritical flow conditions are not considered critical at intersections unless normal flow depth is above required limits. Table 2 summarizes uniform street flow conditions at key locations while Table 3 presents computed parameter values at critical intersections. Sample calculations are included in Appendix B.

E) Offsite Drainage

The basins which contribute offsite runoff onto the site are outlined on Plate 2. Control of offsite runoff will be in compliance with the previously referenced Master Conveyance Study and with a supplementary report entitled "Tanoan Clubhouse and Appurtenant Drainage Basins, Drainage Management Plan" published in December, 1978. These reports basically call for three approaches:

1) Release of flows from areas C & D to Academy Road to be intercepted by a Storm Sewer on Academy Road approximately midway along the southerly project boundary.

2) Retention ponding of areas A, B, H1, and part of G1 on the adjacent golf course fairways

3) Diversion of Areas E and F into the Pino Arroyo

This plan complies with the overall intent of the referenced plans, but proposes certain alternative measures regarding the actual mechanics of offsite runoff control as follows:

1) Aras A & B will be diverted via RCP storm sewer from point B, along the alignment of a proposed, future, offsite road, to the Pino Arroyo.

2) Area E will be diverted to the Pino Arroyo by means of the same, above mentioned offsite roadway. This roadway will be graded as a temporary diversion channel until development of the surrounding land.

F) Onsite Drainage

Plate 2 illustrates the proposed drainage management plan. In compliance with the aforementioned Master Conveyance Study, the plan will direct surface runoff into one of two, primary basin divides. The first divide consists of subcatchments H1-H3, and will be artificially induced via site grading to divert as much runoff as feasible to point H3 where it will discharge into the Country Club's parking lot. This parking lot was designed and constructed to receive flows from these subcatchments and direct them into the Pino Arroyo.

The second major divide is comprised of areas G1-G4. Runoff from these subcatchments will be collected by the street system and contained within the curb sections till conveyed to point G4 where an extension of the adjacent Academy Road Storm Sewer will intercept the flows. A deviation exists from the Master Conveyance Study in this system. Area E of the referenced Study (corresponding approximately to areas G1 and G2 herein) was shown to drain into a retention pond located on the golf course fairway immediately east of this project. It was later decided that this alternative was not practical, and AmeriWest directed their SAD 205 consultant (also CSC) to plan to accommodate runoff from Conveyance Study area E in the Academy Road storm sewer. This directive was executed and the storm sewer has been so sized. Flows from north of Academy Road were estimated at 118 cfs for design of the storm sewer which compares favorably with the 45 cfs shown at point G4.

Finally, various independent, single subcatchments are shown which will drain via private drainage swales or public drainage rundowns into Academy Road in accordance with the above referenced study. Areas J & I will drain to the clubhouse entrance road which in

turn drains to Academy Road. Areas D, K, L, & M will all drain via easement channels directly to Academy road. Rear lots backing to either of these roadways will be allowed to drain directly to the adjacent gutter by means of weep holes in their garden walls and private drainage easements where required.

G) Erosion Control

Control of excessive soil erosion into City streets and drainage improvements during construction will be accomplished by use of temporary lot line, water-trap berms. These will be windrowed into place following mass grading operations and left in place until each home is constructed and sold. Plate 3 illustrates the dimensions of these berms, and they will be located along those boundaries of each lot which are common to either City rights of way or public easement.

TABLE 1

HYDROLOGICAL FLOW PARAMETERS

AREA/ POINT DESIGNATION	AREA (SQ. MI.)	AREAS CONTRIBUTING	GROSS AREA (SQ. MI.)	FRACTION IMPERVIOUS	C N (PERVIOUS)	C (MINUTES)	Q_{10} R(1) = 1.35 R(6) = 1.85	Q_{100} R(1) = 2.2 R(6) = 2.8	REMARKS
A	.0384	A	.0384	.38	70	12	--	58.3	
B	.0236	A&B	.0620	.13	64	9	--	72.9	A combined w/B by computer
C	.0084	C	.0084	.38	70	7	6.5	14.2	Diverted to Academy Road
D	.0113	D	.0113	.11	64	7	--	8.7	
E	.0420	E	.042	.46	70	10	--	78.0	Diverted to Pino Arroyo
F	.0182	F	.0182	.08	63	14	--	10.7	
G1	.0165	G1	.0165	.38	70	7	--	27.9	
G2	.0013	G2	.0013	.13	64	3	--	1.1	
G3	.0067	G1,G2,G3	.0245	.37	69	10	--	39.8	
G4	.0035	G1-G4	.0280	.43	70	11	21.5	45.2	
H1	.0043	H1	.0043	.13	64	4	--	3.5	
H2	.0070	H1,H2	.0113	.28	68	12	--	14.0	
H3	.0044	H1-H3	.0157	.29	68	14	8.4	19.8	
I	.0014	I	.0014	.6	70	3	--	3.0	
J	.0152	J	.0152	.38	70	12	10.6	23.1	
K	.0103	K	.0103	.65	70	5	--	23.3	
L	.0028	L	.0028	.38	70	5	--	4.7	
M	.0022	M	.0022	.38	70	5	--	3.7	

TABLE 2
STREET FLOW CHARACTERISTICS

POINT DESIGNATION	100 YEAR PEAK FLOW	10 YEAR PEAK FLOW	ESTIMATED STREET SLOPE	100 YEAR FLOW DEPTH	10 YEAR FLOW DEPTH	10 YEAR VEL.	10 YEAR VXD	REMARKS
G4	45.2	21.5	.040	.40	.32	4.88	1.46	OK
H3	19.8	8.4	.038	.33	.25	3.78	0.95	OK
J	23.1	10.6	.030	.34	.26	3.66	0.95	OK
E	78.0	39.0	.022	0.55	0.43	5.04	2.77	OK

TABLE 3

FLOW CHARACTERISTICS AT KEY INTERSECTIONS

OINT ESIG-ATION	INTER-SECTION	LOCATION	Q	STREET WIDTH	SLOPE	D_N	V_N	F	D_C	V_C	JUMP DEPTH = $\frac{-Y_1}{2} + \sqrt{\left(\frac{Y_1}{2}\right)^2 + \frac{2V_1^2 Y_1}{g}}$	POOL DEPTH $D + \frac{1.25 \Delta V^2}{2g}$	SPECIAL REQUIREMENTS
G3	I1	Upstream	39.8	35	.018	.44	4.56	1.6			0.57		8" curb
		Downstream	39.8	27	.04	.39	6.41	2.35	0.56	3.62		0.81	8" curb
H2	I2	Upstream	14	*9	.072	0.19	8.40	3.44			0.82		8" curb
		Downstream	14	27	.038	0.26	4.25	2.09	0.36	2.37		0.47	8" curb

* Section is easement channel

PLATE 1
LOCATION MAP

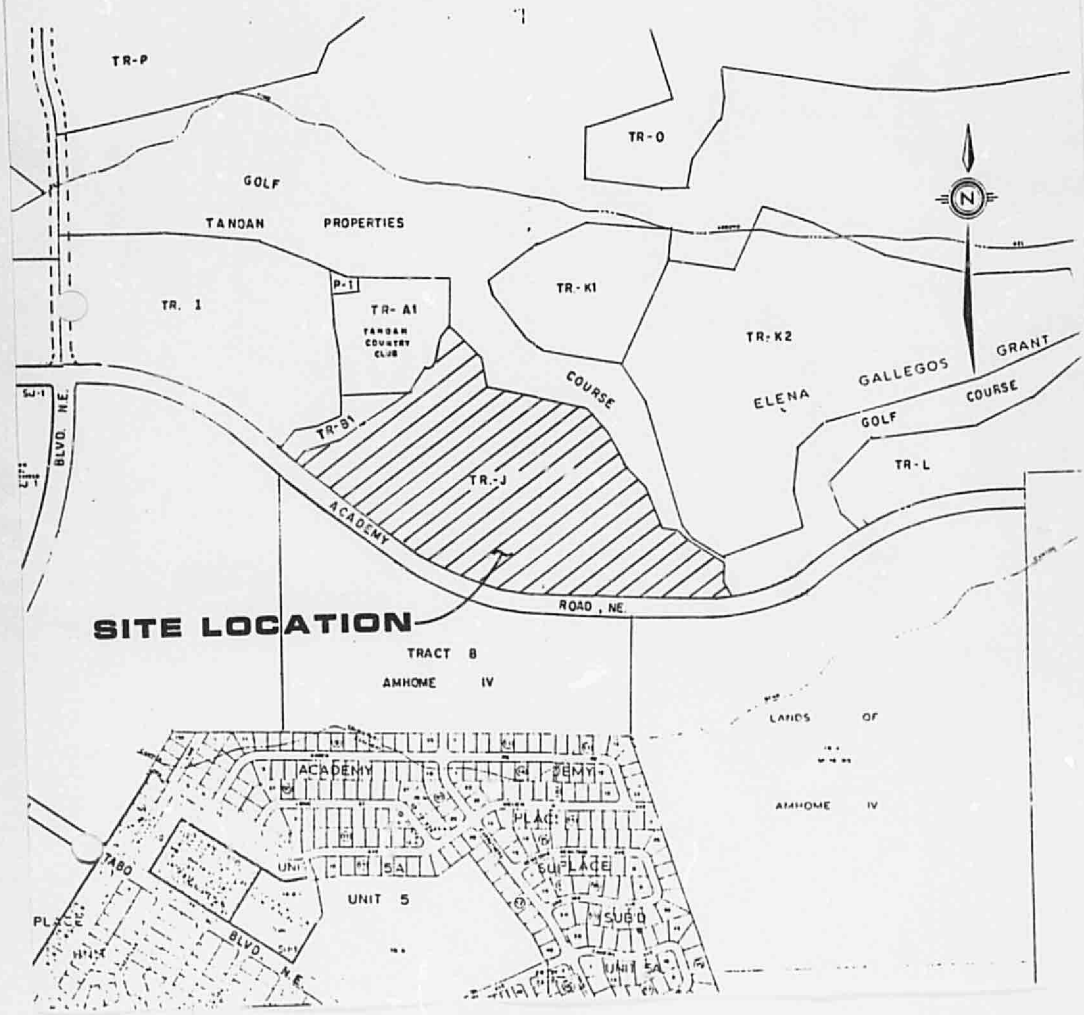
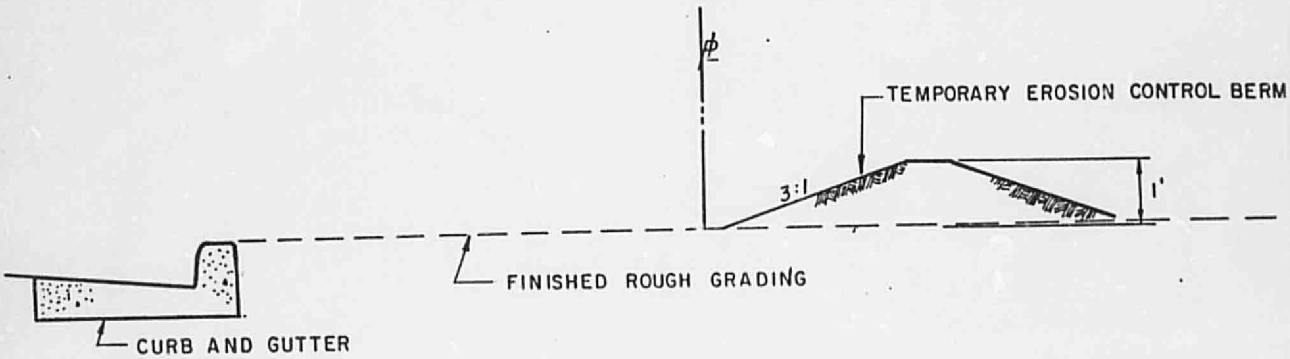


PLATE 3

TYPICAL EROSION CONTROL BERM



Scale: 1" = 2'

APPENDIX A

MODSCS OUTPUT

```
AREA/POINT DESIGNATION = C
AREA=                8.4E-03  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  7  MINUTES
FRAC IMPERV=         .38
CN (PERVIOUS)=       70
CN (IMPERVIOUS)=     95
```

100 yr.

I = 7.09

C = 0.38

A = 5.38 ac.

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	14.2

VOL = 24054 CF

```
AREA/POINT DESIGNATION = C
AREA=                8.4E-03  SQ MI
1 HR RAIN=           1.35  INCHES
6 HR RAIN=           1.85  INCHES
TC=                  7  MINUTES
FRAC IMPERV=         .38
CN (PERVIOUS)=       70
CN (IMPERVIOUS)=     95
```

10 yr.

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	6.5

VOL = 12202.6 CF

```
AREA/POINT DESIGNATION = D
AREA=                .0113  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  7  MINUTES
FRAC IMPERV=         .11
CN (PERVIOUS)=       64
CN (IMPERVIOUS)=     95
```

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	8.7

VOL = 15491.3 CF

AREA/POINT DESIGNATION = E
AREA= .042 SQ MI
1 HR RAIN= 2.2 INCHES
6 HR RAIN= 2.8 INCHES
TC= 10 MINUTES
FRAC IMPERV= .46
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	78.0

VOL = 133141 CF

AREA/POINT DESIGNATION = F
AREA= .0182 SQ MI
1 HR RAIN= 2.2 INCHES
6 HR RAIN= 2.8 INCHES
TC= 14 MINUTES
FRAC IMPERV= .08
CN (PERVIOUS)= 63
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
243	10.7

VOL = 21332.9 CF

```
AREA/POINT DESIGNATION = G1
AREA=                .0165  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  7  MINUTES
FRAC IMPERV=         .38
CN (PERVIOUS)=       70
CN (IMPERVIOUS)=     95

PEAK ONLY OUTPUTTED

     TIME        Q(CFS)

      240            27.9

VOL =  47249  CF
```

```
AREA/POINT DESIGNATION = G2
AREA=                1.3E-03  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  3  MINUTES
FRAC IMPERV=         .13
CN (PERVIOUS)=       64
CN (IMPERVIOUS)=     95

PEAK ONLY OUTPUTTED

     TIME        Q(CFS)

      240            1.1

VOL =  1895.17  CF
```

37% Impervious = .37 x .95 = 0.35
63% Pervious = .63 x .38 = 0.24
C 0.59

Q=CIA = 0.59 (6.92) 15.68 ac
Q= 54.77 cfs

```
AREA/POINT DESIGNATION = G3
AREA=                .0245  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  10  MINUTES
FRAC IMPERV=         .37
CN (PERVIOUS)=       69
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

     TIME        Q(CFS)

      240          39.8

VOL =  67763.4  CF
```

?

```
AREA/POINT DESIGNATION = G4
AREA=                .028  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  11  MINUTES
FRAC IMPERV=         .43
CN (PERVIOUS)=       70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

     TIME        Q(CFS)

      243          45.2

VOL =  85543  CF
```

```
AREA/POINT DESIGNATION = G4
AREA=                .028  SQ MI
1 HR RAIN=           1.35  INCHES
6 HR RAIN=           1.85  INCHES
TC=                  11  MINUTES
```

```
FRAC IMPERV=        .43
CN (PERVIOUS)=      70
CN (IMPERVIOUS)=    95

PEAK ONLY OUTPUTTED

     TIME        Q(CFS)

      243          21.5

VOL =  44429.1  CF
```

```
AREA/POINT DESIGNATION = H1
AREA=                 4.3E-03  SQ MI
1 HR RAIN=            2.2  INCHES
6 HR RAIN=            2.8  INCHES
TC=                   4  MINUTES
FRAC IMPERV=          .13
CN (PERVIOUS)=        64
CN (IMPERVIOUS)=      95

PEAK ONLY OUTPUTTED

     TIME        Q(CFS)

      233           3.5

VOL =  6268.64  CF
```

```
AREA/POINT DESIGNATION = H2
AREA=                 .0113  SQ MI
1 HR RAIN=            2.2  INCHES
6 HR RAIN=            2.8  INCHES
TC=                   12  MINUTES
FRAC IMPERV=          .28
CN (PERVIOUS)=        68
CN (IMPERVIOUS)=      95

PEAK ONLY OUTPUTTED

     TIME        Q(CFS)

      243          14.0

VOL =  26523.4  CF
```

```
AREA/POINT DESIGNATION = H3
AREA=              .0157  SQ MI
1 HR RAIN=         2.2  INCHES
6 HR RAIN=         2.8  INCHES
TC=                14  MINUTES
FRAC IMPERV=       .29
CN (PERVIOUS)=     68
CN (IMPERVIOUS)=   95

PEAK ONLY OUTPUTTED

     TIME       Q(CFS)

      243          19.8

VOL -  37481.6  CF
```

```
AREA/POINT DESIGNATION = H3
AREA=              .0157  SQ MI
1 HR RAIN=         1.35  INCHES
6 HR RAIN=         1.85  INCHES
TC=                14  MINUTES
FRAC IMPERV=       .29
CN (PERVIOUS)=     68
CN (IMPERVIOUS)=   95

PEAK ONLY OUTPUTTED

     TIME       Q(CFS)

      243           8.4

VOL =  17992.3  CF
```

```
AREA/POINT DESIGNATION = I
AREA=              1.4E-03  SQ MI
1 HR RAIN=         2.2  INCHES
6 HR RAIN=         2.8  INCHES
TC=                3  MINUTES
FRAC IMPERV=       .6
CN (PERVIOUS)=     70
CN (IMPERVIOUS)=   95
```

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
236	3.0

VOL = 5188.84 CF

AREA/POINT DESIGNATION = J
AREA= .0152 SQ MI
1 HR RAIN= 2.2 INCHES
6 HR RAIN= 2.8 INCHES
TC= 12 MINUTES
FRAC IMPERV= .38
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
243	23.1

VOL = 43526.3 CF

AREA/POINT DESIGNATION = J
AREA= .0152 SQ MI
1 HR RAIN= 1.35 INCHES
6 HR RAIN= 1.85 INCHES
TC= 12 MINUTES
FRAC IMPERV= .38
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
243	10.6

VOL = 22081 CF

AREA/POINT DESIGNATION = K

```
AREA=                .0103  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  5  MINUTES
FRAC IMPERV=         .65
CN (PERVIOUS)=       70
CN (IMPERVIOUS)= 95


PEAK ONLY OUTPUTTED


     TIME        Q(CFS)

      233            23.3

VOL =  40147.9  CF



AREA/POINT DESIGNATION = L
AREA=                2.8E-03  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  5  MINUTES
FRAC IMPERV=         .38
CN (PERVIOUS)=       70
CN (IMPERVIOUS)= 95


PEAK ONLY OUTPUTTED


     TIME        Q(CFS)

      234            4.7

VOL =  8018.01  CF



AREA/POINT DESIGNATION = M
AREA=                2.2E-03  SQ MI
1 HR RAIN=           2.2  INCHES
6 HR RAIN=           2.8  INCHES
TC=                  5  MINUTES
FRAC IMPERV=         .38
CN (PERVIOUS)=       70
CN (IMPERVIOUS)= 95


PEAK ONLY OUTPUTTED


     TIME        Q(CFS)
```

234	3.7

VOL = 6299.87 CF

AREA/POINT DESIGNATION = A
AREA= .0384 SQ MI
1 HR RAIN= 2.2 INCHES
6 HR RAIN= 2.8 INCHES
TC= 12 MINUTES
FRAC IMPERV= .38
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
243	58.3

VOL = 109961 CF

POINT A ADDED TO MAIN FLOWS

TIME	Q(CFS)
125	0.1
130	0.2
135	0.3
140	0.3
145	0.3
150	0.3
155	0.3
160	0.4
165	0.4
170	0.4
175	0.4
180	0.5
185	0.6
190	0.7
195	0.8
200	1.6
205	3.1
210	4.2
215	6.7
220	10.6
225	13.5
230	24.5
235	43.2
240	58.3
245	54.6
250	37.4
255	23.7
260	14.8

265	9.4
270	5.9
275	4.0
280	3.5
285	3.2
290	3.1
295	3.1
300	3.1
305	2.9
310	2.6
315	2.3
320	2.3
325	2.4
330	2.6
335	2.5
340	2.3
345	2.2
350	2.0
355	1.8
360	1.7
365	1.3
370	0.7
375	0.2

HYDROGRAPH AT POINT A TIME TRANSLATED TO POINT B

COMPUTED VELOCITY = 3.00209

TIME	Q(CFS)
130	0.1
135	0.2
140	0.3
145	0.3
150	0.3
155	0.3
160	0.3
165	0.4
170	0.4
175	0.4
180	0.4
185	0.5
190	0.6
195	0.7
200	0.8
205	1.7
210	3.1
215	4.3
220	6.9
225	10.7
230	14.0
235	25.4
240	43.9
245	58.3
250	53.8
255	36.8
260	23.3
265	14.6
270	9.2

275	5.8
280	4.0
285	3.4
290	3.2
295	3.1
300	3.1
305	3.1
310	2.9
315	2.5
320	2.3
325	2.3
330	2.4
335	2.6
340	2.5
345	2.3
350	2.2
355	2.0
360	1.8
365	1.7
370	1.3
375	0.7
380	0.2

AREA/POINT DESIGNATION = B

AREA=	.0236 SQ MI
1 HR RAIN=	2.2 INCHES
6 HR RAIN=	2.8 INCHES
TC=	9 MINUTES
FRAC IMPERV=	.13
CN (PERVIOUS)=	64
CN (IMPERVIOUS)=	95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	19.4

VOL = 34404.6 CF

POINT B ADDED TO MAIN FLOWS

TIME	Q(CFS)
130	0.2
135	0.3
140	0.3
145	0.4
150	0.4
155	0.4
160	0.4
165	0.4
170	0.5

175	0.5
180	0.5
185	0.6
190	0.7
195	0.9
200	1.3
205	2.6
210	4.2
215	6.1
220	9.7
225	14.1
230	23.2
235	42.1
240	63.4
245	72.9
250	62.2
255	43.2
260	28.0
265	17.0
270	10.9
275	7.3
280	5.3
285	4.7
290	4.4
295	4.3
300	4.3
305	4.2
310	3.8
315	3.4
320	3.3
325	3.3
330	3.5
335	3.6
340	3.4
345	3.2
350	3.0
355	2.7
360	2.5
365	2.1
370	1.4
375	0.7
380	0.2

APPENDIX B

SAMPLE CALCULATIONS

Country Club Estates Subdivision

1) <u>Capacity Section A Channel</u>

Q = 14.2 cfs

n = .03

slope = .02

sideslopes = 3:1

width = 10'

From Manning $Q = \frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D = 0.4' <<2' OK

V = 3.4 fps

F = 1.02

2) <u>Capacity Section B Swale</u>

Q = 10.7

n = .035

slope = .005 min.

sideslopes = 5:1

width = 5'

From Manning $Q = \frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Country Club Estates Subdivision

Solving for Depth

D = 0.69 < 1.5 OK

V = 1.85 fps

F = 0.47

3) Capacity Section C Swale

Q max = 3.5 cfs

n = .035

slope = .005 min.

sideslopes = 5:1

width = 0

From Manning $Q = \frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D = 0.7' < 1' OK

V = 1.46

F = 0.44

4) Capacity Section D Channel

Q max = 58.3 + 72.9 = 131.2 cfs

n = .03

slope = .02 min

sideslopes = 3:1

width = 20

Country Club Estates Subdivision

From Manning $Q = \frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D = 0.94' < 3' OK

V = 6.15 fps

F = 1.19

5) Capacity 42" RCP Storm Sewer

ϕ = 42"

n = .013

slope = .005 min.

$Q = \frac{1.75^2\ 1.49\ (1.75/2)^{2/3}\ (.005)^{1/2}}{.013}$

Q = 71.3 ≈ 72.9 OK

6) Capacity Concrete Rundowns, Points D, L, M

a) Normal capacity:

Q max = 8.7 cfs

n = .015

slope = .01 min

sideslopes = 0

width = 9'

From Manning $Q = \frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

TABLE 1

HYDROLOGICAL FLOW PARAMETERS

AREA/ POINT DESIGNATION	AREA (SQ. MI.)	AREAS CONTRIBUTING	GROSS AREA (SQ.MI.)	FRACTION IMPERVIOUS	C N (PERVIOUS)	T_C (MINUTES)	Q_{10} R(1) = 1.35 R(6) = 1.85	Q_{100} R(1) = 2.2 R(6) = 2.8	REMARKS
A	.0384	A	.0384	.38	70	12	--	58.3	
B	.0236	A&B	.0620	.13	64	9	--	72.9	A combined w/B by computer
C	.0084	C	.0084	.38	70	7	6.5	14.2	Diverted to Academy Road
D	.0113	D	.0113	11	64	7	--	8.7	
E	.0420	E	.042	.46	70	10	--	78.0	150.9 cfs when combined with PointB
F	.0182	F	.0182	.08	63	14	--	10.7	
G1	.0165	G1	.0165	.38	70	7	--	27.9	
G2	.0013	G2	.0013	.13	64	3	--	1.1	
G3	.0067	G1,G2,G3 D	.0358	.29	68	10	--	50.2	
G4	.0035	G1-G4, D	.0393	.30	70	11	21.7	53.7	
H1	.0043	H1	.0043	.13	64	4	--	3.5	
H2	.0070	H1,H2	.0113	.28	68	12	--	14.0	
H3	.0044	H1-H3	.0157	.29	68	14	8.4	19.3	
I	.0014	I	.0014	.6	70	3	--	3.0	
J	.0152	J	.0152	.38	70	12	10.6	23.1	
K_1	.0017	K_1	.0080	.38	70	5	--	13.5	
K_2	.0017	K_2	.0017	.38	70	3	--	2.9	
L	.0028	L	.0028	.38	70	5	--	4.7	
M	.0022	M	.0022	.38	70	5	--	3.7	

TABLE TWO

STREET FLOW CHARACTERISTICS

POINT DESIGNATION	100 YEAR PEAK FLOW	10 YEAR PEAK FLOW	ESTIMATED STREET SLOPE	100 YEAR FLOW DEPTH	10 YEAR FLOW DEPTH	10 YEAR VEL.	10 YEAR VXD	REMARKS
G4	53.7	21.7	.040	.50	.38	5.04	1.92	OK
H3	19.8	8.4	.038	.33	.25	3.78	0.95	OK
J	23.1	10.6	0.30	.34	.26	3.66	0.95	OK
E	78.0	39.0	.022	0.55	0.43	5.04	2.77	OK

TABLE THREE

FLOW CHARACTERISTICS AT KEY INTERSECTIONS

POINT DESIG-NATION	INTER-SECTION	LOCATION	Q	STREET WIDTH	SLOPE	D_N	V_N	F	D_C	V_C	JUMP DEPTH = $\frac{-Y_1}{2} + \sqrt{\left(\frac{Y_1}{2}\right)^2 + \frac{2V_1^2 Y_1}{g}}$	POOL DEPTH $D_C + \frac{1.25 \Delta V^2}{2g}$	SPECIAL REQUIREMENTS
G3	11	UPSTREAM	50.2	35	.01	.61	4.21	1.27			0.57		8" CURB
		DOWNSTREAM	50.2	27	.04	.49	7.08	2.43	0.57	3.90		0.87	
H2	12	UPSTREAM	14	*9		.072	0.19	8.40	3.44		0.82		8" CURB
		DOWNSTREAM	14	27	.038	0.26	4.25	2.09	0.36	2.37		0.47	8" CURB
		* SECTION IS EASEMENT CHANNEL											

AREA/POINT DESIGNATION = G3
AREA= .0358 SQ MI
1 HR RAIN= 2.2 INCHES
6 HR RAIN= 2.8 INCHES
TC= 10 MINUTES
FRAC IMPERV= .29
CN (PERVIOUS)= 68
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	50.2

VOL = 85467.5 CF

AREA/POINT DESIGNATION = G4
AREA= .0393 SQ MI
1 HR RAIN= 1.35 INCHES
6 HR RAIN= 1.85 INCHES
TC= 11 MINUTES
FRAC IMPERV= .3
CN (PERVIOUS)= 68
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
243	21.7

VOL = 46127.8 CF

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
243	38.3

VOL = 66342.8 CF

AREA/POINT DESIGNATION = G4
AREA= .0393 SQ MI
1 HR RAIN= 2.2 INCHES
6 HR RAIN= 2.8 INCHES
TC= 11 MINUTES
FRAC IMPERV= .3
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
243	53.7

VOL = 100495 CF

AREA/POINT DESIGNATION = K1
AREA= 8E-03 SQ MI
1 HR RAIN= 2.2 INCHES
6 HR RAIN= 2.8 INCHES
TC= 5 MINUTES
FRAC IMPERV= .38
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
234	13.5

VOL = 22908.6 CF

```
AREA/POINT DESIGNATION = K2
AREA=            1.7E-03  SQ MI
1 HR RAIN=       2.2  INCHES
6 HR RAIN=       2.8  INCHES
TC=              3  MINUTES
FRAC IMPERV=     .38
CN (PERVIOUS)=   70
CN (IMPERVIOUS)= 95


PEAK ONLY OUTPUTTED


     TIME      Q(CFS)

      234 -        2.9

VOL =  4868.08  CF
```

COUNTRY CLUB ESTATES SUBDIVISION

DRAINAGE REPORT

ADDENDUM #1

1) Capacity Concrete Rundown, Point K_2

a) Normal Capacity:
Q max = 2.9 cfs.

n = .015
slope = .03 ft./ft.
sideslopes = 0
width = 4'

From Manning $Q = \frac{A1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D = 0.15'
V = 4.70 fps.
F = 2.11

b) Inlet Capacity

Dc = 0.25
Vc = 2.85 fps.

Entrance Depth = $0.25 + 1.25(2.85^2/64.4)$
= 0.41' OK

HYDROLOGY E21/D26 11 PLANS 2 of 2

Country Club Estates Subdivision

Solving for Depth

D = 0.25'

V = 3.81 fps

F = 1.34

b) inlet capacity

Dc = 0.31'

Vc = 3.13 fps

entrance depth = $0.31 + 1.25\ (3.13^2/64.4)$

$= 0.50 < 0.66$ OK

7) <u>Capacity Concrete Rundown, Points H2 & H3</u>

a) Normal Capacity:

Q max = 19.8

n = .015

slope = .01 min.

sideslopes = 0

width = 14'

From Manning $Q = \frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D = 0.32'

V = 4.48 fps

F = 1.41

b) inlet capacity:

Dc = 0.39

Vc = 3.59

entrance depth = $.39 + 1.25\ (3.59^2/64.4)$

= 0.64 < 0.66 OK

8) <u>Capacity Concrete Rundown, Point K</u>

a) Normal capacity:

Q = 23.3

n = .015

slope = .03

sideslopes = 0

width = 19'

From Manning $Q = \frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D = 0.21'

V = 5.89 fps

F = 2.28

b) inlet capacity:

Dc = 0.36'

Vc = 3.42 fps

entrance depth = $0.36 + 1.25\ (3.42^2/64.4)$

= 0.59' < 0.66' OK

Country Club Estates Subdivision

9) <u>Erosion Control Pond - Area C</u>

Q_{10} = 6.5 cfs

Pond cross sectional area = $1.5(20) + 3(1.5)^2$

= 36.75 $ft.^2$

Velocity = 6.5/36.75 = 0.18 fps <<1

OK

Addendum to Drainage Report

for

Country Club Estates Subdivision, dated April, 1984

To clarify the intent of the report regarding offsite flow management, the following should be added to item 1 on page eight; "As an interim measure, until surrounding lands are developed, this RCP storm sewer shall be constructed only for that distance necessary to daylight the pipe into a temporary earthen channel as referenced below and shown on Plate 2".

Kent M. Whitman, P.E.

4/26/84
DATE

E21-D26

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COUNTRY CLUB ESTATES SUBDIVISION

1) Capacity 0.5% Channel Line "B"

Q=27.9 cfs
n=.03
Slope=.005
Side Slope=3:1
Width=10'

From Manning $Q=\frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D=0.83'
V=2.70 Ft/Sec.
F=0.57

2) Capacity 7.0% Channel Line "B"

Q=27.9 cfs
n=.03
Slope=.07
Side Slope=3:1
Width=10'

From Manning $Q=\frac{A\ 1.49\ R^{2/3}\ S^{1/2}}{n}$

Solving for Depth

D=0.39'
V=6.46 Ft/Sec
F=1.92

RECEIVED
JUL 18 1984
HYDROLOGY SECTION

21026

ACADEMY / TRAMWAY / EUBANK

SECTOR DEVELOPMENT PLAN

MASTER STORM WATER CONVEYANCE STUDY

PREPARED FOR:

AFFILIATED MORTGAGE & DEVELOPMENT COMPANY

BY:

COMMUNITY SCIENCES CORPORATION

JULY, 1978

KENT M. WHITMAN, P.E.

RECEIVED
APR 11 1984
HYDROLOGY SECTION

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APPENDIX C - Cost Comparison - Earth/Concrete Channels on Bear Tributary Arroyo

APPENDIX D - Cost Estimates for Basin Improvements

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APR 11 1984
HYDROLOGY SECTION

A. PURPOSE AND SCOPE

Under the leadership of Affiliated Mortgage and Development Company, several Albuquerque Developers have organized their individual land holdings into one large contiguous land area for development plan review by the City of Albuquerque under the Sector Development Plan provisions of the Comprehensive Zoning Ordinance. The purpose of this study is to evaluate the various drainage facilities which will be necessary in order to convey storm flows to the major arroyo systems at locations where street conveyance becomes impractical. This study does not address drainage patterns and facilities which are considered internal to individual platting areas. Where preliminary platting schemes were available, street patterns were taken into account to the extent necessary for basin definition and street capacity evaluation.

B. STUDY AREA

The boundaries of this study are roughly as follows:

1) Eubank Boulevard and Academy Place Subdivision on the West.

2) The northerly ridge line of the Bear Canyon Arroyo on the South.

3) The southerly ridge line of the Pino Arroyo on the North.

4) Tramway Boulevard on the East.

A concurrent study has been conducted by Herkenhoff and Associates for the Pino Basin itself and the reader is referred to that report for the sake of continuity and thorough coverage of the subject matter.

The land within the study area slopes from east to west at an average rate of 3 1/2%. Soils typically consist of fine, granular, decomposed granite and fall into the SP, SM, or SC classifications on the Unified System.

C. DESIGN CRITERIA

1) Engineering Parameters:

In accordance with AMAFCA and City of Albuquerque requirements all hydrological analysis is based on 100

year frequency accumulated rainfall figures as presented in NOAA Atlas #2. Volume calculations utilize the 6 hour rainfall figure of 2.8". Rate calculations are based on the 1 hour rainfall figure since this results in higher peak rates of runoff than the 6 hour figure in the hydrograph procedure used.

Runoff coefficients were estimated by calculation of composite values based on the typical plot plan shown in Plate 1. For areas where rear yard ponding will be employed a $C_{COMP.}$ value of 0.8 was calculated for the portion of the lot draining to the streets. Rear yard ponding was assumed applicable to all areas except D & F. (Proposed treatment for Areas D & F will be discussed later in the Report) The $C_{COMP.}$ value of 0.8 was also assumed applicable for all commercial and high density development above 6 du/acre. For those basins in standard R-1 development where it is proposed to allow uncontrolled runoff to street systems and other conveyances a $C_{COMP.}$ of 0.67 was calculated for the entire lot area as shown in Plate 1.

In order to comply with the City Engineer's requirements regarding stability of earthen channels the procedure for determination of maximum allowable velocity as outlined in SCS Technical Release #25 was employed. This procedure relates the D_{75} and Plasticity Index values of the channel soils to the maximum allowable average channel velocity. Consultation with Albuquerque Testing Laboratories resulted in acquisition of the following data from their files regarding D_{75} for soils testing in various NE heights locations:

Location	D_{75} Value
Sta 149+00 Juan Tabo Boulevard (Test #1)	1.75 mm
Sta 149+00 Juan Tabo Boulevard (Test #2)	1.10 mm
Lomas Boulevard East of Juan Tabo Boulevard	1.20 mm
Subgrade of Juan Tabo Boulevard	2.40 mm
Wyoming Boulevard 500' South of Candelaria	0.80 mm
Los Angeles Boulevard at North Diversion Channel	1.30 mm
Sample Average	1.43 mm

In addition A.T.L. advised that plasticity indexes for northeast Albuquerque soils average 12-15 with a value of 20 being safe as an assumed maximum. Using these values in the SCS procedure yields a maximum allowable velocity in earthen channels of 3.3 fps for the study area with maximum allowable channel sideslopes of 5:1.

Hydraulic stability becomes a consideration in concrete lined channels running in an east-west direction. Since bottom widths must be kept to a minimum of 10' for mainten-

ance purposes and since flow depths are relatively low at the grades available, the depth-to-bottom width ratios in most east-west concrete channels is much less than 1. This coupled with high Froude numbers leads to inherent stability problems due to the tendency to form surface waves and the sensitivity to obstructions and transitions. The approach taken to this problem in this study is to provide a minimum freeboard in concrete lining of 0.2 times the flow depth on all concrete channels. In addition, those east-west channels with flows greater than 200 cfs and having flows within the unstable range shall have additional freeboard provided in earthen embankments such that the conjugate depth of the supercritical flow mode would be contained within the overall concrete and earth section. An illustration of this concept in cross section is presented on Plate 3. An inherently stable channel on the steep gradients occurring from east to west within the study area would be much more costly to construct than those using the approach outlined above. Hydraulic stability in channels carrying less than 200 cfs is not considered significant.

All channels designed to flow supercritically must have turns designed in spiral curves with the appropriate superelevation throughout the turn.

Energy Dissipators have been recommended for all high velocity conveyance discharge points. An illustration of the design being recommended is shown on Plate 3. This design is presented as a somewhat less effective but much more economical construction than the standard concrete impact basins in common use for very high volume, high velocity dissipators. The design, if employed, should undoubtedly be laboratory modeled for flows greater than 1000 cfs. Since proposed discharge points on the Pino and Bear Basins are safely removed from residential areas an allowable discharge velocity of 5 fps rather than 3.3 fps was selected for these locations. The slight difference in velocities results in a more than 50% savings in the cost of the smaller dissipator over the larger one.

An allowable discharge velocity of 7 fps was selected for the Bear Tributary Dissipator at Eubank Boulevard.

All computations are based on the construction of a planned diversion facility immediately east of Tramway Boulevard. This diversion will protect basins C, B, and G from all offsite flows occurring east of Tramway Boulevard by diverting them into the Bear Canyon Arroyo.

2) Flood Control Regulations:

The drainage plan presented in this report has been developed assuming compliance with the 1972 AMAFCA Resolution in regard to rate and volume of runoff leaving the site. That Resolution has been interpreted to say that the rate and volume of runoff allowed to leave the site after development shall be no greater than the rate and volume running off prior to development.

These regulations were taken into account in two ways:

a) Basin areas were adjusted in hydrological calculations to compensate for portions of the land area draining into ponds.
b) Required ponding volumes were calculated for those areas where central ponding is being anticipated or considered.

D. COMPUTATIONAL PROCEDURES

1) Hydrology:

Based on anticipated (or existing) land uses runoff ratios were assigned to each watershed. These ratios are adjustment factors to account for the use of onsite ponding and represent the portion of overall land area expected to drain to streets and conveyances. It was decided that this approach would present a more realistic representation of what will actually occur physically after development than would be attained if ponding effects were absorbed in the runoff coefficient. Based on the plot plan shown in Plate 1, areas employing rear yard ponding have been assigned runoff ratios of 0.52. Examination of grading plans for Academy Place Unit 5A resulted in assignment of 0.75 runoff ratio to that area. Composite runoff ratios were calculated for areas having multiple land uses and for combinations of sub-basins. Composite C factors were also calculated for these areas.

For the purpose of developing runoff hydrographs the Bureau of Reclamation Triangular Hydrograph Method was used. This method, available on computer at Herkenhoff and Associates, simulates the runoff characteristics of a watershed by development of a series of short duration triangular hydrographs at short intervals relative to storm duration - finally summing the individual hydrographs into one "curve" for the entire duration of the storm. The equivalent to the runoff coefficient in the BoR procedure is a parameter called the Curve Number (Cn). Based of percents of rainfall actually running off for a given Cn value an equation was developed to convert $C_{COMPOSITE}$ into Cn. This equation is written:

$$Cn = 87 + 29.68\ (C-0.5)$$

Times of concentration were estimated based on the following travel velocities for street and channel flow:

1) Street @ 0.5% - 3.4 fps
2) Street @ 1.0% - 4.8 fps
3) Street @ 2.0% - 6.8 fps
4) Street @ 3.0% - 8.3 fps
5) Street @ 4.0% - 9.5 fps
6) Street @ 6.0% - 12.1 fps
7) East-West Channel - 26.0 fps
8) North-South Channel - 10.0 fps

Examination of the hydraulics of the flow rates generated with this input showed a reasonable correlation to the estimated travel times and deviations are not expected to have any significant effect upon the analysis as presented.

The hydrographs developed by the computer are shown in Appendix A and Table 1 gives a summary of input data and the peak flow rates derived.

2) Hydraulics:

Street, pipe, and channel capacities were calculated based on the Manning equation for uniform flow. Hydraulic jump conjugate depths were calculated by means of a tabular solution for trapezoidal sections as presented in the "Handbook of Hydraulics" by King and Brater. Drop inlets were sized by means of the orifice equation with a net/gross grate area ratio of 80% as provided by Irving bridge deck type grates. Dissipators were sized by means of extrapolations from the broad crested weir equations and those relationships are shown in the detail illustrated on Plate 3.

E. COST COMPARISONS

An economic evaluation was made for two alternate improvement plans for each of two separate comparative circumstances with regards to conveyance of the Bear Canyon Tributary Arroyo. The first, itemized in Appendix B, presents a cost comparison between those improvements required both with and without a proposed diversion which would transfer flows occurring in the Bear Tributary just east of Tramway Boulevard into the newly constructed Pino Dam. As the figures indicate, the plan employing the diversion will cost nearly one half of the required improvement costs without it.

Therefore, the diversion plan is adopted as a "given" for the remainder of this report, and all subsequent analysis of the Bear Canyon Tributary is based on the implementation of the plan.

The second comparison is outlined in Appendix C. It evaluates the cost effectiveness of an improved earth/ drop structure conveyance versus a conventional concrete lined channel. This analysis indicates the earth channel to be roughly twice as costly as the hard lined alternate. This analysis is based on the velocity and geometric restrictions discussed under item C1 for earth sections, and would undoubtedly need to be re-evaluated in the event these restrictions are relaxed. The analysis is judged to be relatively applicable to all basins under study and consequently earth sections are not considered cost effective throughout the remainder of the report.

Elements included in cost comparisons are only those necessary for the comparison. Structures such as bridge crossings required under each comparison plan are not included in the cost figures. Land costs are also included only where needed for comparison. No figures are shown for channel fencing since it is assumed that normal yard block wall construction will fill this need by in large.

F. DRAINAGE NETWORKS

1) General:

Plate 2 outlines the drainage basins under study. Basin boundaries were established through a dual consideration of both topography and anticipated conveyance optimization. Each overall basin has been given a letter designation which is followed by a number designation indicating appropriate sub-basin divisions where applicable. The basin/sub-basin designations are also placed on the map at flow confluence locations. Improvements keyed to a given basin/sub-basin refer to those improvements beyond normal street construction required to manage the flows through and/or out of the basin in a controllable manner.

The requirement on the part of the City to maintain one lane dry in each direction on all collectors and arterials during the 100 year storm is virtually impossible to meet. Assuming a 2% crown this would allow a flow depth of 0.25' on a 4 lane facility with a resultant capacity of as little as 6 cfs. The standard both recommended and widely used in the past permits flows to attain a depth of 0.2' above top

of curb. This standard is recommended for adoption as applicable to the study area and the hydraulic analysis of the report are based on it. Table 2 summarizes the flow capacitites of various street sections. Spain Road is assumed to be a 50' arterial section @ 3% while Chelwood is assumed to be a 44' section @ 0.5%. Academy Road will be an arterial section at no less than 1% at peak flow points.

Cost estimates for storm sewer improvements are based on use of riser type manholes wherever possible. A sketch of this type of construction is shown on Plate 3. Plate 3 also illustrates the assumed geometry for special design inlets which are considered for several locations as discussed below.

Table 3 summarizes the improvements evaluated for basins under study while Appendix D itemizes cost estimates for these improvements. In some cases alternate plans were considered for single basin/sub-basin areas. It is suggested that the reader refer to this material throught the remainder of the report.

2) Individual Networks:

a) It is assumed that street patterns within sub-basin A1 will carry all flows to the western boundary. At that point two alternatives are considered. One would incorporate a channel running along the western boundary with culverts beneath Spain Road. The other would employ a north-south street to convey flows to Spain Road with a special design drop inlet and culverts to carry the runoff beneath Spain Road. The second alternative is more cost effective and is recommended.

Flows from sub-basin A1 join those from A2 South of Spain Road. Street patterns currently proposed for sub-basin A2 will convey flows to a planned 70' wide drainage easement extending along the west boundary and into the Bear Canyon Arroyo. A concrete channel and dissipator are recommended for this easement. In addition a cost analysis of a pipe diversion to the Bear Canyon Arroyo for basin B proved to be uneconomical. It is therefore recommended that flows from Basin B be allowed to flow down Spain Road to point A1 where a pair of 2'x40' special design drop inlets will collect the flows, divert them into a reinforced concrete junction box, and discharge them into the channel recommended for sub-basin A2. Plate 4 illustrates this scheme in plan view.

b) Basin B boundaries appear unorthodox at first glance. This is due to the fact that a preliminary plat has already been filed establishing proposed street patterns for sub-basins B2 as well as C1. The sub-basin boundaries reflect these proposed patterns. Areas and runoff coefficients for both B2 and C1 are based on a Drainage Management Plan for Peppertree Subdivision, prepared for Dale Bellamah Corporation by Community Sciences Corporation submitted in November of 1977 and revised in June of 1978. Sub-basin B1 must drain to Spain Road. B2 will drain through internal street patterns to Chelwood Boulevard which in turn will drain to Spain Road. As explained under the discussion for Basin A above, a pipe diversion scheme considered for Basin B proved to be uneconomical. Flows reaching Spain will ultimately be intercepted by the sub-basin A2 channel and carried to the Bear Canyon Arroyo.

Since lands south of Spain are currently being platted, street patterns have already been established for this area. A preliminary investigation revealed that these streets will be taxed to near capacity conveying internal flows. For this reason discharge of basin B flows into the street systems of basins A & G was discounted as infeasible.

c) Basin C1 is part of a preliminary platted area as explained above. It is recommended that drop inlets be provided at the flow confluence point to intercept the 10 year storm runoff and carry it beneath Chelwood Boulevard into a proposed channel. The 100 year flows above the 10 year rate would be allowed to flow across Chelwood, join flows from sub-basin C2 and spill into that same channel. Said channel would continue to the west, increase in capacity at point C3, and finally terminate at a dissipator at point C7. Flows from the dissipator will cross Eubank Boulevard and enter the Park/Drainage Way already provided immediately west of the pavement.

Two alternatives were considered for sub-basin C5. The first is a special design drop inlet and storm sewer combination. The second is a road embankment spillway and channel combination. Both would empty flows into the aforementioned channel between points C7 & C2. The pipe/inlet alternate is slightly less costly than the spillway/channel alternate and is therefore recommended. Some of the ponding requirements for sub-basin C5 could be met by diversion of

flows in Academy Boulevard into a golf course retention pond located on fairway 17. Should this approach be elected once a development plan for the sub-basin has been prepared, it should have little effect upon the analysis presented herein.

d&e) All flows from basins D & E will be directed into fairway retention ponds along fairways 16 & 18. These ponds will provide 100% retention for the 100 year runoff from these basins.

f) Sub-basin F1 will drain onto Eubank Boulevard and central ponding is recommended to provide retention for the difference between developed and natural runoff volumes. A portion of sub-basin F2 will be diverted northward directly into the Pino Basin by means of regrading, parallel street patterns, and interceptor swales. The area which is anticipated to be included under this catagory is shaded on Plate 2.

It is desirable to allow the remaining flows from sub-basin F2 to drain uncontrolled to Academy Boulevard since space for onsite yard ponding will be scarce in this high density development area. It is proposed to compensate for the lack of retention in sub-basin F2 by providing a corresponding retention volume in the Pino Basin within golf course fairway areas. This compensating volume has been included in the volume requirements listed in the aforementioned Herkenhoff Report.

Flows from sub-basins F1 & F2 converge at F3 where two alternate conveyance plans have been considered. The first would employ a special design inlet and pipe system with dissipator to convey the flows northward into the Pino Arroyo. The second plan would incorporate special design curbs, 1.0' high, along Eubank Boulevard north of Academy Road. With these curbs the street section will have the capacity to carry the total flow rate to a spillway and dissipator at the crossing point of the Pino Arroyo. Since this section of Eubank Boulevard will have no accesses connecting into it, and since the economics are much more favorable for alternate #2 than for alternate #1, alternate #2 is recommended.

g) Flows from basin G will be collected by a street pattern currently under design and conveyed directly into the Bear Canyon Arroyo.

One approach which could significantly increase both the efficiency and effectiveness of on-site ponding is central retention ponding on a subdivision by subdivision basis. In employing this approach, the developer constructs a central retention basin into which all runoff from his development is directed. The facility is usually equipped with a controlled release outlet which can be designed to simulate various frequency storm hydrographs rather than the 100 year storm only. The pond and improvements are dedicated to the City as public improvements just as street, water, and sewer improvements are dedicated. This approach has the added advantage of not being subject to the whims of individual property owners as are lot ponds. This has been used successfully in other municipalities for drainage control.

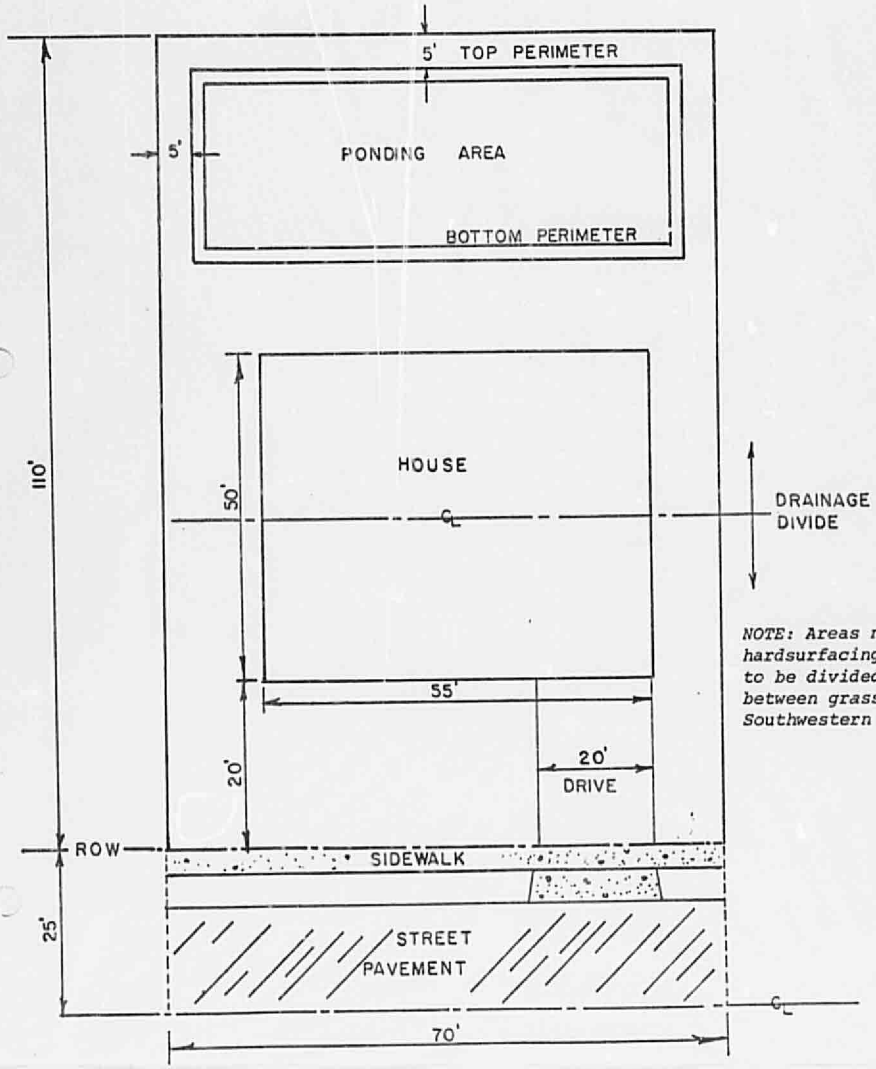
TABLE 2

STREET CAPACITIES AT 0.2' DEPTH ABOVE CURB

slope / pavement width	0.5%	1%	2%	3%
32	Q = 121 V = 5.4 Ve = .45	Q = 171 V = 7.6 Ve = .89	Q = 242 V = 10.7 Ve = 1.79	Q = 297 V = 13.2 Ve = 2.69
40	Q = 137 V = 5.2 Ve = .42	Q = 194 V = 7.3 Ve = .83	Q = 274 V = 10.4 Ve = 1.67	Q = 336 V = 12.0 Ve = 2.50
44	Q = 136 V = 5.0 Ve = .38	Q = 192 V = 7.0 Ve = .77	Q = 271 V = 10.0 Ve = 1.54	Q = 332 V = 12.2 Ve = 2.31
50 (arterial with median)	Q = 155 V = 5.0 Ve = .39	Q = 219 V = 7.1 Ve = .77	Q = 309 V = 10.0 Ve = 1.55	Q = 379 V = 12.2 Ve = 2.32
		NOTE: Q = Flow in cfs V = Velocity in fps Ve = Velocity head in feet		

PLATE 1

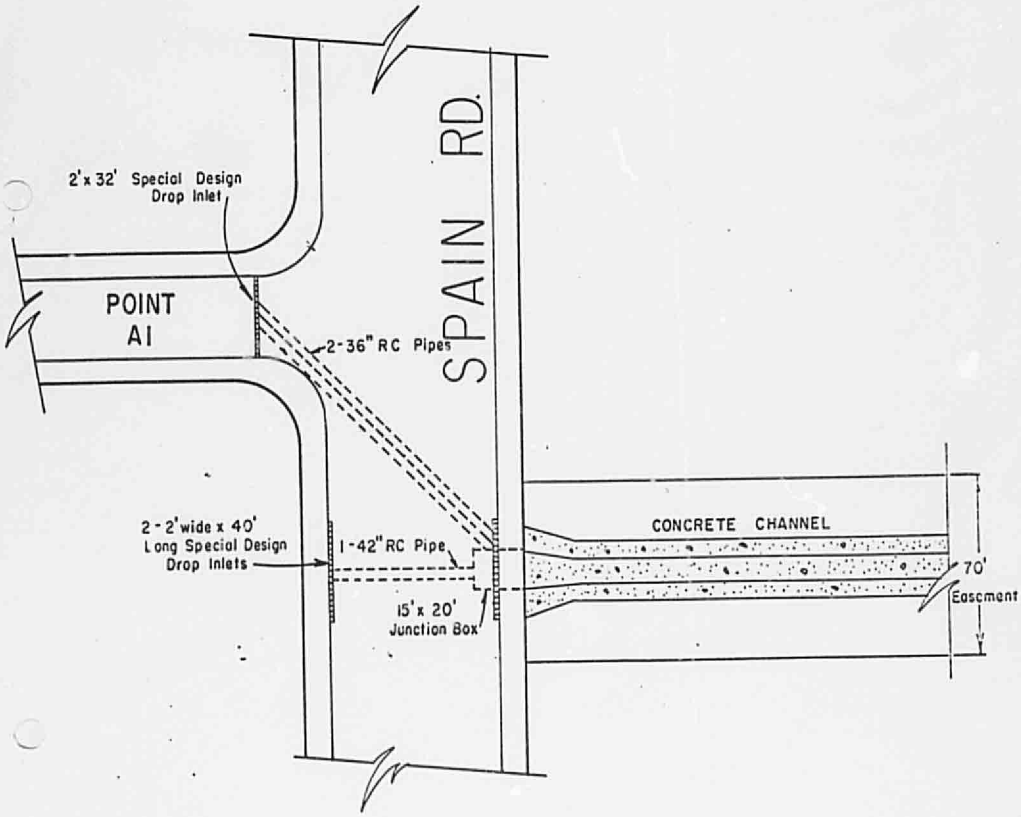
TYPICAL PLOT PLAN



NOTE: Areas not in hardsurfacing assumed to be divided equally between grass and Southwestern Landscaping

PLATE 4

DETAIL OF RECOMMENDED IMPROVEMENTS- SPAIN ROAD



APPENDIX "A"

HYDROGRAPH PRINTOUTS

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE A-1

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.04(SQ-MI)
CN FACTOR 96.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 96.00
TOTAL DRAINAGE AREA ..... 0.04(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.10(HRS)
TIME TO PEAK ..... 0.19(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.44	13.929	0.144
0.69	48.283	0.787
0.94	119.536	2.520
1.19	49.762	4.269
1.44	5.460	4.840
1.69	0.000	4.896

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: A-2

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.06(SQ-MI)
CN FACTOR 96.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 96.00
TOTAL DRAINAGE AREA ..... 0.06(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.13(HRS)
TIME TO PEAK ..... 0.20(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.45	18.983	0.196
0.70	67.302	1.087
0.95	167.826	3.516
1.20	79.661	6.073
1.45	10.496	7.005
1.70	0.000	7.113

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: B-1

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.03(SQ-MI)
CN FACTOR 96.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 96.00
TOTAL DRAINAGE AREA ..... 0.03(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.20(HRS)
TIME TO PEAK ..... 0.25(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.50	6.448	0.067
0.75	23.626	0.377
1.00	59.510	1.236
1.25	33.196	2.194
1.50	5.151	2.590
1.75	0.000	2.643

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: B-2

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.05(SQ-MI)
CN FACTOR 92.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 92.00
TOTAL DRAINAGE AREA ..... 0.05(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.15(HRS)
TIME TO PEAK ..... 0.22(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.47	4.596	0.047
0.72	33.350	0.439
0.97	106.721	1.886
1.22	56.044	3.568
1.47	8.072	4.230
1.72	0.000	4.314

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: B-3

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.05(SQ-MI)
CN FACTOR 92.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 92.00
TOTAL DRAINAGE AREA ..... 0.05(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.20(HRS)
TIME TO PEAK ..... 0.25(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.50	4.382	0.045
0.75	32.178	0.423
1.00	104.377	1.834
1.25	61.338	3.546
1.50	9.860	4.281
1.75	0.000	4.383

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: B-4

1 HR POINT RAINFALL	2.30(IN)
DRAINAGE AREA	0.08(SQ-MI)
CN FACTOR	94.00
WEIGHTED RAINFALL	2.30
WEIGHTED CN	94.00
TOTAL DRAINAGE AREA	0.08(SQ-MI)

** PASS 1 **

TIME OF CONCENTRATION	0.20(HRS)
TIME TO PEAK	0.25(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.50	11.569	0.120
0.75	59.013	0.849
1.00	168.872	3.203
1.25	96.655	5.946
1.50	15.254	7.102
1.75	0.000	7.260

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS

SECTOR MASTER CONVEYANCE: C-1

1 HR POINT RAINFALL	2.30(IN)
DRAINAGE AREA	0.06(SQ-MI)
CN FACTOR	91.00
WEIGHTED RAINFALL	2.30
WEIGHTED CN	91.00
TOTAL DRAINAGE AREA	0.06(SQ-MI)

** PASS 1 **

TIME OF CONCENTRATION	0.12(HRS)
TIME TO PEAK	0.20(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.45	4.632	0.048
0.70	41.244	0.522
0.95	138.767	2.381
1.20	66.199	4.499
1.45	8.400	5.269
1.70	0.000	5.356

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

MASTER CONVEYANCE C-2

1 HR POINT RAINFALL	2.30(IN)
DRAINAGE AREA	0.03(SQ-MI)
CN FACTOR	96.00
WEIGHTED RAINFALL	2.30
WEIGHTED CN	96.00
TOTAL DRAINAGE AREA	0.03(SQ-MI)

** PASS 1 **

TIME OF CONCENTRATION	0.15(HRS)
TIME TO PEAK	0.22(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.47	8.259	0.085
0.72	29.555	0.476
0.97	73.911	1.545
1.22	36.915	2.690
1.47	5.152	3.124
1.72	0.000	3.178

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: C-3

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.14(SQ-MI)
CN FACTOR 94.00
WEIGHTED RAINFALL 2.29
WEIGHTED CN 94.00
TOTAL DRAINAGE AREA ..... 0.14(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.18(HRS)
TIME TO PEAK ..... 0.23(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.48	22.699	0.234
0.73	115.318	1.660
0.98	329.020	6.251
1.23	182.258	11.532
1.48	27.935	13.704
1.73	0.000	13.992

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: C-5

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.07(SQ-MI)
CN FACTOR 96.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 96.00
TOTAL DRAINAGE AREA ..... 0.07(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.28(HRS)
TIME TO PEAK ..... 0.29(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.29	2.068	0.021
0.54	21.766	0.268
0.79	72.831	1.245
1.04	147.344	3.519
1.29	88.542	5.956
1.54	14.906	7.025
1.79	0.000	7.179

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: C-7

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.34(SQ-MI)
CN FACTOR 95.00
WEIGHTED RAINFALL 2.29
WEIGHTED CN 95.00
TOTAL DRAINAGE AREA ..... 0.34(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.31(HRS)
TIME TO PEAK ..... 0.31(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.31	10.090	0.104
0.56	92.057	1.159
0.81	335.243	5.574
1.06	664.002	15.896
1.31	418.788	27.082
1.56	89.327	32.331
1.81	4.649	33.302
2.06	0.000	33.350

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: D

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.06(SQ-MI)
CN FACTOR 92.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 92.00
TOTAL DRAINAGE AREA ..... 0.06(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.10(HRS)
TIME TO PEAK ..... 0.19(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.44	6.908	0.071
0.69	49.371	0.653
0.94	155.074	2.765
1.19	67.814	5.067
1.44	7.627	5.847
1.69	0.000	5.926

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: E

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.01(SQ-MI)
CN FACTOR 92.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 92.00
TOTAL DRAINAGE AREA ..... 0.01(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.04(HRS)
TIME TO PEAK ..... 0.15(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.40	1.169	0.012
0.65	8.118	0.108
0.90	24.638	0.446
1.15	6.749	0.771
1.40	0.000	0.840

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: F-1

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.01(SQ-MI)
CN FACTOR 96.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 96.00
TOTAL DRAINAGE AREA ..... 0.01(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.04(HRS)
TIME TO PEAK ..... 0.15(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.40	5.051	0.052
0.65	16.556	0.275
0.90	40.227	0.862
1.15	10.505	1.386
1.40	0.034	1.495
1.65	0.000	1.495

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

SECTOR MASTER CONVEYANCE: F-2

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.08(SQ-MI)
CN FACTOR 96.00
WEIGHTED RAINFALL 2.30
WEIGHTED CN 96.00
TOTAL DRAINAGE AREA .... 0.08(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.19(HRS)
TIME TO PEAK ..... 0.24(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.49	20.586	0.213
0.74	75.150	1.202
0.99	189.095	3.931
1.24	103.551	6.955
1.49	15.811	8.188
1.74	0.000	8.351

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS

SECTOR MASTER CONVEYANCE: F-3

1 HR POINT RAINFALL	2.30(IN)
DRAINAGE AREA	0.09(SQ-MI)
CN FACTOR	96.00
WEIGHTED RAINFALL	2.30
WEIGHTED CN	96.00
TOTAL DRAINAGE AREA	0.09(SQ-MI)

** PASS 1 **

TIME OF CONCENTRATION	0.19(HRS)
TIME TO PEAK	0.24(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.49	23.742	0.245
0.74	86.686	1.386
0.99	218.134	4.535
1.24	119.455	8.023
1.49	18.239	9.445
1.74	0.000	9.633

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

MASTER CONVEYANCE A-2 REVISED

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 0.14(SQ-MI)
CN FACTOR 95.00
WEIGHTED RAINFALL 2.29
WEIGHTED CN 95.00
TOTAL DRAINAGE AREA ..... 0.14(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.28(HRS)
TIME TO PEAK ..... 0.29(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.29	3.321	0.034
0.54	35.685	0.437
0.79	133.505	2.185
1.04	230.375	6.461
1.29	171.265	11.126
1.54	29.200	13.197
1.79	0.000	13.499

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS

MASTER CONVEYANCE C-O, WO DIVERSION

1 HR POINT RAINFALL	2.30(IN)
DRAINAGE AREA	0.66(SQ-MI)
CN FACTOR	96.00
WEIGHTED RAINFALL	2.27
WEIGHTED CN	96.00
TOTAL DRAINAGE AREA	0.66(SQ-MI)

** PASS 1 **

TIME OF CONCENTRATION	0.33(HRS)
TIME TO PEAK	0.32(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL. (ACRE-FT)
0.32	28.571	0.293
0.57	220.732	2.871
0.82	714.757	12.535
1.07	1308.444	33.436
1.32	838.061	55.610
1.57	215.048	66.489
1.82	19.176	68.909
2.07	0.000	69.107

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS

MASTER CONVEYANCE C-3 WO DIVERSION

1 HR POINT RAINFALL	2.30(IN)
DRAINAGE AREA	0.81(SQ-MI)
CN FACTOR	96.00
WEIGHTED RAINFALL	2.27
WEIGHTED CN	96.00
TOTAL DRAINAGE AREA	0.81(SQ-MI)

** PASS 1 **

TIME OF CONCENTRATION	0.51(HRS)
TIME TO PEAK	0.43(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.43	43.202	0.498
0.68	274.190	3.828
0.93	842.810	15.368
1.18	1307.759	37.584
1.43	958.280	60.994
1.68	438.243	75.421
1.93	72.943	80.702
2.18	0.000	81.455

'SMALL DAM' UNIT HYDROGRAPH ANALYSIS PAGE 1

MASTER CONVEYANCE C-7 WO DIVERSION

1 HR POINT RAINFALL ..... 2.30(IN)
DRAINAGE AREA ..... 1.00(SQ-MI)
CN FACTOR 96.00
WEIGHTED RAINFALL 2.26
WEIGHTED CN 96.00
TOTAL DRAINAGE AREA ..... 1.00(SQ-MI)

** PASS 1 **
TIME OF CONCENTRATION ..... 0.64(HRS)
TIME TO PEAK ..... 0.51(HRS)

COMPOSITE HYDROGRAPH

TIME (HRS)	FLOW (CFS)	ACCUM VOL (ACRE-FT)
0.26	2.118	0.022
0.51	67.963	0.746
0.76	338.925	4.949
1.01	978.542	18.559
1.26	1424.780	43.387
1.51	1110.955	69.583
1.76	621.851	87.484
2.01	216.896	96.148
2.26	29.433	98.693
2.51	0.000	98.997

APPENDIX "B"

COST COMPARISON
BETWEEN BASIN C IMPROVEMENTS
WITH AND WITHOUT
BEAR TRIBUTARY DIVERSION

A. Improvement Cost without Diversion:

100 cy structural concrete @ $280.00	$28,000.00
125 cy excavation and backfill @ $9.00	1,125.00
182 LF 36" Asho Bridge Beam @ $33.00	6,006.00
232,915 cy excavation and grading @ $3.00	698,745.00
220,610 SF 6" concrete channel lining @ $2.50	551,525.00
22,432 SF 4" concrete channel lining @ $2.00	44,864.00
800 cy wire enclosed rip rap @ $70.00	56,000.00
21,316 SF filter blanket @ $0.15	3,197.00
Subtotal Improvement Cost	1,389,462.00
10% Contingency	138,946.00
10% Engineering	152,841.00
Total Improvement Cost	1,681,249.00
Land Value (100'x 8600' and 20'x1550' easements @ $20,000.00/acre)	409,090.00
TOTAL ESTIMATED COST	$2,090,339.00

B. Improvement Cost with Diversion:

Total Estimated Cost of Improvements West of Tramway (from Appendix C)	$609,598.00
Construction Cost of Diversion (from Bovay Engineers)	30,000.00
Land Cost for Diversion (8 acres @ $15,000.00)	120,000.00
TOTAL ESTIMATED COST	$759,598.00

APPENDIX "C"

COST COMPARISON BETWEEN
EARTH AND CONCRETE CHANNELS
ON BEAR TRIBUTARY ARROYO
BETWEEN POINTS C1 AND C7

A. Cost Earth Channel:

77,333 cy earth excavations and grading @ $3.00	$231,999.00
50 Concrete/Gabion Drop structures @ $10,000.00	500,000.00
Subtotal Improvement Costs	$731,999.00
10% Contingency	73,200.00
10% Engineering	80,520.00
Total Improvement Cost	885,719.00
Land Cost (110'x5800' easement @ $20,000.00/acre)	292,929.00
TOTAL ESTIMATED COST	$1,178,648.00

B. Cost Concrete Channel:

Total Improvement Cost (from Appendix A-Items C3 & C7)	$471,168.00
Land Cost (60'x2700' and 45'x3100' easements @ $20,000.00/acre)	138,430.00
TOTAL ESTIMATED COST	$609,598.00

APPENDIX "D"

COST ESTIMATES FOR BASIN IMPROVEMENTS

BASIN A1

Alternate #1 - Concrete Channel with Culverts

20,050 SF 4" thick concrete channel lining @ $2.00	$40,100.00
1,300 cy earth excavation and grading @ $6.00	7,800.00
200 LF 36" RCP @ $36.00	7,200.00
5.2 cy structural concrete headwalls @ $280.00	1,456.00
Subtotal Improvement Cost	$56,556.00
10% Contingency	5,656.00
10% Engineering	6,221.00
Total Improvement Cost	$68,433.00
Estimated Land Value (20'x1200' easement @ $20,000.00/acre)	11,019.00
TOTAL ESTIMATED COST	$79,452.00

Alternate #2 - Street Flow with Drop Inlet

10 cy structural concrete @ $280.00	$ 2,800.00
18 cy excavation and backfill @ $9.00	162.00
64 SF of steel frame and grating @ $15.00	960.00
280 LF 36" RCP @ $36.00	10,080.00
Subtotal Improvement Cost	$14,002.00
10% Contingency	1,400.00
10% Engineering	1,540.00
TOTAL ESTIMATED COST	$16,942.00

BASIN A2

Concrete Channel with Dissipator

18,944 SF 4" thick concrete channel lining @ $2.00	$37,888.00
6,500 cy mass earth cut @ $1.50	9,750.00
1,600 cy earth excavation and grading @ $6.00	9,600.00
100 cy wire enclosed rip rap @ $70.00	7,000.00
2,600 SF filter blanket @ $0.15	390.00
Subtotal Improvement Cost	$64,628.00
10% Contingency	6,463.00
10% Engineering	7,109.00
TOTAL ESTIMATED COST	$78,200.00

BASINS B1, B3, and B4

Alternate #1 - Drop Inlets with Pipe

8 cy structural concrete @ $280.00	$ 2,240.00
14 cy excavation and backfill @ $9.00	126.00
40 SF of steel frame and grating @ $15.00	600.00
108 SY concrete pavement @ $10.00 (above asphalt cost)	1,080.00
1 - type A inlet	1,300.00
1 - type C inlet	1,100.00
65 LF 27" RCP @ $28.00	1,820.00
100 LF 36" RCP @ $36.00	3,600.00
1,400 LF 54" RCP @ $66.00	92,400.00
1 - 8" Ø junction M.h.	2,000.00
3 - 36" Ø riser M.h.s. @ $800.00	2,400.00
100 cy wire enclosed rip rap @ $70.00	7,000.00
2,600 SF filter blanket @ $0.15	390.00
Subtotal Improvement Cost	$116,056.00
10% Contingency	11,605.00
10% Engineering	12,766.00
TOTAL ESTIMATED COST	$140,427.00

BASINS B1, B3, and B4

Alternate #2 - Flow Down Spain with Drop Inlets into A1 - A2 Channel

Note: The following are additional costs above those stated for improvements outlined for reach A2

50 CY structural concrete @ $280.00	$14,000.00
334 CY excavation & backfill @ $9.00	3,006.00
160 SF steel frame & grating @ $15.00	2,400.00
55 LF 42" RCP @ $49.00	2,695.00
4,572 SF 4" thick concrete channel lining @ $2.00	9,144.00
340 CY wire enclosed rip rap @ $70.00	23,800.00
6,425 SF filter blanket @ $0.15	964.00
Subtotal Improvement Cost	56,009.00
10% Contingency	5,600.00
10% Engineering	6,160.00
TOTAL ESTIMATED COST	$67,769.00

BASIN C1

Drop Inlets for 10 Year Flows with Dip Section Across Chelwood

2 - double C inlets @ $1,250.00	$ 2,500.00
40 LF 30" RCP @ $29.00	1,660.00
1 - 6' Ø junction M.h.	1,500.00
200 LF 42" RCP @ $49.00	9,800.00
264 SY concrete pavement @ $10.00 (above asphalt cost)	2,640.00
Subtotal Improvement Cost	$18,100.00
10% Contingency	1,810.00
10% Engineering	1,991.00
TOTAL ESTIMATED COST	$21,901.00

BASIN C3

Concrete Channel

16,734 CY earth excavation and grading @ $3.00	$ 50,202.00
58,730 SF 4" concrete channel lining @ $2.00	117,460.00
Subtotal Improvement Cost	$167,662.00
10% Contingency	16,766.00
10% Engineering	18,443.00
TOTAL ESTIMATED COST	$202,871.00

BASIN C5

Alternate #1 - Drop Inlet with Pipe

8 CY structural concrete @ $280.00	$ 2,240.00
25 CY excavation and backfill @ $9.00	225.00
67 SF of steel frame and grating @ $20.00	1,340.00
573 SY concrete pavement @ $10.00 (above asphalt cost)	5,730.00
800 LF 48" RCP @ $54.00	43,200.00
2 - 36" Ø riser M.h.s. @ $800.00	1,600.00
Subtotal Improvement Cost	$54,335.00
10% Contingency	5,434.00
10% Engineering	5,977.00
TOTAL ESTIMATED COST	$65,746.00

BASIN C5

Alternate #2 - Dip Section with Channel

573 SY concrete pavement @ $10.00 (above ashalt cost)	$ 5,730.00
17,945 SF 4" concrete channel lining @ $2.00	39,890.00
1,400 CY earth excavation and grading @ $6.00	8,400.00
Subtotal Improvement Cost	$54,020.00
10% Contingency	5,402.00
10% Engineering	5,942.00
Total Improvement Cost	$65,364.00
Estimated Land Value (20'x900' easement @ $20,000/acre)	8,264.00
TOTAL ESTIMATED COST	$73,628.00

BASIN C7

Concrete Channel

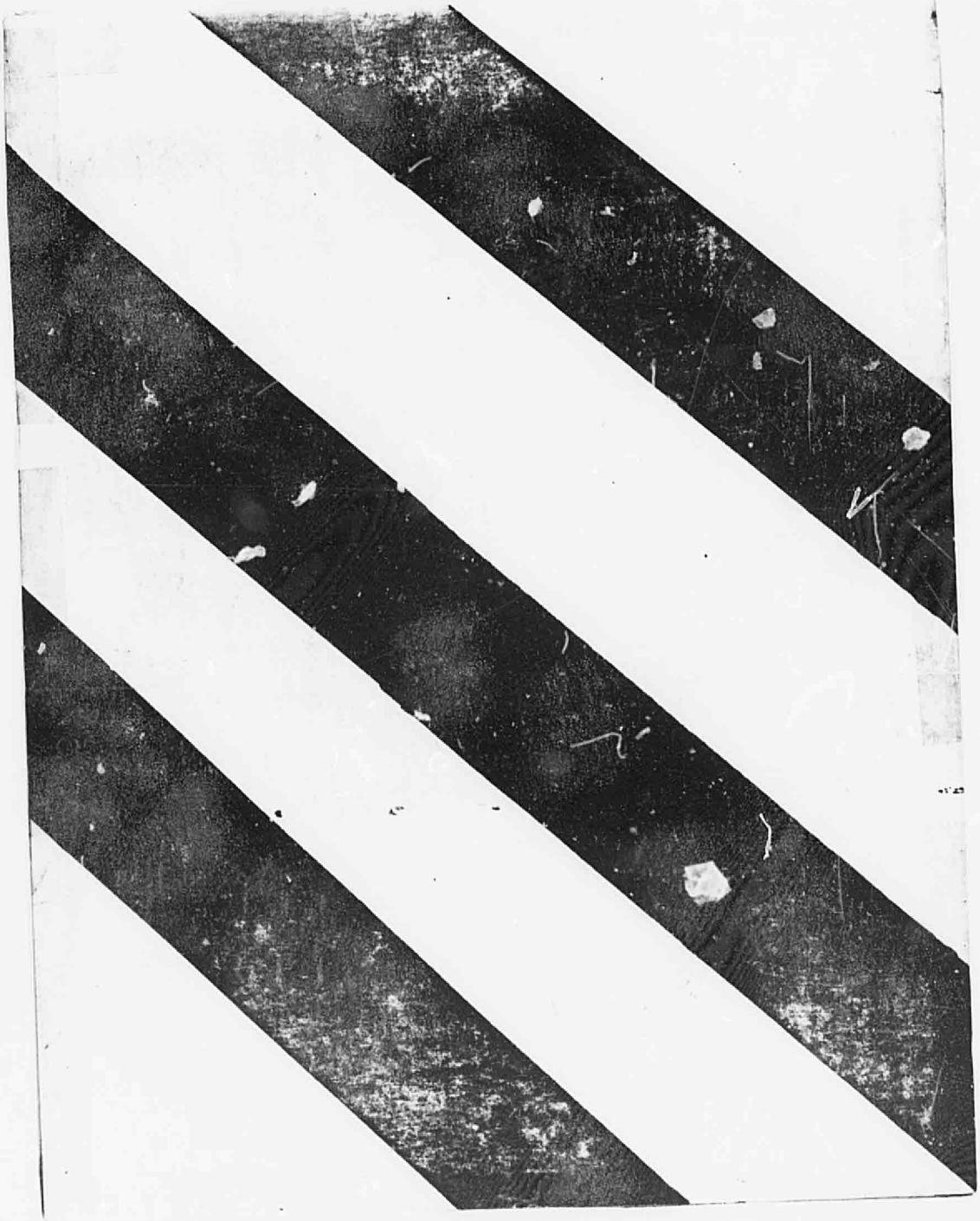
27,200 CY earth excavation and grading @ $3.00	$ 81,600.00
63,224 SF 4" concrete channel lining @ $2.00	126,448.00
185 CY wire enclosed rip rap @ $70.00	12,950.00
4,900 SF filter blanket @ $0.15	735.00
Subtotal Improvement Cost	$221,733.00
10% Contingency	22,173.00
10% Engineering	24,391.00
TOTAL ESTIMATED COST	$268,297.00

BASIN F3

Alternate #1 - Drop Inlet on East Side of Intersection with Pipe

17.5 CY structural concrete @ $280.00	$ 4,900.00
31 CY excavation and backfill @ $9.00	279.00
80 SF steel frame and grating @ $15.00	1,200.00
210 SF concrete pavement @ $10.00 (above asphalt cost)	2,100.00
1,200 LF 66" RCP @ $85.00	102,000.00
1 - 8' Ø junction M.h. @ $2,000.00	2,000.00
2 - 36" Ø riser M.h.s. @ $800.00	1,600.00
230 CY wire enclosed rip rap @ $70.00	16,100.00
6,084 SF filter blanket @ $0.15	913.00
Subtotal Improvement Cost	$131,092.00
10% Contingency	13,109.00
10% Engineering	14,420.00
TOTAL ESTIMATED COST	$158,621.00

BASIN

Alternate #2 - Special Design Curbs 1.2' High on Eubank

2,000 LF of special design curbs (1.0' high) @ $4.00 (above normal curb cost)	$ 8,000.00
650 SY concrete pavement @ $10.00 (above asphalt cost)	6,500.00
2,280 SF 4" concrete channel lining @ $2.00	4,560.00
50 CY wire enclosed rip rap @ $70.00	3,500.00
1,332 SF filter blanket @ $0.15	200.00
Subtotal Improvement Cost	$22,760.00
10% Contingency	2,276.00
10% Engineering	2,504.00
TOTAL ESTIMATED COST	$27,540.00