HYDROLOGY G10/D5 ONE OF TWO FOUR PLANS

G10-D5

4 PLANS

Drainage file

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

March 3, 1978

Chris Weiss
C.C.I.C.,Inc.
3500 Indian School Rd.,NE
Albuquerque, New Mexico 87106

RE: Ladera Heights Subdivision

Dear Mr. Weiss:

I have reviewed the drainage report for the above referenced subdivision and I am in partial agreement with the proposed methods of handling the runoff as I have already verbally indicated to you.

Regarding the single family portion the general concept is acceptable with the following two exceptions:

1. I consider it desireable to provide a drainage rundown to convey the runoff from 80th St. and Georgetown Ave. directly to the Rinconda Channel through an easment between the lots in the cul-de-sac.
2. I also find that the area indicated as "off site area west" is for the most part a parcel of this property and the drainage from it should be carried down St. Joseph Ave. I do not perceive this requirement as being excessively severe in view of the fact that an equivalent amount of runoff would be removed from the flow in St. Joseph Ave.

At the present time I feel very reluctant in concurring with the recommendation of conveying the runoff from the RT portion of the development into the pressurized storm sewer outfall in St. Joseph. In reviewing drainage provisions I do not like to make the assumption of continuous and adequate maintenance by city forces of such facilities as the flap gates (that supposedly would prevent backflows into the subdivision). We have discussed this subject and I am aware of a preliminary concurrence on the part of Mr. Jim Smith with the concept proposed. Nevertheless I'd like

to suggest the investiagtion of the possiblity of 100% runoff retention on site. Roadside ditches could be used to this purpose or the runoff could be conveyed to the AMAFCA owned property south of the Equestian Trail. Finally I cannot concurr with the proposed concept of crossing the dike with pipe culverts to drain the eastern most portion of property. An alternative solution will have to be found as was required of the subdivision El Rancho Atrisco to the south.

If you want to discuss these matters further I'll be at your disposal.

Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/gm

cc: Jim Smith
V.M. Kimmick
Drainage file

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

Date: May 24, 1978

Mr. H. Griffin Pickard
H.G.P. Development Corporation
8421 Osuna Rd. N.E.
Albuquerque, New Mexico 87111

G10-DS

SUBJECT: SUBDIVISION REQUEST FOR USE OF TEST TURNKEY PROCEDURE

Dear Mr. Pickard:

We are in receipt of your letter of May 2, 1978 requesting the use of the Test Turnkey Procedures. Enclosed is a copy of the "Test Turnkey Project Flow Chart and Test Turnkey Operational Instructions" which will be followed in using this test procedure.

A very important element in this procedure and one which must be rigidly observed is the "Start of Construction Work" stage following Steps 18,19,20 and 21. No field work may commence under this test procedure until this point.

Therefore, your request to design and construct this subdivision is approved, subject to following the procedures enclosed.

Sincerely,

V. M. Kimmick, P.E.
City Engineer

Copy to: H. R. Orr
Q. R. Kielich
Dwayne Sheppard
LaMonte Urban
Bruno Conegliano

Enclosures

May 2, 1978

RECEIVED
MAY 04 1978
CITY ENGINEERING

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
Post Office Box 1293
Albuquerque, New Mexico 87103

RE: Ladera Heights Subdivision

G-10-D5

Dear Mr. Kimmick:

On behalf of H.G.P. Development Corporation, I would like to request for Turnkey Procedure for the development of Ladera Heights Subdivision. This project includes new subdivision streets, drainage facilities and utility improvements for the subdivision. Exhibit One (attached) indicates the extent of the work.

Also, by way of this letter, I would like to appoint Chambers, Campbell, Isaacson, Chaplin, Inc. as agents for H.G.P. Development Corporation for the future supervision and implementation of this development. Therefore, it is requested that CCIC be contacted as the engineer for the project. With your approval of this request, we will proceed to execute the Turnkey Agreement as set forth in the test procedure for Turnkey Projects dated March 13, 1978.

Sincerely,

H. Griffin Pickard
H.G.P. Development Corporation

JMH/al
cc: Thomas O. Isaacson
Chase Magnuson

APPROVED: _____
City Engineer

DATE: _____

8421 OSUNA RD., N.E., ALBUQUERQUE, NEW MEXICO 87111 (505) 298-7651

PICKARD & ASSOCIATES REALTORS
COMMERCIAL AND INVESTMENT DIVISION

Redline

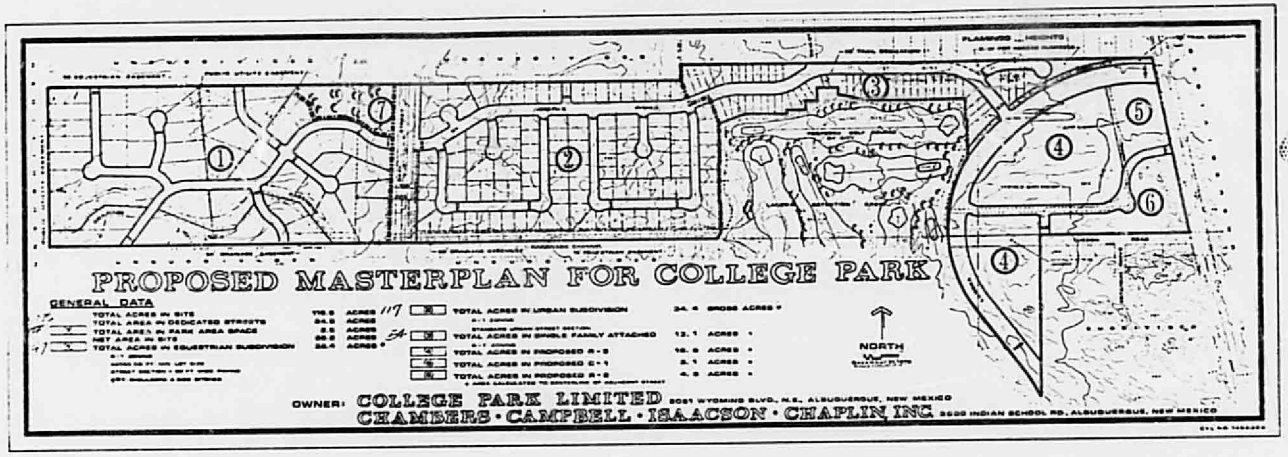


EXHIBIT 1

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

June 2, 1978

Fred Arfman
CCIC Inc.
3500 Indian School Rd.,NE
Albuquerque, New Mexico 87106

RE: Ladera Heights Subdivision

Dear Mr. Arfman:

The addendum and revisions for the drainage report are in agreement with our previous discussions. The drainage report is therefore approved as submitted.

Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/gm

cc; V. M. Kimmick
Jim Smith
Drainage file

August 10, 1978

RECEIVED
AUG 11 1978
CITY ENGINEERS

Mr. Richard Leonard
AMAFCA
P.O. Box 25851
Albuquerque, NM 87125

RE: Construction on AMAFCA Property

Dear Mr. Leonard:

This correspondence is to request permission to construct drainage facilities on properties owned and controlled by AMAFCA. These drainage related improvements are to be referenced by stationing to those found in the construction drawing entitled: Ladera Storm Drainage Diversion and Detention Facility. These plans were prepared for AMAFCA by a joint venture of engineers, Leverton/Denny and MacCormack/Burns.

Our proposed construction is as follows:

1. Entering into the Rinconada Channel at station 105 + 66, pg. 20 of 59 with three 24" dia. RCP's. These pipes are an extension from a 10' wide drainage channel that services approx. 36 acres of R-1 housing located north of the Rinconada Channel. A location map and details are shown on the accompanying construction detail sheets.

2. The conversion of MH#1, sta. 268 + 09.50 of the outfall storm drain, such that it be capable of accepting 20 cfs. of local storm runoff. This figure of 20 cfs. was based upon the undeveloped flow rate of the area contributing runoff. Presently, this MH was built as a pressurized MH since the system was assumed to have a HGL greater than the rim elevation. But, the MH can be converted based on the information and data found in the study by the Boyle Engineering firm for AMAFCA called Drainage Facilities Improvements. It shows the HGL for both MH#1 & #2 as being below the rim elevation, therefore not under pressure. Construction details for the conversion of MH#1 can be found on the accompanying sheets.

   The same MH conversion is proposed for MH#2, sta. 275 + 50. This MH is required to accept 7 cfs. of local storm runoff.

3. The construction of a storm runoff collection system for Ladera Road and an area to the south is also proposed. Three combination inlets are required to drain Ladera Road. The runoff will be carried into the storm drain outfall at sta. 278 + 68. At this stationing, a new manhole must be constructed.

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects engineers planners 3500 indian school road ne albuquerque new mexico 87106 505 266 5521

The above mentioned construction is needed in order to solve the drainage problems associated with the Ladera Heights Subdivision. All proposed changes and additions to AMAFCA facilities had the approval from Mr. Jim Smith prior to final design.

It is therefore requested that the design concept be formally approved and permission be granted to construct drainage structures on AMAFCA property.

We would appreciate receiving your reply as soon as possible since we are approaching our pre-construction date of August 30.

Thank you,

Fred C. Arfman

Fred C. Arfman, for
Chambers, Campbell,
Isaacson & Chaplin, Inc.

FCA:at
Encl.

cc: Bruno Conegliano, Asst. City Engineer

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

September 7, 1978

G10-05

Mr. H. Griffin Pickard
H.G.P. Development Corporation
8421 Osuna Rd. N.E.
Albuquerque, New Mexico 87111

SUBJECT: TEST TURNKEY PROJECT WORK AUTHORIZATION #T-13
LADERA HEIGHTS SUBDIVISION

Dear Mr. Pickard:

Under the provisions of the Test Turnkey Project procedures, this letter is the Work Authorization to begin field work on the project.

Very truly yours,

C. D. Sheppard, P.E.

C. D. Sheppard
Acting City Engineer

CDS/fs

cc - H. R. Orr
Kent Nowlin Construction Co.
Ray Dawson
Water Resources
Dwayne Sheppard
Bob Kielich
LaMonte Urban
Bruno Conegliano
Bill Mueller

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

October 19, 1979

G10-D5

Mr. Richard Leonard
PO Box 26851
Albuquerque, New Mexico

Reference: Reference Drainage Report for Ladera Heights Subdivision:

Dear Mr. Leonard:

I have received the attached drainage report for the referenced development. Basically, there is no change in the drainage pattern previously approved, but since the run-off in conveyed to the outfall pipe for the Ladera Detention Basin. I feel that you should concurr in the acceptance of the revised plan.

Please notify me of your concurrence so that I can sign the revised plat.

Sincerely yours,

Bruno Conegliano
Assistant City Engineer-Hydrology

BC/lc

cc: Dick Heller, City Engineer
Fred Arfman
Bill Muller
Drainage file

RICHARD E. LEONARD
EXECUTIVE ENGINEER

S. H. SWINBURNE, CHAIRMAN
WILLIAM V. HEREFORD, VICE-CHAIRMAN
FRANCES McCOY, SECRETARY-TREASURER
VERNON DOAK, DIRECTOR
KLESTON LAWS, DIRECTOR

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority
2600 PROSPECT AVE. N.E.
P. O. BOX 25851 - ALBUQUERQUE, N. M. 87125
TELEPHONE 344-3516

RECEIVED
OCT 23 1979
CITY ENGINEER

October 22, 1979

Mr. Bruno Conegliano
Assistant City Engineer-Hydrology
Municipal Development Department
City of Albuquerque

Re: Drainage Report for Ladera Heights Subdivision

Dear Sir:

We have reviewed the revised plan and concur in its acceptance.

We have no objection to the signing of the revised plat.

Sincerely,

Dan Sabo

Dan Sabo
Engineer

ic
cc: Bill Mueller

RECEIVED

SEP 11 1980

CITY ENGINEER

RECEIVED

SEP 5 1980

C.C.I.C.

August 12, 1980

Mr. Bruno Conegliano
City of Albuquerque
Post Office Box 1293
Albuquerque, New Mexico 87103

RE: Ladera Heights Townhomes

Dear Mr. Conegliano:

CCIC has been contracted by Pickard Enterprises to investigate an alternate drainage plan for their Ladera townhouse development. This revised plan is necessitated by the fact that since the time of re-platting, the developer has been trying to secure FHA financing. In order to satisfy FHA and local government's drainage criteria, a new plan that calls for no additional discharge of water onto public right-of-way was formulated.

Of the seventy-four (74) lots in the townhouse portion of the subdivision, only the lots bordering the Ladera Golf Course are to be considered in this revision. The plan calls for lots 18 through 43, 46 through 51, 54 through 58, 62 and 63 being void of any rear/side yard retention of storm waters. Instead, the waters shall sheet flow to the south and onto property controlled by the City Parks and Recreation Department (Ladera Golf Course). Because of the area's topography and the detention basin characteristics, these minor flows shall be handled in either one of two ways. First, for those lots west of lot 34, the storm water will runoff into the detention basin after it travels between 100 and 250 feet overland. The remaining lots to the east all border the golf course, and along this frontage is a 25 foot wide ditch which is not interconnected with the storage volume of the detention basin. See attachment for the increased storm water volumes and ditch cross sections. It should be noted at this time that these flows historically drained into the area of land now designated as a detention basin prior to any earthmoving and construction. Rear/side yard ponds are not acceptable to the soils

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects, engineers, planners, 3500 indian school road ne albuquerque new mexico 87106, 505-266-5521

engineer or to standards established by FHA, if they are within 15' of the building foundation.

Most of the lots in question have minimum setbacks and therefore, a waiver of the onsite ponding requirement for those lots previously mentioned is requested. It seems more logical to let the storm waters enter into the detention basin or be retained in the adjacent ditch (community pond).

A letter to Mr. Marty Valdez, City Parks and Recreation Department, dated March 20, 1978 (see attachment), addressed itself with the ponding of storm water on this very same property. Approval was granted for the retention of 27,000 cu. ft. The scheme of this revision is similar but at a 75% reduction in volume. Impact on the area would be minor if not negligible.

Since a majority of the lots in question have minimum setbacks coupled with the fact that the soils engineer's recommendation calls for 15 foot separation between pond's edge and foundation, it would be advantageous to the development and City to let these storm waters leave the site as described above.

Your attention to this revised plan would be appreciated and I shall be available for further discussion upon request.

Sincerely,

Fred C. Arfman

Fred C. Arfman, P.E.
Associate Vice President

FCA:df

Attachments

no objection

8/27/80

Bruno Conegliano
Assistant City Engineer-Hydrology

no objection

Orlando D. Sedillo, Parks Department

SUPPLEMENTAL CALCULATIONS

I. OFFSITE RETENTION DITCH:

Ditch has common border with lots 34-43, 46-51 and 54-58.

A. Determination of Volume:

Area contribution runoff	=	1 ac.
Composite "C" Value	=	0.60
Depth of rainfall	=	2.2"

$V = CD(\frac{1}{12})A$ (Rational Method)
$= (0.60)(2.2)(\ \ )(43560)$
$= 4800$ cu. ft.

B. Determine retention capacity of ditch/pond:

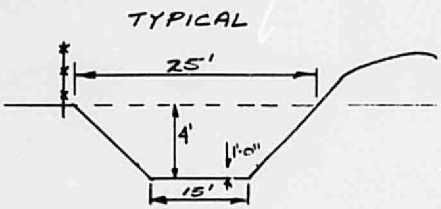
Length	=	460'
Depth	=	4'
Bottom width	=	15'
Surface width	=	25'

$V = 460 \times (\frac{25+15}{2}) \times 4$
$= 36{,}800$ cu. ft.

C. Total depth of pond:

from townhouse area	=	0.67'
from ditch and berm	=	0.33'
Total depth	=	1.0'

D. Cross-section:

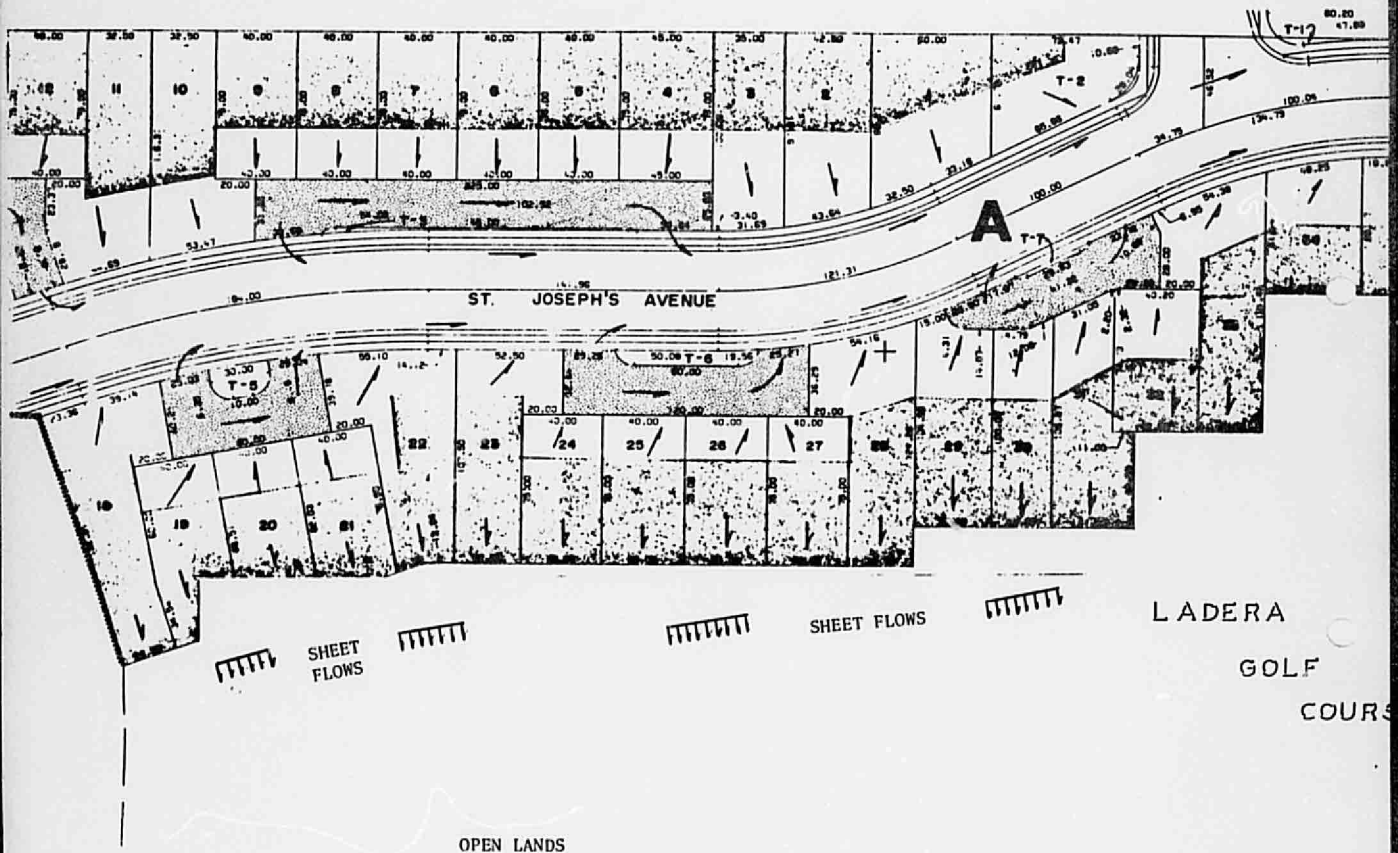


ultimate capacity 36,800 cu.ft.

actual capacity 6,900 cu.ft.

E. Summary:

Ditch/pond is very consistent in its cross-section. The bottom of pond elevation is continuous, therefore, no concentrated volumes should be encountered.



OPEN LANDS
(Native grasses and vegetation)

EXHIBIT I
Sheet 1 of 2

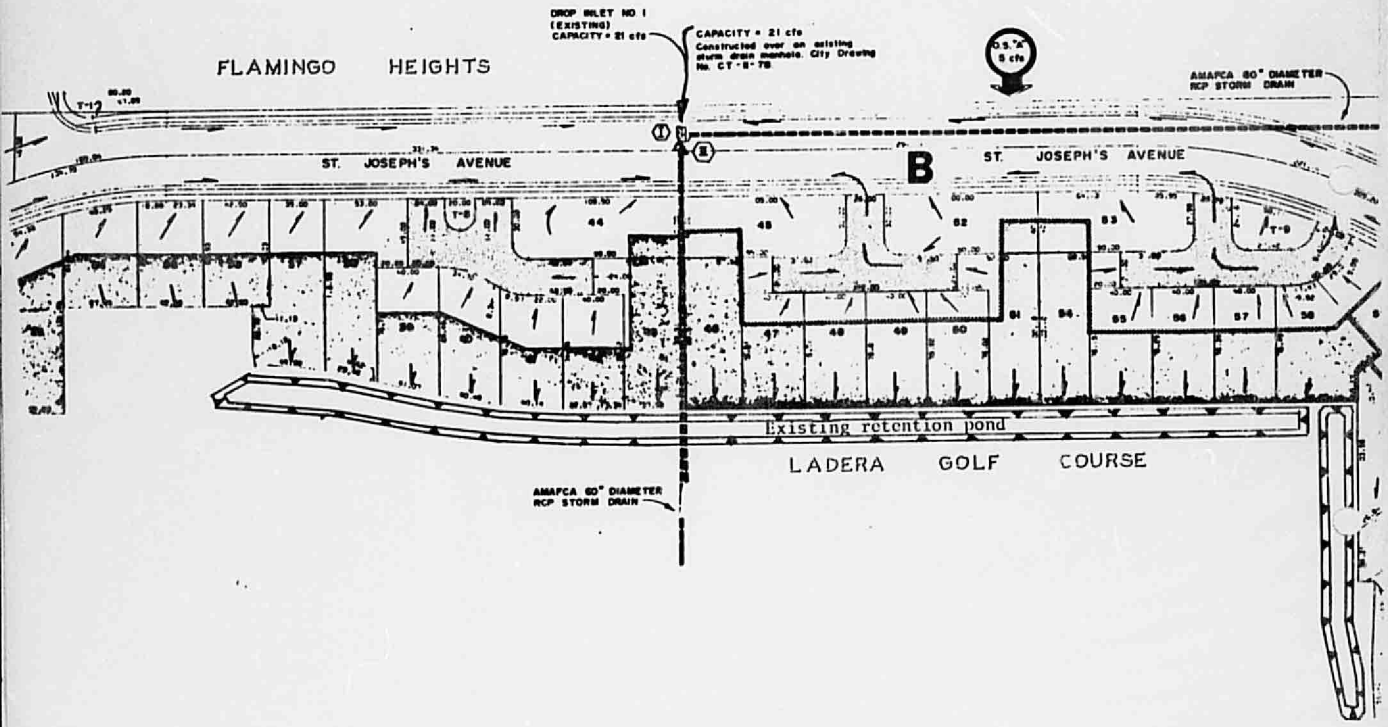


EXHIBIT I
Sheet 2 of 2

March 20, 1978

Mr. Marty Valdez
City Parks & Recreation Department
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

RE: Ponding on City Park Property

Dear Mr. Valdez:

The purpose of this letter is to summarize our discussions concerning the ponding of localized runoff on city park property.

The pond area is situated north of the Ladera Detention Basin's berm and south of the intersection of 65th. Street and St. Joseph's Avenue. The pond has a retention capacity of 27,000 cu. ft. and at that volume a surface area of 13,800 sq. ft.

On March 14, 1978, acting on behalf of the City of Albuquerque' Parks & Recreation Department, you gave preliminary approval of this concept. Upon receiving and reviewing this letter, it shall be accepted as final approval.

Your cooperation has been greatly appreciated in helping us with this matter.

Thank you.

Very truly yours,

Fred C. Arfman

Fred C. Arfman, for
CHAMBERS, CAMPBELL, ISAACSON &
CHAPLIN, INC.

FCA:ysh

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects engineers planners 3500 indian school road ne albuquerque new mexico 87106 505-266-5521

FILE:
1 RANCHO ATRISCO
2 ATRISCO BUSINESS PARK
3 LADERA SYSTEM

RICHARD E. LEONARD
EXECUTIVE ENGINEER

B. H. SWINBURNE, CHAIRMAN
R. WARD HUNNICUTT, VICE-CHAIRMAN
FRANCES McCOY, SECRETARY-TREASURER
VERNON DOAK, DIRECTOR
KLESTON LAWS, DIRECTOR

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT AVE., N.E.
P. O. BOX 25651 - ALBUQUERQUE, N. M. 87125
TELEPHONE 884-2215

RECEIVED
JUN 17 1981
ENVIRONMENT

June 16, 1981

Mr. Wiley Smith
Environmental Planning Committee
Albuquerque, NM

Dear Mr. Smith:

Reference your questions regarding drainage of the El Rancho Atrisco area between Interstate 40 and our Ladera system of dams and channels.

AMAFCA originally envisioned that most of this area would drain into the Ladera System, and Ladera is designed to accommodate flows from this area. (Ref. "Design Report for the Ladera Storm Drainage Diversion and Detention System," Boyle Engineers, 1979.)

Subsequently the City formulated plans to construct an interceptor channel immediately north of Interstate 40. This would make it easier to develop and drain the area between I-40 and Ladera. The El Rancho Atrisco drainage concept assumes this channel will be built.

It is my understanding that the City has reasonably firm plans to construct the I-40 channel. If not, the drainage concept for El Rancho Atrisco is probably inappropriate.

Sincerely,

Rich Leonard

Richard E. Leonard
Executive Engineer

ic
cc: V. Hagen
R. Heller
H. Orr
C. Easterling ✓
F. Denney

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

July 8, 1981

Ms. Cindy Pennington
State Farm Insurance
3636 Menaul Blvd. N.E.
Albuquerque, New Mexico 87110

Re: 6212 St. Joseph N.W.; Ladera Heights; Lot 63

Dear Ms. Pennington:

At your request, I am submitting the following information regarding the above address:

An analysis of present conditions indicates that the referenced site does not lie in a flood hazard area. The Ladera Flood Control System protects the site from flooding.

If you have any further questions, please call.

Very truly yours,

Charles M. Easterling
Principal Asst. City Engineer/Hydrology

CME/fs

MUNICIPAL DEVELOPMENT DEPARTMENT

Richard S. Heller, P.E., City Engineer ENGINEERING DIVISION Telephone (505) 766-7467

DRAINAGE REPORT

FOR

LADERA HEIGHTS SUBDIVISION

OCTOBER 1979

RECEIVED
OCT 05 1979
CITY ENGINEER

September 28, 1979

Mr. Bruno Conegliano
Assistant Engineer
P.O. Box 1293
Albuquerque, NM 87103

REFERENCE: Ladera Heights

Dear Mr. Conegliano:

At the request of the Rickard Development Corporation, owners of Ladera Heights Subdivision, CCIC has been asked to replat a 13 acre portion which is designated for townhouse construction. Since this replatting will alter the site's grading, lot configuration, and density; the drainage characteristics will also be changed. Therefore, we are submitting this amendment to our previously approved drainage report of June 2, 1978.

The replatting of the townhouse lands shall create 74 lots with common areas and private drives controlled by a home owner's association. The alignment of St. Joseph's Ave. and St. Joseph's Court does not change from the original platting and all street improvements shall remain as is. Presently, all storm drainage improvements are 100% complete. They consist of a double drop inlet located atop of the AMAFCA 60" dia. storm drain in St. Joseph's Ave., a similar inlet in St. Joseph's Court, and a combination inlet on the north side of Ladera Road. These structures are shown on the accompanying exhibits along with all the supportive calculations.

In summary, all of the storm water runoff generated from this site shall be directed into one of the three inlets mentioned above. The inlet have sufficient capacity to accept these flows as they are also the same rates and volume as before. Therefore, no additional construction or alteration is required.

Hopefully, the following exhibits and calculations are sufficient in order to amend our drainage report for the Ladera Heights Subdivision.

Sincerely,

Fred C. Arfman

Fred C. Arfman, for
CHAMBERS, CAMPBELL,
ISAACSON, CHAPLIN, INC.

FCA:pw

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects engineers planners 3500 indian school road ne albuquerque new mexico 87106 505/266-5521

DROP INLETS

Design Information: Flow line elevation is 5108.26. Inlets are located in a sag (low point of the street's vertical curve), therefore a ponding depth of 8" is allowable within the limits of the 60' R.O.W.

Total opening = 14.5 sq. ft.

Clear open area = 10.9 sq. ft.

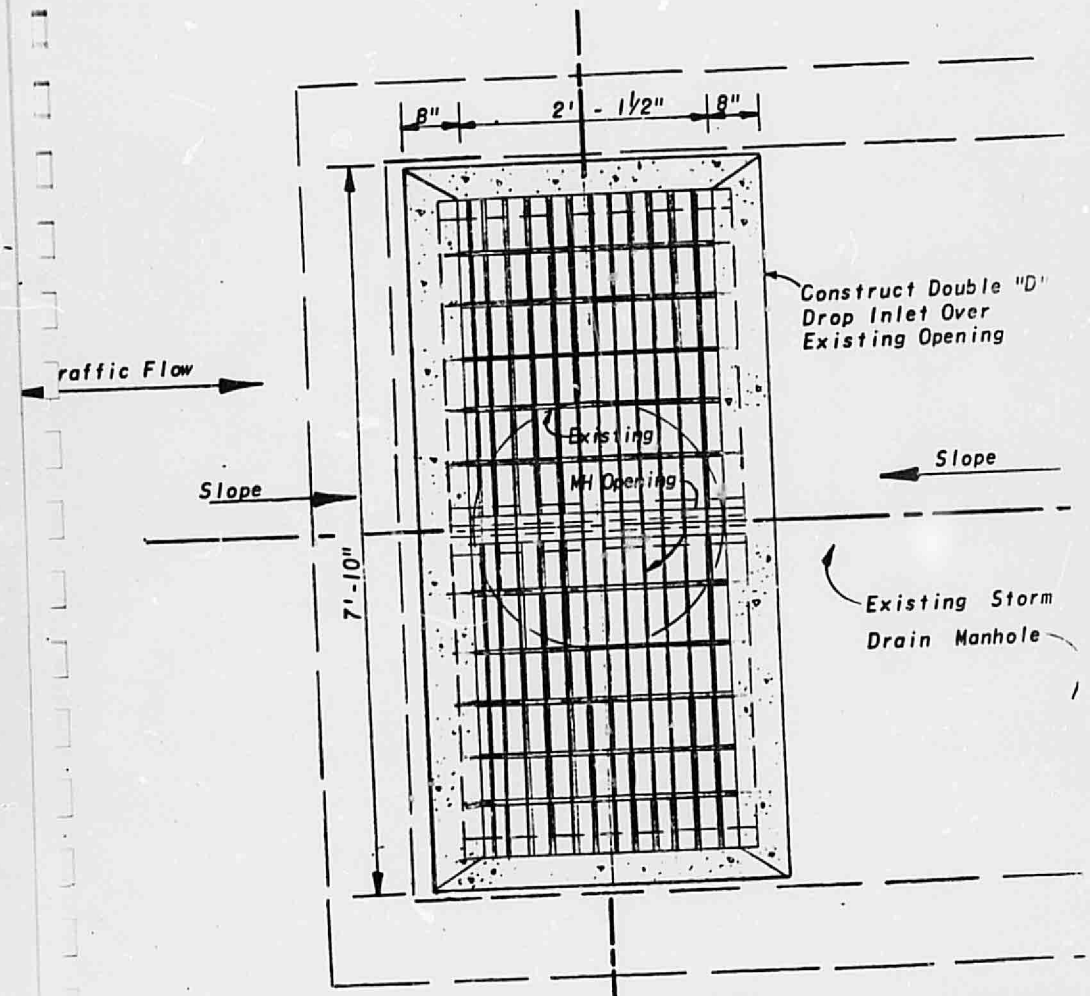
So

Grate Capacity equals 10.9 $ft.^2$ x 3.8 $cfs/ft.^2$ (capacity per square foot for 8 inch head from accompanying chart) - 10.9 $ft.^2$ x 3.8 $cfs/ft.^2$ = 41.4 cfs

From Table 2-1 (attached) (Reduction Factors to Apply to Inlets) a 50% reduction must be applied against the theoratical capacity.

Design Capacity:

41.4 x 0.50 = 20.7 cfs



PLAN
No Scale

CONVERSION OF EXISTING
MANHOLE TO DROP INLET
St. Joseph's Avenue
St. Joseph's Court

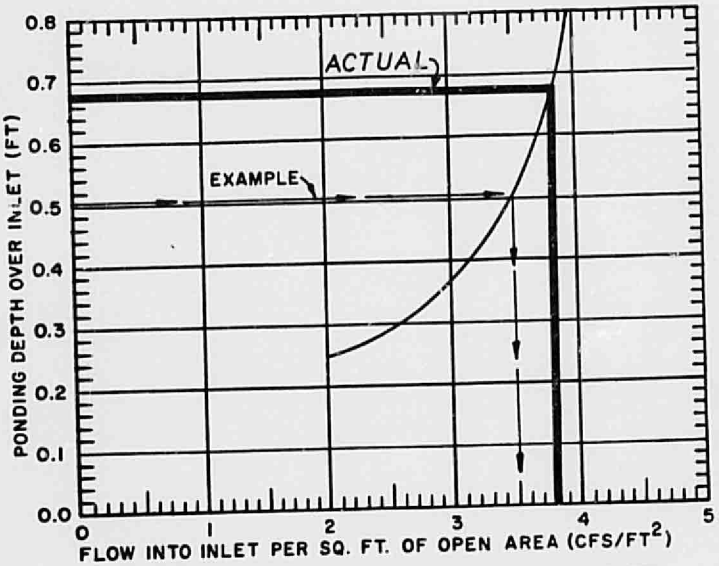


FIGURE 4-1. CAPACITY OF GRATED INLET IN SUMP

TABLE 2-1
REDUCTION FACTORS TO APPLY TO INLETS

Condition (1)	Inlet Type (2)	Percentage of Theoretical Capacity Allowed (3)
Sump	Curb Opening	80%
Sump	Grated	50%
Sump	Combination	65%
Continuous Grade	Curb Opening	80%
Continuous Grade	Deflector	75%
Continuous Grade	Longitudinal Bar Grated	60%
Continuous Grade	Transverse Bar Grate or Longitudinal Bar Grate incorporating transverse bars	50%
Continuous Grade	Combination	110% of that listed for type of grate utilized

DRAINAGE REPORT

FOR

LADERA HEIGHTS SUBDIVISION

ALBUQUERQUE, NEW MEXICO

DECEMBER 1977

37-4

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

June 2, 1978

Fred Arfman
CCIC Inc.
3500 Indian School Rd.,NE
Albuquerque, New Mexico 87106

RE: Ladera Heights Subdivision

Dear Mr. Arfman:

The addendum and revisions forthe drainage report are in agreement with our previous discussions. The drainage report is therefore approved as submitted.

Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/gm

cc; V.M.Kimmick
Jim Smith
Drainage file

April 28, 1978

Mr. Bruno Conegliano
Assistant City Engineer - Hydrology
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

RE: Ladera Heights Subdivision

Dear Mr. Conegliano:

This is in response to your letter of March 3, 1978, and the meeting of March 17, between our firm and the City, where we discussed your recommendations of the drainage study for Ladera Heights Subdivision.

Regarding the R-1 portion, it was the consensus at the above mentioned meeting, that an additional drainage channel would not be necessary due to the low volume of runoff that would actually be diverted into the Rinconada Channel. Secondly, we also agreed that the offsite runoff should not enter the site at the west end of St. Joseph's Ave. So, as an alternate solution, a retention pond capable of accepting all runoff would be sized and situated to the northwest of the end of St. Joseph's Ave. (See supplement for pond sizing and accompanying drainage plat for location of pond). At a future date when Unser Blvd. is constructed, the ponding area will be incorporated into the 200' public utility easement, that is proposed to be used as a greenway and parallels Unser Blvd. to the west.

Reference is made to the R-T recommendation of your letter. First we have redesigned the storm runoff collector inlets based on information found in the design report for Ladera Storm Drainage Retention and Drainage Facility, prepared for AMAFCA by Doyle Engineering. This report establishes the hydraulic gradiant line at each manhole (manhole no. 1 and 2 HGL are found in the supplement to this letter) in the detention's drain system. It indicates that for manhole no. 1 and no. 2 the HGL is lower than existing manhole rim elevations. Therefore, our design calls for the manhole adaption to allow them to accept the localized runoff from the R-T area of the development. This design is in accordance with the recommendations of Mr. Jim Smith and the design report.

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects engineers planners 3500 indian school road ne albuquerque new mexico 87106 505-266-5521

Finally, in the spirit of cooperation, we are willing to abandon the pipe culverts with the flapper gate design that would have had to cross the detention facilities' berm. Instead, this runoff shall be directed to an inlet collection system on Ladera Road by means of grading. This system is designed to drain the total runoff (calculations found in accompanying supplement). Mr. Smith concurrs with the design to allow total runoff into the drain system.

You will find these changes located on the accompanying revised drainage plat and the calculations in the supplement to this correspondence.

Very truly yours,

Fred Arfman, for
CHAMBERS, CAMPBELL, ISAACSON
AND CHAPLIN, INC.

FA:ysh

Enclosure

SUPPLEMENTAL CALCULATIONS

1. Retention Pond - This pond is located offsite and to the northwest of the end of St. Joseph's Ave. See drainage plat.

   Area contributing runoff = 7.1 ac.
   Rainfall (depth in inches) = 2.2 in.
   C - Value = 0.35

   Area - 7.1 ac. x $\frac{43560 \text{ s.f.}}{1 \text{ ac.}}$ = 309,280 s.f.

   (0.35)(309,280)(2.2)(1/12) = 19,845 cu. ft.

   Therefore pond should be sized at:
   90' x 90' x 3' = 19,926 cu. ft. cap.
   (pond to have 3.1 s.s.)

2. The hydraulic gradiant line for manhole of the basin's drainage facility are as follows:

	Rim El.	HGL(in)	HGL(out)
Manhole 1	5108.15	5108.15	5107.85
Manhole 2	5106.72	5106.72	5106.62

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

March 3, 1978

Chris Weiss
C.C.I.C., Inc.
3500 Indian School Rd., NE
Albuquerque, New Mexico 87106

RE: Ladera Heignts Subdivision

Dear Mr. Weiss:

I have reviewed the drainage report for the above referenced subdivision and I am in partial agreement with the proposed methods of handling the runoff as I have already verbally indicated to you.

Regarding the single family portion the general concept is acceptable with the following two exceptions:

1. I consider it desireable to provide a drainage rundown to convey the runoff from 80th St. and Georgetown Ave. directly to the Rinconda Channel through an easment between the lots in the cul-de-sac.
2. I also find that the area indicated as "off site area west" is for the most part a parcel of this property and the drainage from it should be carried down St. Joseph Ave. I do not perceive this requirement as being excessively severe in view of the fact that an equivalent amount of runoff would be removed from the flow in St. Joseph Ave.

At the present time I feel very reluctant in concurring with the recommendation of conveying the runoff from the RT portion of the development into the pressurized storm sewer outfall in St. Joseph. In reviewing drainage provisions I do not like to make the assumption of continuous and adequate maintenance by city forces of such facilities as the flap gates (that supposedly would prevent backflows into the subdivision). We have discussed this subject and I am aware of a preliminary concurrence on the part of Mr. Jim Smith with the concept proposed. Nevertheless I'd like

? 1978
C.C.I.C

to suggest the investiagtion of the possiblity of 100% runoff retention onssite. Roadside ditches could be used to this purpose or the runoff could be conveyed to the AMAFCA owned property south of the Equestian Trail. Finally I cannot concurr with the proposed concept of crossing the dike with pipe culverts to drain the eastern most portion of property. An alternative solution will have to be found as was required of the subdivision El Rancho Atrisco to the south.

If you want to discuss these matters further I'll be at your disposal.

Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/gm

cc: Jim Smith
V.M. Kimmick
Drainage file

375-4

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

June 2, 1978

Fred Arfman
CCIC Inc.
3500 Indian School Rd.,NE
Albuquerque, New Mexico 87106

RE: Ladera Heights Subdivision

Dear Mr. Arfman:

The addendum and revisions forthe drainage report are in agreement with our previous discussions. The drainage report is therefore approved as submitted.

Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/gm

cc; V.M.Kimmick
Jim Smith
Drainage file

DRAINAGE REPORT

FOR

LADERA HEIGHTS SUBDIVISION

NOVEMBER 1979

REVISED OCTOBER 1979

FOR TOWNHOUSED ONLY

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Table II- Ladera Heights Subdivision Drainage Masterplan Estimated Flows - Developed State

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IV Overland Time of Travel

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VI Curb Opening Capacity

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INTRODUCTION

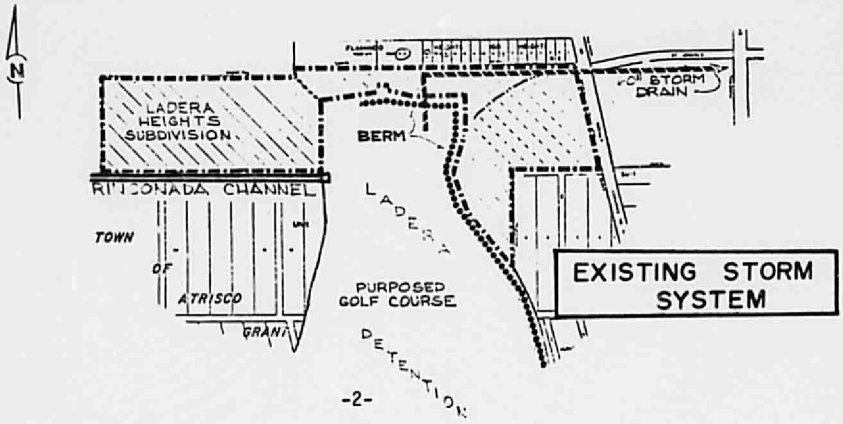
This drainage report will analyze the drainage characteristics of an area known as Ladera Heights Subdivision. The site is located due west of the University of Albuquerque, with Atrisco Road forming the east boundary, A-1 land the north boundary, and undeveloped land the south and west boundaries. More particularly, the site is located within Sections 2 and 3, T10N, R2E. (Zone Atlas G-10, G-11.)

The site area is divided into three distinct land uses: R-1, R-T, and R-2-3. The areas scheduled for development at this time include the R-1 and R-T areas. The report will deal with these areas in detail to seek specific drainage solutions. The R-2-3 area will be developed at a future date. The report will deal with this area in a general manner in order to coordinate the overall area in an orderly manner.

EXISTING STORM DRAIN SYSTEMS

The Ladera Heights Subdivision is located in a unique geological area. Pre-1977, the site lay across part of a natural depression which collected surface runoff from a large drainage basin south and west of the site. Improvements to the overall basin area were sponsored by A.M.A.F.C.A. The improvements in the site area consist of the following: a dirt berm constructed around the north and east boundaries of the natural basin, which resulted in a more defined basin; a 60" storm drain constructed through the R-T area, which drains off the runoff trapped within the basin; a concrete lined channel along the south boundary of the R-1 area, referred to as the Rinconada Channel. Further improvements within the basin are proposed by the City in the form of a public golf course.

The drainage sturctures and the proposed golf course will have a direct bearing on the drainage solutions presented for the individual areas within Ladera Heights Subdivision.



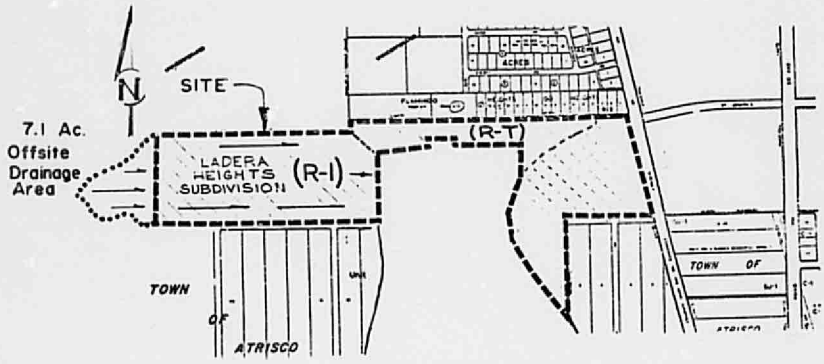
UNDEVELOPED DRAINAGE CHARACTERISTICS

R-T Area - No runoff occurs from the north onto this area.

R-1 Area - This area has minimal offsite flows entering the site from the west.

The concrete lined channel along the south boundary of the R-1 Area intercepts offsite flows from the west which previously passed through the R-1 Area.

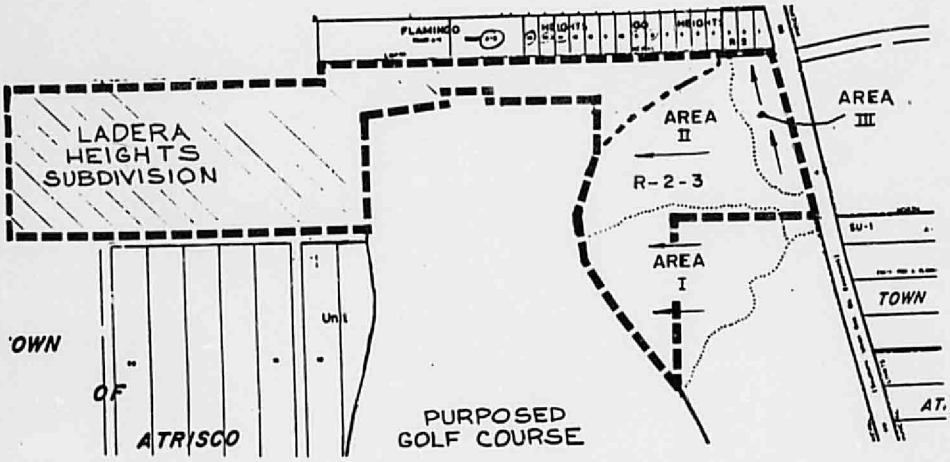
An offsite area of 7.1 acres will contribute runoff to the R-1 Area, as shown below. (Refer to Exhibit I for larger scale map of the topography of the area.)



Offsite Flows and Undeveloped Flows -- R-1, R-T Areas.

R-2-3 Areas - The area east of the Ladera Detention Basin is lower than the dirt berm at the point of outflow. Therefore, volumes of runoff will be computed, in addition to flow rate, to determine if adequate natural storage now exists against the berm. General recommendations for removing these flows will be covered later.

The area east of the berm is divided into three areas, as shown below.



Offsite Flows and Undeveloped Flows -- R-2-3 Areas.

The following table summarizes the existing undeveloped flow rates and volumes of the R-1, R-T and R-2-3 Areas.

TABLE I

ESTIMATED UNDEVELOPED FLOW

Area	Tc	I	C	Area	Q or Volume	Remarks
Western Area -- Ladera Heights Subdivision						
R-1 Area + 7.1 Ac. O.S.	18	4.40	0.35	38.0	= 58 cfs	Flows enter Ladera Detention Basin from west.
R-T Area --	10	5.40	0.35	10.7	= 20 cfs	Flows pond against outside of the north berm.
	Vol. = $\frac{(0.35)(2.2)(10.7)}{12}$ = 0.69 Ac.-Ft.					
Eastern Area -- Ladera Heights Subdivision						
Area I --	10	5.40	0.35	15.3	= 29 cfs	Flows pond against the outside of the east berm.
	Vol. = $\frac{(0.35)(2.2)(15.3)}{12}$ = 0.98 Ac.Ft.					
Area II --	12	5.11	0.35	18.8	= 34 cfs	Flows pond against the outside of the east berm
	Vol. = $\frac{(0.35)(2.2)(18.8)}{12}$ = 1.2 Ac.-Ft.					
Area III --	10	0.35	5.40	5	= 9 cfs	Flows sheet flow north to St. Joseph's Avenue and pond along Atrisco Road.
	Vol. = $\frac{(0.35)(2.2)(5)}{12}$ = 0.32 Ac.-Ft.					

Total volume from Areas I, II, and III = 2.5 Acre-Feet, and have a surface-area of 1.67 Acres.
Volume based on 2.2" for a 6 hour-100 year storm.

The following table summarizes the developed flow rates for the R-1 and R-T Areas (refer to Exhibit I).

TABLE II

LADERA HEIGHTS SUBDIVISION
DRAINAGE MASTERPLAN

ESTIMATED FLOWS - DEVELOPED STATE

Areas	Pts. of Study	Tc	I	C	Area	Q	Discharge Pt.
B	I	7 (10)	5.4	.57	4.00	12	72nd St. & St. Joseph
A & B	II	7 (10)	5.4	.56	9.03	27	71st St. & St. Joseph
C + 1/2(A+B)	III	11	5.25	.55	10.29	30	Georgetown Ave. & 67th Street
D + 1/2(A+B)	IV	11	5.25	.54	9.17	26	Georgetown Ave. & 67th Street
A - D	V	11	5.25	.55	19.47	56	Rinconada Channel
E & F	VI	11	5.25	.57	9.7	29	St. Joseph Ave.

(See Appendix for composite "C" calculations and runoff computations.)

DEVELOPED DRAINAGE CONDITIONS

Grading for areas A - D (R-1 zoning) shall be done in such a way as to meet the following conditions:

(1) Lots shall be graded to provide back yard ponding where indicated (Exhibit I).

(2) Grade the west end of St. Joseph Ave. so that it will prevent any off-site flows from entering the site and deflect them northward along Unser Avenue.

(3) Grade all R-1 Area runoff to exit at the southwest corner of the area. This exit is common with the Rinconado Channel exit, which flows into the Ladera Detention Basin.

(4) Grade the R-T site so that runoff flows toward the existing 60" storm sewer and drains into the system.

(5) Grade Ladera Street to prevent flow from going down St. Joseph Avenue. Construct a water block that will prevent any flows from crossing the boundary between the R-1 and the R-T zones.

REQUIRED STRUCTURES (Refer to Exhibit I)

I. (Study Pt. V): This channel shall have a length of 160 ft. and shall require a 10' R/W. The channel shall conform to City Standard Drawings No. P-17-1.

II. (Study Pt. VI): Combination Inlets. These inlets must be capable of accepting a flow rate of 29 cfs (16 cfs from the west and 13 cfs from the east). A double combination inlet in a sump condition on each side of St. Joseph Ave. will be acceptable. (See Appendix for inlet capacities.)

III. (Study Pt. VI): The above inlet system must have a one-way valve to prevent any backflow onto the street because the 60" storm drain was designed to work under pressure. The system is under pressure at the manhole. A one-way flapper gate located between the inlets and the manhole will satisfy this design condition.

RECOMMENDATIONS

R-1, R-T Areas

1. Where off-site flows from the west intersect the western boundary, they will be diverted northward[1] by grading differential between the R-1 Area and Unser Avenue.
2. No individual street is required to handle a large flow rate, but the minimum grade as per City Standards should be 0.5%. For a 32' FF street, 8" curb, 4" crown, at 0.5%, the maximum capacity = 63 cfs at top of curbs.[2]
3. At the outflow point for the R-1 Area, flows will enter the detention basin by means of an open channel that will lie between the two corner lots (see Plat).
4. Rear yard ponding will require a minimum of 13% of the area drained to the pond. This will allow a maximum depth of 0.5'. The limits of the ponded waters should be kept a minimum distance of 5' away from any walls and 15' away from any house foundations.[3]
5. Where flows from Areas E and F empty into the storm sewer (Study Pt. VI), two Double C Drop Inlets[4] shall be built with the added feature of a one-

---

[1] In the preliminary discussion with AMAFCA, it was agreed that flows could be diverted northward.

[2] See Appendix for street carrying capacity computations.

[3] These general recommendations are only intended to call the developer's attention to potential settlement problems in the area. A qualified soils engineer should prepare specific guidelines for ponding water around structures.

[4] When inlet is constructed, conform to City Standard Drawings No. S-16-1. (See Appendix for information concerning capacities).

way drainage gate.[5]

6. Certain lots on the eastern side of the R-T Area, bordering Ladera Avenue, lie within the 100 year flood hazard boundary. These lots, along with Ladera Avenue, should be raised up to match the detention basin berm's elevation[6] to guarantee against any flooding by off-site ponding.

R-2-3 Area (Includes C-1 Area)

The following recommendations are included to show that future development of the R-2-3 Area can be accomplished by using the existing Ladera Detention System. The existing ground adjacent to the berm is lower than the top of the berm. Until this area is developed, runoff will pond outside the berm, and/or against Ladera Road.

1. Flows from Tract C (C-1 zoning), after development travel north. An inlet structure could be built to handle design flows into the existing 60" storm drain system.
2. Where off-site and on-site flows pond against Ladera Road's embankment, two sets of culverts with directional flow control could be built. This will allow relief for any ponded water, so that it may enter into the detention basin (see Appendix for details).
3. If the future developer of this area elects to go to total ponding on-site, the above structures would not apply.

---

[5]One-way flapper gate necessary since storm sewer line is under pressure of this location.

[6]Design elevation from AMAFCA as-built equals 5112.

APPENDIX

Composite "C" Calculations

Runoff Computations

Street Carrying Capacities

Combinations Inlet Capacities

Rear Yard Ponding

Culvert Computations

DESIGN CRITERIA

In analyzing the storm runoff to determine the runoff basis of the undeveloped and developed site, the Rational formula, Q - CIA, was used.

Where:

Q = Runoff quantity in cubic feet/second

A = Contributing area in acres

I = Intensity in inches/hour

For duration equal to the time of accumulation (duration) measured in minutes and obtained from Figure II - Intensity Duration Frequency Curve (Albuquerque Area - 1961). (Note: where a Time of Concentration, Tc, is less than 10 minutes, the intensity value of 10 minutes was used as shown on the curve for a 100 year storm.)

C = Runoff coefficient (no unit). This coefficient represents the integrated effects of infilltration detention storage, evaporation, retention, flow routing, and interception which all affect the time distribution and peak rate of runoff.

For the proposed developed areas, it was desirable to develop a composite runoff coefficient based on the percentage of different types of surface in each subdrainage area. Different coefficients with respect to surface types are as follows:[1]

Street, walks and driveways	C = 0.90
Roofs	C = 0.90
Lawn, Sandy Soils, Ave. 2 to 7% slope	C = 0.20

---

[1] Table 3-2, Urban Storm Drainage Criteria Manual, Volume I, Denver Regional Council of Governments.

COMPOSITE "C" CALCULATIONS

Refer to Area A as an example:

Step #1: Determine Area subject to runoff = 5.03 acres

Step #2: Determine Hard Surface Area

(a) Streets and Walks (33' BB, 4' Sidewalks)

Length = 1585

Width = 41'

Area = (1585) (41) = 64,985 ft.^{2}

(b) Driveway

Length = 25'

Width = 18'

Area = (25') (18') = 450 ft.^{2} x No. of Units

= 450 ft.^{2} x 30 = 13,500 ft.^{2}

(c) Roofs - Typical Roof = 40' x 50'

Ponded Lots - 1/2 roof drains to street

(1) Area of Roof x No. of Units

(20') (50') = 1000 ft.^{2} x 27 ponded lots = 27,000 ft.^{2}

Unponded Lots - entire roof drains to street.

(1) Area of Roof x No. of Units

(40') (50') = 2000 ft.^{2} x 3 in ponded lots = 6,000 ft.^{2}

Total Hard Surface Area = a) 64,985 ft.^{2}

b) 13,500 ft.^{2}

c) 27,000 ft.^{2}

6,000 ft.^{2}

111,485 ft.^{2}

= 2.56 acres

Step #3: Determine unsurfaced area which drains to the street.

5.03 acres

- 2.56 acres

2.47 acres = Unsurfaced area

Step #4: Calculate composite "C"

$0.90 \left(\frac{2.56}{5.03}\right) = .46$

$0.20 \left(\frac{2.47}{5.03}\right) \quad .10$

.56

The following table (Table I) is a summary of the Composite "C" values for the individual areas of the developed units of Ladera Heights Subdivision.

TABLE III

LADERA HEIGHTS SUBDIVISION

DRAINAGE MASTER PLAN

Subdivision & Drainage Section	Area Acres	By Area C=.20 Acres	By Area C=.90 Acres	Composite "C" Factor (No Units)
A	5.03	2.47	2.56	.56
B	4.00	1.91	2.09	.57
C	5.78	3.00	2.78	.54
D	4.66	2.43	2.23	.53
E	5.26	2.48	2.78	.57
F	4.43	2.18	2.25	.56

Pt. #	Area	% Total Area		Ind. Composite "C"		Overall Composite "C"
Pt. #1	B	1.00	x	.57	=	.57
Pt. #II	A	5.03/9.03	x	.56	=	.31
	B	4.00/9.03	x	.57	=	.25
						.56
Pt. #III	A/2	2.51/10.29	x	.56	=	.14
	B/2	2.00/10.29	x	.57	=	.11
	C	5.78/10.29	x	.53	=	.30
						.55
Pt. #IV	A/2	2.51/9.17	x	.56	=	.15
	B/2	2.00/9.17	x	.57	=	.12
	D	4.66/9.17	x	.53	=	.27
						.54
Pt. #V	A	5.03/19.47	x	.56	=	.14
	B	4.00/19.47	x	.57	=	.12
	C	5.78/19.47	x	.53	=	.16
	D	4.66/19.47	x	.53	=	.13
						.55
Pt. #VI	E	1.0	x	.57	=	.57

RUNOFF COMPUTATIONS

Sheet No. _____

LAUREL HEIGHTS
PROJECT

Drainage Area No. DA#1

Area = 4.00 Acres

C = .57

Maximum Overland Flow: L = 50 feet S = .4

H = 2 feet

Maximum Channel Flow: L = 1045 feet S = .01

H = 9.5 feet

Accumulation Time

Overland Flow: (Figure IV) = 4 min

Channel Flow: (Figure III)

Velocity = 5.9 ft/sec Time = 1045 feet / 5.9 feet/sec x 60 = 3 min

Total Accumulated Time = 7 min

MC = 10 min.

I = 189 / t+25 = 189 / 35 = 5.40 "/hr.

Q = CIA = (.57)(5.4)(4.00) = 12 cfs

Date 11-21-77

Com. by FCA Ck. by _____

RUNOFF COMPUTATIONS

Sheet No. _____

LADERA HEIGHTS
PROJECT

Drainage Area No. II

Area = 9.03 Acres

C = .56

Maximum Overland Flow: L = 50 feet S = [illegible]

H = [illegible] feet

Maximum Channel Flow: L = 170 feet S = [illegible]

H = 10 feet

Accumulation Time

Overland Flow: = 7 min

Channel Flow:

Velocity = [illegible] ft/sec Time = 1170 feet / [illegible] feet/sec x 60 = [illegible] min

Total Accumulated Time = 7 min

I = 18.9 / 4.35 = 18.9 / 3.5 = 5.4 "/hr.

Q = CIA = (.56)(5.4)(9.03) = 27 cfs

Date 11-21-77

Com. by FCH Ck. by _____

RUNOFF COMPUTATIONS

Sheet No. _____

LADERA HEIGHTS
PROJECT

Drainage Area No. III

Area = 10.29 Acres

C = .55

Maximum Overland Flow: L = [illegible] feet S = [illegible]

H = 2 feet

Maximum Channel Flow: L = [illegible] feet S = [illegible]

H = 21 feet

Accumulation Time

Overland Flow: = [illegible] min

Channel Flow:

Velocity = 5.9 ft/sec Time = [illegible] feet / 5.9 feet/sec x 60 = [illegible] min

Total Accumulated Time = 11 min

I = 189 / 4.25 = [illegible] / [illegible] = 5.25 "/hr.

Q = CIA = (.55)(5.25)(10.29) = 30 cfs

Date 11-21-77

Com. by ECA Ck. by _____

RUNOFF COMPUTATIONS

Sheet No. _____

[illegible] HEIGHTS
PROJECT

Drainage Area No. IV

Area = 9.17 Acres

C = .54

Maximum Overland Flow: L = 50 feet S = [illegible]

H = 2 feet

Maximum Channel Flow: L = 2420 feet S = [illegible]

H = [illegible] feet

Accumulation Time

Overland Flow: = 4 min

Channel Flow:

Velocity = 5.9 ft/sec Time = 2420 feet / 5.9 feet/sec x 60 = 7 min

Total Accumulated Time = 11 min

I = 189 / t+25 = 189 / [illegible] = [illegible] "/hr.

Q = CIA = (.54)([illegible])(9.17) = [illegible] cfs

Date 11-21-77

Com. by ECA Ck. by _____

RUNOFF COMPUTATIONS

Sheet No. _____

LADERA HEIGHTS
PROJECT

Drainage Area No. V

Area = 19.47 Acres

C = .55

Maximum Overland Flow: L = 50 feet S = [illegible]

H = 2 feet

Maximum Channel Flow: L = 2635 feet S = [illegible]

H = 23 feet

Accumulation Time

Overland Flow: = [illegible] min

Channel Flow:

Velocity = 5.9 ft/sec Time = $\frac{2635 \text{ feet}}{5.9 \text{ feet/sec} \times 60}$ = 7 min

Total Accumulated Time = 11 min

I = $\frac{189}{4.25}$ = $\frac{189}{11}$ = [illegible] "/hr.

Q = CIA = (.55)([illegible])(19.47) = 56 cfs

Date 11-21-77

Com. by EGA Ck. by _____

RUNOFF COMPUTATIONS

Sheet No. _____

LADERA HEIGHTS
PROJECT

Drainage Area No. VI

Area = 9.7 Acres

C = .57

Maximum Overland Flow: L = 150 feet S = [illegible]

H = 3 feet

Maximum Channel Flow: L = 1110 feet S = 1

H = [illegible] feet

Accumulation Time

Overland Flow: = _____ min

Channel Flow:

Velocity = 5.9 ft/sec Time = $\frac{1110 \text{ feet}}{5.9 \text{ feet/sec} \times 60}$ = 5 min

Total Accumulated Time = 11 min

I = $\frac{189}{t+25}$ = $\frac{189}{36}$ = 5.25 "/hr.

Q = CIA = (.57)(5.25)(9.7) = 29 cfs

Date 11-21-77

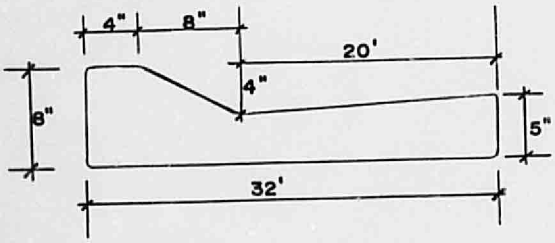
Com. by FCH Ck. by _____

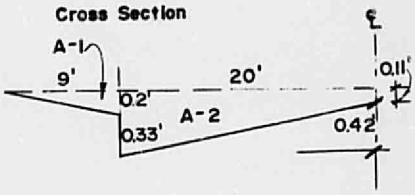
STREET CAPACITIES (100 year storm)

Street carrying capacities for 32' FF, with 4" crown and with no overflow at a 0.5% slope equals a Q of 63 cfs. No street will carry runoff approaching 63 cfs.

STREETS WITH MOUNTABLE CURB

Street Section 40 FF, 4" crown, 0.2 overflow.





A - 1 $(9)(0.2)(1/2)(2) = 1.80$

A - 2 $\frac{(0.53 + 0.11)}{2} \times 20 \times 2 = \frac{12.8}{14.6 \text{ ft.}^2}$

W.P. $= 50 + 2\ (.33) = 50.67$

$Q = \frac{1.486}{n} \times \frac{d\ 5/3}{p\ 2/3} \times S\ 1/2\ (n = .015)$

$Q = \frac{1.486}{.015} \times \frac{(14.6)^{1.67}}{50.67^{0.67}} \times S\ 1/2$

$= 628\ S\ 1/2$

Shere S = .008

Q = 56 cfs

Velocity = Q/A

V = 3.8 ft/sec

COMBINATION INLETS

Design Information: Manhole elevation = 5108.5

Inlets will be located in a sump with an elevation of 5103 and will be of a double inlet design, capable of handling 29 cfs.

Solution:

Q = 29 cfs

Q/2 = 14.5 cfs (one side of St. Josephs Ave.)

Combination Inlet in 2" depression and 2" overflow.

Curb open length = 6 feet

Curb open height = 6 inches

Grate clear opening = 6 sq. feet.

(1) Allowable ponding depth over grate = 4" (curb) + 2" (sump) = 6"

(2) Grate capacity = 6 $ft.^2$ x 3.8 = 22.8 cfs (Figure V)

(3) Curb opening capacity = 6' - 0" x 0.75 cfs/ft = 4.5 cfs (Figure VI)

(4) Total theoretical capacity of inlet = (22.8 + 4.5) cfs = 27.3 cfs.

(5) Reduction Factor = 0.65 0.65 x 27.3 = 17.75

(6) Check - 17.75 14.5

REAR YARD PONDS

Development of the R-1 area increases runoff by approximately 1.33 times the undeveloped flow rate. The use of rear yard ponds will help prevent the developed runoff rate from exceeding the undeveloped rate.

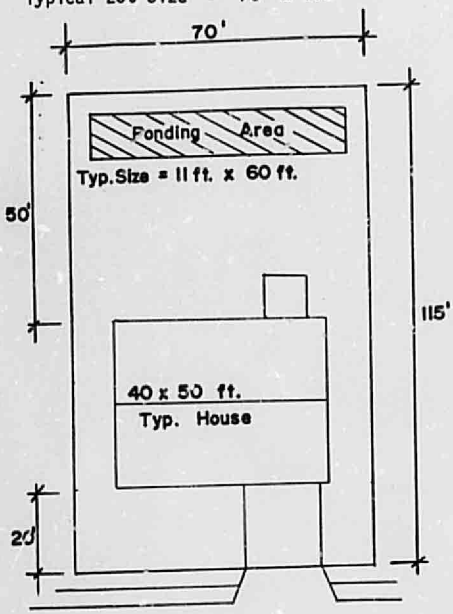
For the individual lot with backyard ponding, the only area within each lot to contribute flow to the street would be the frontyard, one-half of the roof and sideyards. The area required for backyard ponds, 0.5' deep, average around 13% of the total area draining to the pond. This area includes the rear one-half of the roof, one-half of the sideyard, and all of the rear yard. The following sketch shows these relationships.

Looking at the R-T area, no backyard ponding was required because of the availability of a major storm drainage system located within the R-T area. However, some backyard ponding may be desired to avoid grading problems. The calculations reflect total runoff from the R-T area.

HYDROLOGY G10/D5 TWO OF TWO FOUR PLANS

REAR YARD POND CALCULATIONS

Typical Lot Size = 70' x 115'



Area Drainage to Rear Yard
70 ft. x 70 ft. = 4900 sq. ft.
Roof Area = 20 ft. x 50 ft.
= 1000 sq. ft.
Patio (typ.) = $(10.0)^2$ = 100 sq. ft.

Composite "C"

$0.9\ (\frac{1100}{4900}) = .20$

$0.2\ (\frac{3800}{4900}) = .16$

$.36$

Volume of Runoff*

(Area)(2.2 in.)(c)(1/12) =

(4900)(2.2 in.)(.36)(1/12)= 323 cu. ft.

at 0.5' in depth in Pond Surface
Area Required = 646 sq. ft.
Typical Pond Size = 11 ft. x 60 ft.

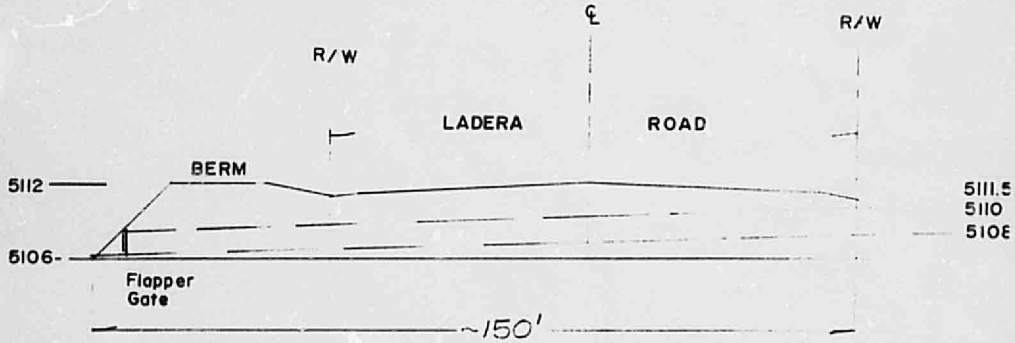
% of Area = $\frac{646}{4900}$ = 13%

*Precipitation for 100 year - 6 hour storm = 2.2 in.

LADERA STREET CULVERT COMPUTATIONS

R-2-3 Areas

In order to have runoff flow into the Ladera Detention Basin, a system of culverts with directional control devices could be developed. Other methods of handling runoff from the R-2-3 areas could be total ponding onsite.



Design: Where, Q = 72 cfs

V = CDA(1/12) = 2.2 ac-ft.

Headwater ratio to pipe dia. = 1.4

Try 4 - 24" R.C.P.

Q_1 = 18 cfs (Figure VII, VIII)

Q_4 = 72 cfs -- checks

Use 4 - 24" R.C.P. culverts at approximately 150' each in length, each with a directional control device.

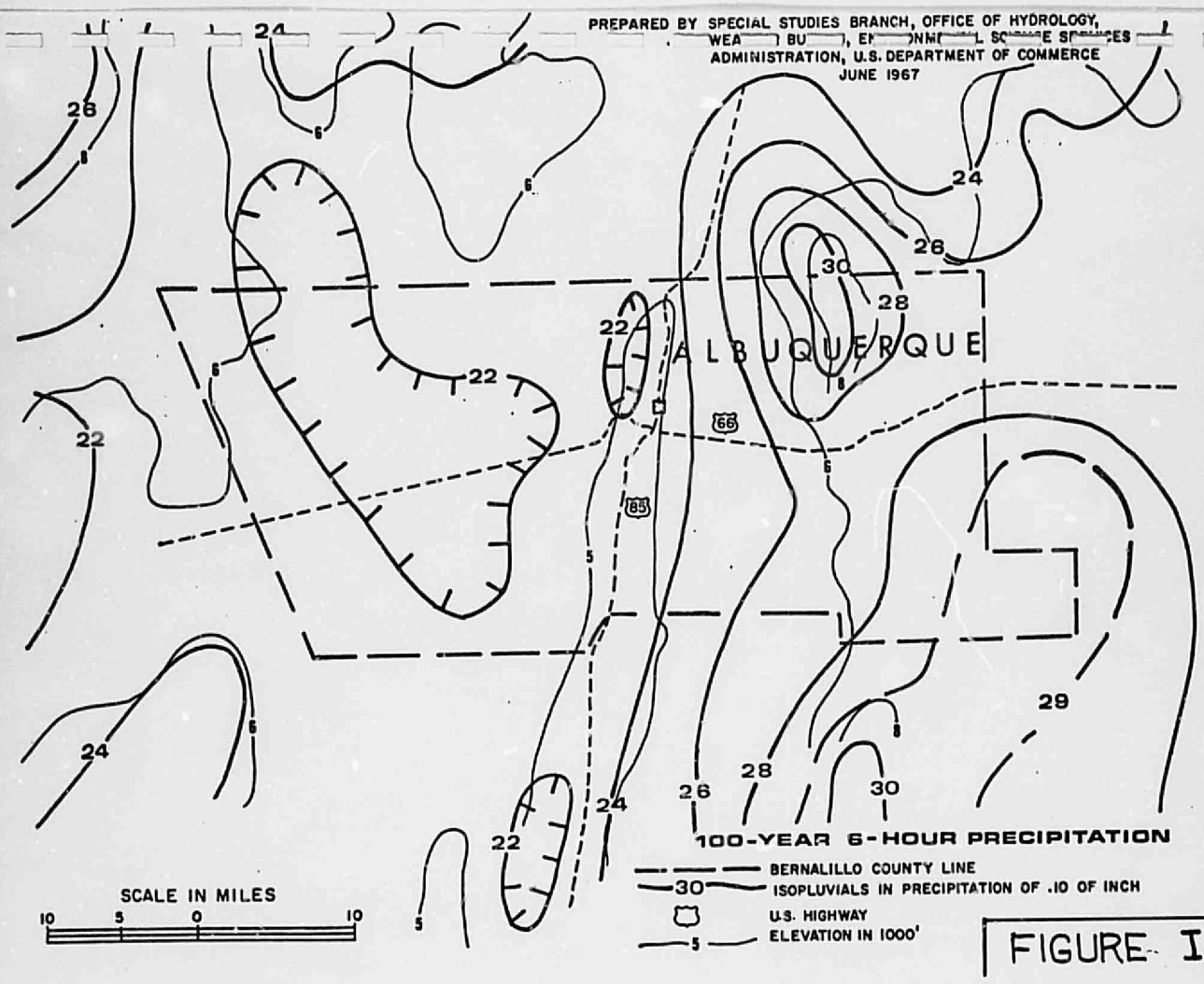

PREPARED BY SPECIAL STUDIES BRANCH, OFFICE OF HYDROLOGY,
WEA BU, EN NM L SC E SE ES
ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE
JUNE 1967
ALBUQUERQUE
66
85
100-YEAR 6-HOUR PRECIPITATION
BERNALILLO COUNTY LINE
30 ISOPLUVIALS IN PRECIPITATION OF .10 OF INCH
U.S. HIGHWAY
5 ELEVATION IN 1000'
SCALE IN MILES
10 5 0 10

FIGURE I

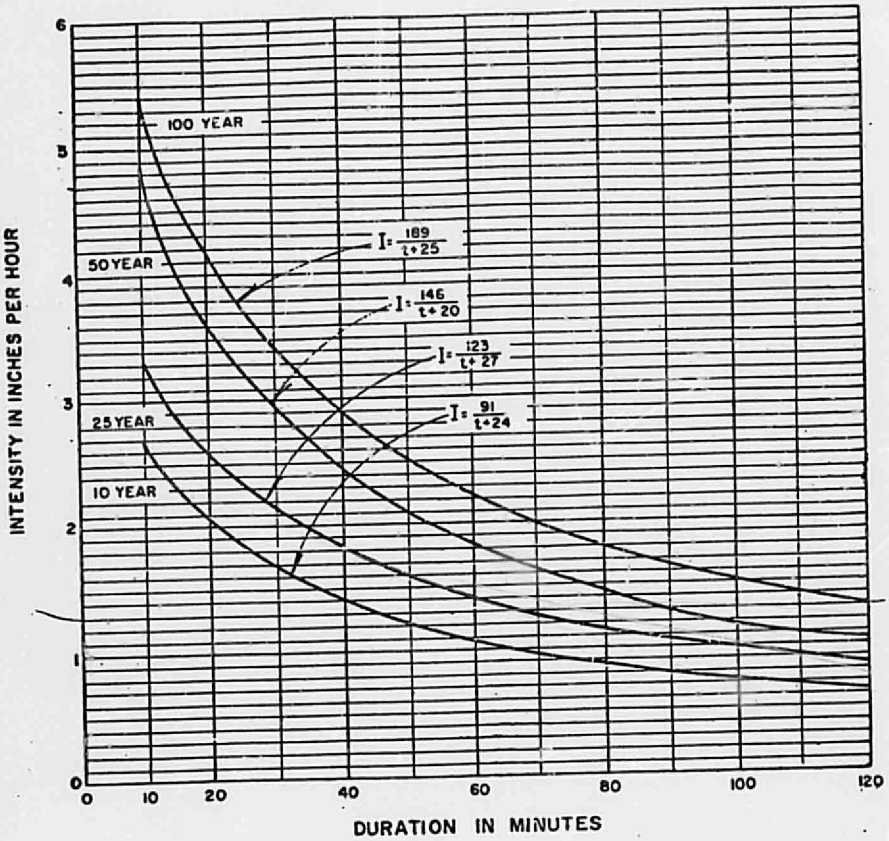
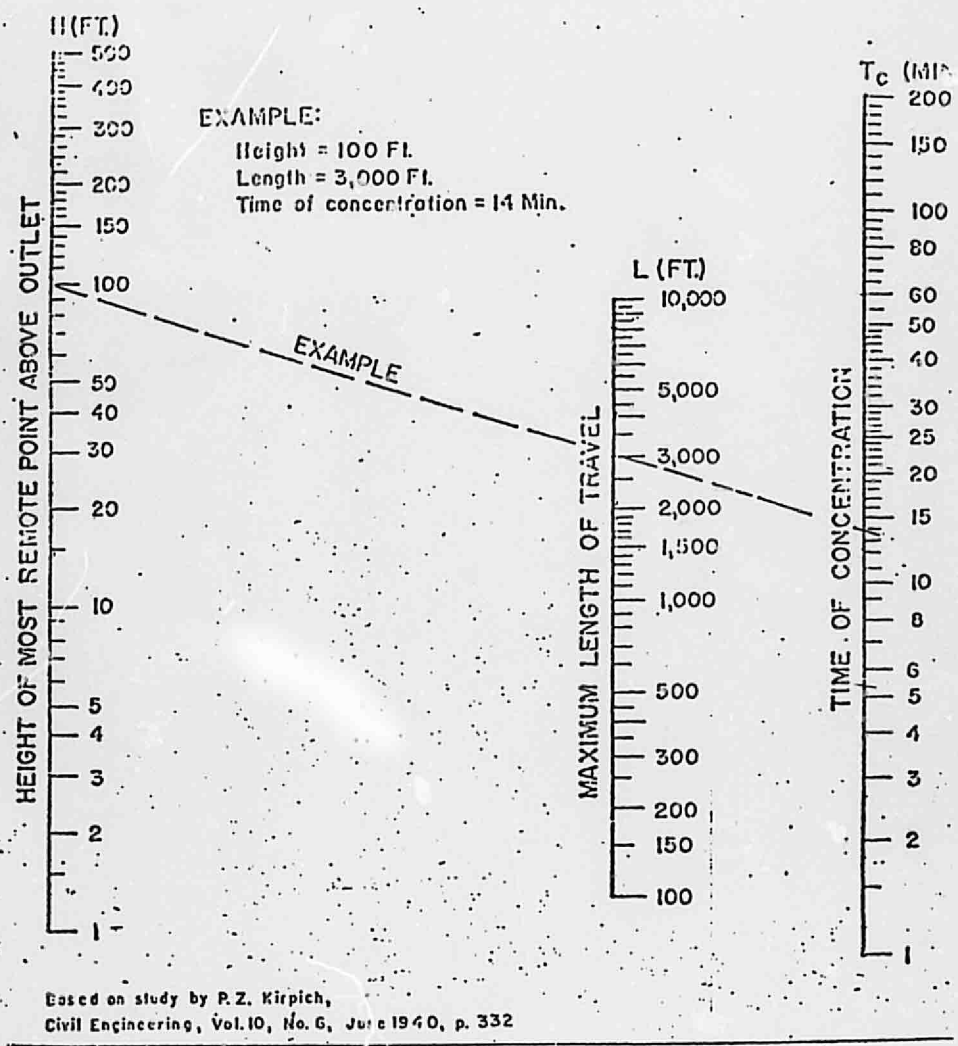


FIGURE II

MASTER PLAN OF DRAINAGE CITY OF ALBUQUERQUE – NEW MEXICO AND ENVIRONS	
INTENSITY DURATION FREQUENCY CURVES (ALBUQUERQUE AREA - 1961)	
GORDON HERKENHOFF & ASSOC CONSULTING ENGINEERS ALBUQUERQUE, NEW MEXICO	CHART 1



Based on study by P. Z. Kirpich,
Civil Engineering, Vol. 10, No. 6, June 1940, p. 332

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

Reprinted from "Design of Roadside Drainage Channels - Hydraulic Engineering Circular No. 6", April 1962, U. S. Dept.

FIGURE III

FIGURE IV

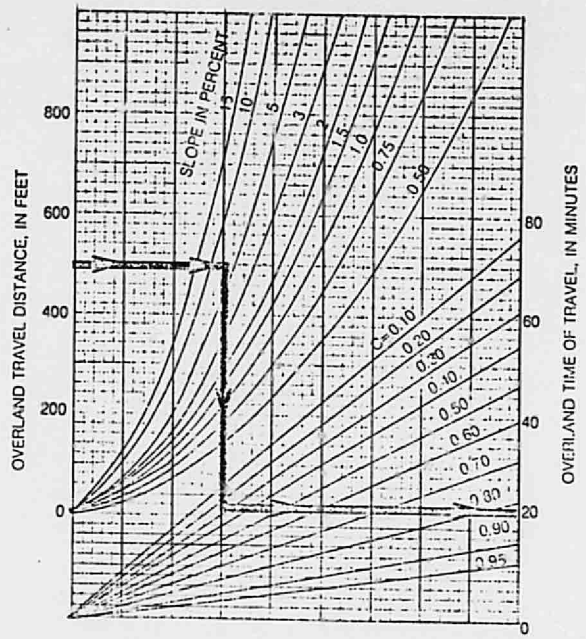
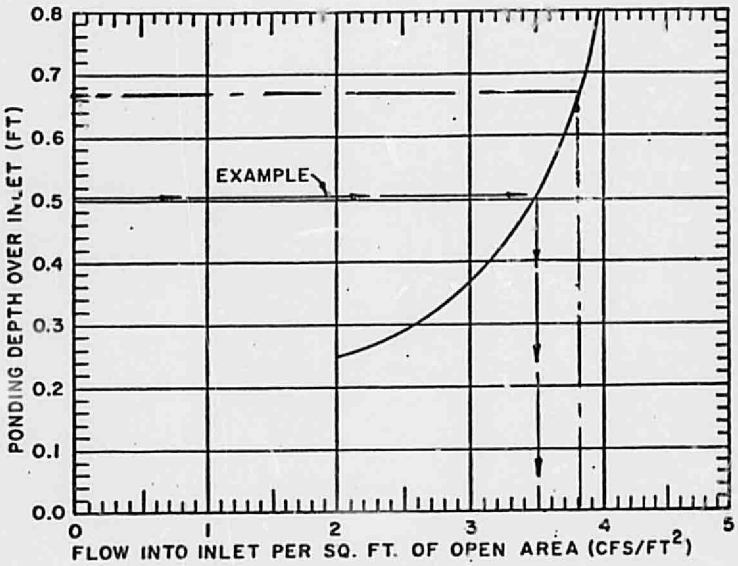


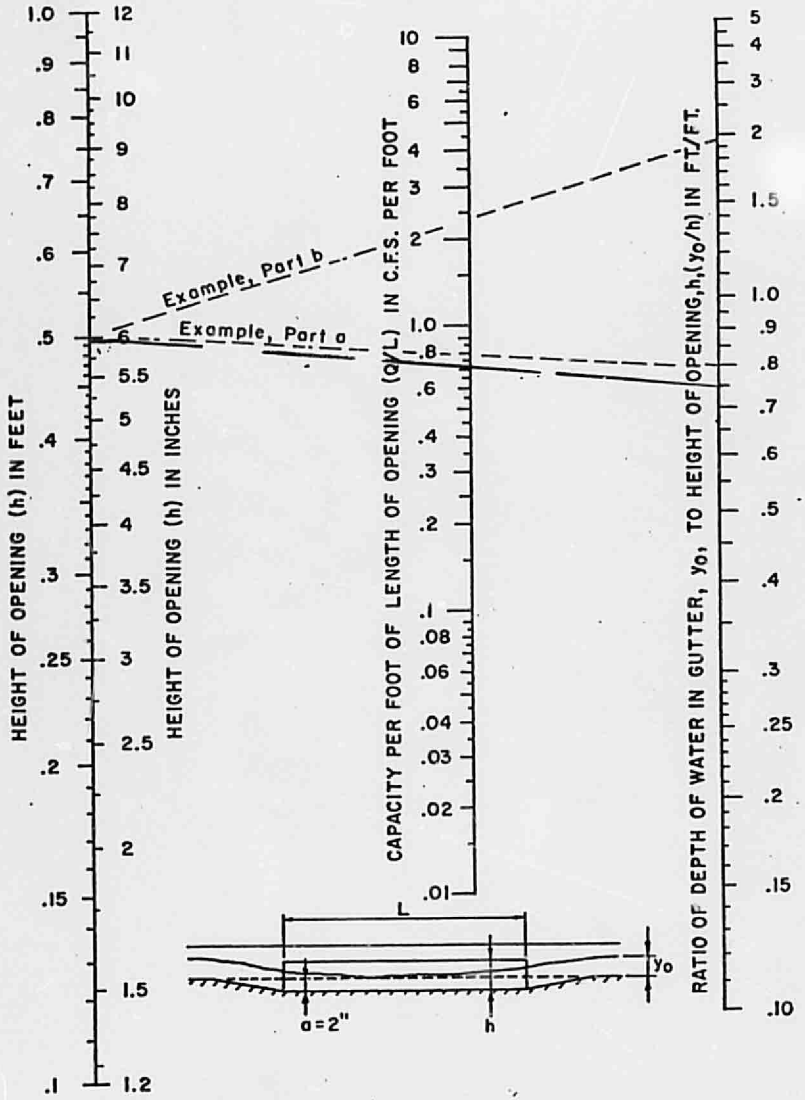
Figure 2
Relation of overland time of travel to overland travel distance, average overland slope, and coefficient C —for use in Rational Method.

Source:
Wright-McLaughlin Engineers/
"Airport Drainage,"
Federal Aviation Administration
Washington, DC 1965.



~~FIGURE 5-1~~. CAPACITY OF GRATED INLET IN SUMP

FIGURE V



NOMOGRAPH FOR CAPACITY OF CURB OPENING
INLETS IN SUMPS, DEPRESSION DEPTH 2"

Adopted from Bureau of Public Roads Nomograph.

FIGURE VI

CORRUGATED PIPE					
CIRCULAR & ARCH		FULL ASPHALT-SPUN LINED		UNLINED OR ASPHALT-COATED	
SIZE	AREA	AM	0.0155M²	AM	0.0135M²
18"X11"	1.01	48	36	26	10
15"	1.23	65	43	35	13
22"X13"	1.56	85	46	46	14
18"	1.77	105	55	57	16
25"X16"	2.17	134	59	72	17
21"	2.41	159	67	86	20
29"X18"	2.86	192	70	104	21
24"	3.14	226	80	122	24
36"X22"	4.33	333	92	180	27
30"	4.91	410	108	222	32
43"X27"	6.39	560	119	303	35
36"	7.07	667	138	361	40
50"X31"	8.48	816	144	442	42
42"	9.62	1006	170	545	50
58"X36"	11.44	1216	175	659	51
48"	12.57	1437	203	778	59
65"X40"	14.22	1624	202	880	59
54"	15.90	1965	237	1064	69
72"X44"	17.31	2109	230	1143	68
60"	19.63	2603	273	1410	80
66"	23.76	3357	309	1818	91
72"	28.27	4233	348	2293	102
78"	33.18	5242	387	2839	113
84"	38.48	6387	427	3459	125
90"	44.18	7681	469	4161	137
96"	50.27	9119	510	4940	150

CONCRETE PIPE			
SIZE	AREA	AM	0.0155M²
12"	0.79	39	37
15"	1.23	70	50
18"	1.77	114	64
21"	2.41	172	79
24"	3.14	245	94
27"	3.98	336	110
30"	4.91	444	127
33"	5.94	573	144
36"	7.07	723	162
39"	8.30	894	180
42"	9.62	1090	199
45"	11.04	1310	218
48"	12.57	1556	238
51"	14.19	1829	258
54"	15.90	2130	278
57"	17.72	2461	299
60"	19.64	2821	320
63"	21.65	3214	342
66"	23.76	3638	363
69"	25.97	4096	386
72"	28.27	4588	408
75"	30.68	5116	431
78"	33.18	5680	[illegible]
81"	35.78	6281	478
84"	38.48	6921	501
87"	41.28	7600	525
90"	44.13	8319	550
93"	47.17	9079	574
96"	50.27	9881	599

SQUARE ROOTS OF DECIMAL NUMBERS

NUMBER	—0	—1	—2	—3	—4	—5	—6	—7	—8	—9
.001	.03162	.03317	.03464	.03606	.03742	.03873	.04000	.04123	.04243	.04359
.002	.04472	.04583	.04690	.04796	.04899	.05000	.05099	.05196	.05292	.05385
.003	.05477	.05568	.05657	.05745	.05831	.05916	.06000	.06083	.06164	.06245
.004	.06325	.06403	.06481	.06557	.06633	.06708	.06782	.06856	.06928	.07000
.005	.07071	.07141	.07211	.07280	.07348	.07416	.07483	.07550	.07616	.07681
.006	.07746	.07810	.07874	.07937	.08000	.08062	.08124	.08165	.08246	.08307
.007	.08367	.08426	.08485	.08544	.08602	.08660	.08718	.08775	.08832	.08888
.008	.08944	.09000	.09055	.09110	.09165	.09220	.09274	.09327	.09381	.09434
.009	.09487	.09539	.09592	.09644	.09695	.09747	.09798	.09849	.09899	.09950
.010	.10000	.10050	.10100	.10149	.10198	.10247	.10296	.10344	.10392	.10440
.01	.1000	.1049	.1095	.1140	.1183	.1225	.1265	.1304	.1342	.1378
.02	.1414	.1449	.1483	.1517	.1549	.1581	.1612	.1643	.1673	.1703
.03	.1732	.1761	.1789	.1817	.1844	.1871	.1897	.1924	.1949	.1975
.04	.2000	.2025	.2049	.2074	.2098	.2121	.2145	.2168	.2191	.2214
.05	.2236	.2258	.2280	.2302	.2324	.2345	.2366	.2387	.2408	.2429
.06	.2449	.2470	.2490	.2510	.2530	.2550	.2569	.2588	.2608	.2627
.07	.2646	.2665	.2683	.2702	.2720	.2739	.2757	.2775	.2793	.2811
.08	.2828	.2846	.2864	.2881	.2898	.2915	.2933	.2950	.2966	.2983
.09	.3000	.3017	.3033	.3050	.3066	.3082	.3098	.3114	.3130	.3146
.10	.3162	.3178	.3194	.3209	.3225	.3240	.3256	.3271	.3286	.3302

DERIVATION:

$Q = AV, \quad V = \frac{1.486}{n} R^{2/3} S^{1/2}$

$M = \frac{1.486}{n} R^{2/3}$

$V = MS^{1/2}$

$Q = AMS^{1/2}$

$H_v = \frac{V^2}{2g} = 0.0155 M^2 S$

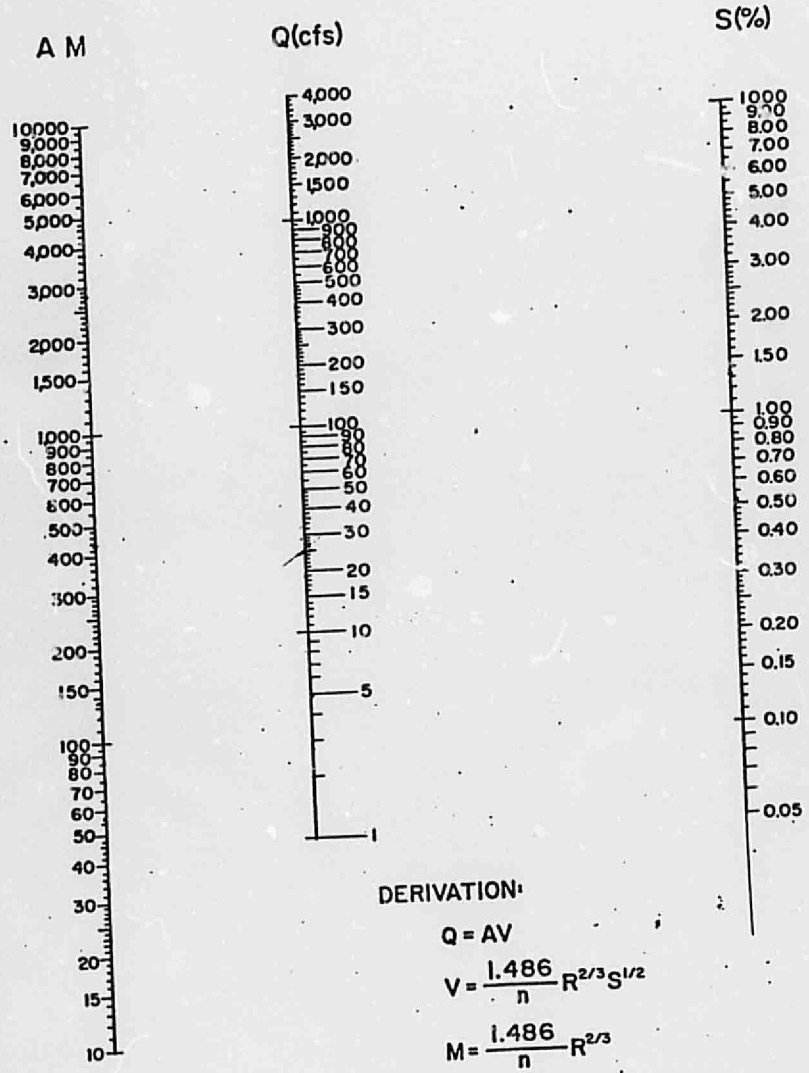
$H_f = LS$

Q = quantity of water carried by pipe in cu. ft. per sec.
A = area of pipe in sq. ft.
V = mean velocity of water in ft per. sec.
R = mean hydraulic radius in ft.
M = constant dependent on "n" and size of pipe.
S = slope of hydraulic gradient in ft. per ft.
H_v = velocity head in feet.
H_f = friction head in feet.
L = length of conduit in feet.
n = 0.012 for concrete pipe, 0.013 for "full asphalt-spun" lined corrugated metal pipe and 0.024 for regular corrugated metal pipe (unlined or asphalt-coated).

CONSTANTS FOR MANNING'S FORMULA, PIPE FLOWING FULL

FIGURE VII

Plate 2.6-0603



DERIVATION:

$$Q = AV$$

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

$$M = \frac{1.486}{n} R^{2/3}$$

$$Q = AMS^{1/2}$$

NOMOGRAM $Q = AMS^{1/2}$
Plate 2.6-0602

FIGURE VIII