HYDROLOGY G21/D15 2 PLANS

G21/D15

2 PLANS

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

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

June 10, 1986

Jeff Mortensen, PE
Tom Mann and Associates
811 DaLLas NE
Albuquerque, NM 87110

REF: REVISED DRAINAGE AND GRADING PLAN OF MONTGOMERY PROFESSIONAL CENTER, LOTS B & C, TRACT A, TOLETEC PARK, RECEIVED MAY 22, 1986, FOR CERTIFICATE OF OCCUPANCY APPROVAL (G21/D15)

Dear Jeff:

The above referenced submittal, revised 4/10/86 is approved. It is your responsibility to see that the contractor for any existing building permits has this approved plan to complete construction with.

If you have any questions call me at 766-7644.

Roger A. Green, PE

Roger A. Green, PE
CE/Hydrology

RAG:mrk

21223

DRAINAGE INFORMATION SHEET

PROJECT TITLE: MONTGOMERY PROFESSIONAL CENTER ZONE ATLAS/DRNG. FILE #: G21

LEGAL DESCRIPTION: LOTS B & C, TRACT A, TOLTEC PARK

CITY ADDRESS:

ENGINEERING FIRM: TOM MANN & ASSOC. CONTACT: J.G. MORTENSEN

ADDRESS: 811 DALLAS NE. PHONE: 265-5611

OWNER: ROGER SMITH CONTACT: ENGINEER

ADDRESS: PHONE:

ARCHITECT: DON KRUEGER CONTACT: BILL KONOPIK

ADDRESS: PHONE: 293-7888

SURVEYOR: TOM MANN & ASSOC. CONTACT: J.G. MORTENSEN

ADDRESS: 811 DALLAS NE PHONE: 265-5611

CONTRACTOR: GENERAL BUILDERS CONTACT: ROGER SMITH

ADDRESS: PHONE:

RECEIVED MAY 22 1986 HYDROLOGY SECTION

PRE-DESIGN MEETING:

___ YES

___ NO

___ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO. ___

EPC NO. ___

PROJ. NO. ___

TYPE OF SUBMITTAL:

___ DRAINAGE REPORT

✓ DRAINAGE PLAN

___ CONCEPTUAL GRADING & DRAINAGE PLAN

✓ GRADING PLAN

___ EROSION CONTROL PLAN

___ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

___ SKETCH PLAT APPROVAL

___ PRELIMINARY PLAT APPROVAL

___ SITE DEVELOPMENT PLAN APPROVAL

___ FINAL PLAT APPROVAL

___ BUILDING PERMIT APPROVAL

___ FOUNDATION PERMIT APPROVAL

✓ CERTIFICATE OF OCCUPANCY APPROVAL

___ ROUGH GRADING PERMIT APPROVAL

___ GRADING/PAVING PERMIT APPROVAL

✓ OTHER PARKING LOT REVISION (SPECIFY)

DATE SUBMITTED: 05-22-86

BY: J.G. MORTENSEN

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

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

March 14, 1985

Jay T. Olson
Tom Mann & Associates, Inc.
811 Dallas, NE
Albuquerque, New Mexico 87110

RE: DRAINAGE/GRADING PLAN FOR MONTGOMERY PROFESSIONAL CENTER
(G-21/D15) RECEIVED FEBRUARY 22, 1985

Dear Mr. Olson:

The referenced plan dated February 22, 1985, is approved.

Please attach a copy of this approved plan along with the appropriately approved "Drainage Facilities Within City Right-of-Way" document to the construction set prior to Hydrology sign-off.

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

Cordially,

Carlos A. Montoya

Carlos A. Montoya, P.E.
City/County Floodplain Administrator

CAM/bsj

cc: Greg Olson
Design Section

21222

DRAINAGE INFORMATION S' T

PROJECT TITLE: MONTGOMERY PROFESSIONAL CENTER ZONE ATLAS/DRNG. FILE #: G-21/D15

LEGAL DESCRIPTION: LOT B AND LOT C, TOLTEC PARK

CITY ADDRESS:

ENGINEERING FIRM: TOM MANN & ASSOCIATES CONTACT: JAY T. OLSON

ADDRESS: 811 DALLAS NE; 87110 PHONE: 265-5611

OWNER: NOT KNOWN CONTACT: —

ADDRESS: — PHONE: —

ARCHITECT: KRUEGER & ASSOCIATES CONTACT: BILL KONOPIK

ADDRESS: PHONE: 293-7888

SURVEYOR: TOM MANN CONTACT: JAY T. OLSON

ADDRESS: 811 DALLAS NE; 87110 PHONE: 265-5611

CONTRACTOR: NOT KNOWN CONTACT: —

ADDRESS: — PHONE: —

PRE-DESIGN MEETING:

✓ YES CONCEPTUAL GRADING & DRAINAGE PLAN APP. 12/1/1982

___ NO

___ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO. ~~DRB-82-167~~ 85-152 (2/26/85 3-5-85

EPC NO. Z-79-173

PROJ. NO. _____

TYPE OF SUBMITTAL:

___ DRAINAGE REPORT

✓ DRAINAGE PLAN

___ CONCEPTUAL GRADING & DRAINAGE PLAN

✓ GRADING PLAN

___ EROSION CONTROL PLAN

___ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

___ SKETCH PLAT APPROVAL

___ PRELIMINARY PLAT APPROVAL

___ SITE DEVELOPMENT PLAN APPROVAL

___ FINAL PLAT APPROVAL

✓ BUILDING PERMIT APPROVAL

___ FOUNDATION PERMIT APPROVAL

___ CERTIFICATE OF OCCUPANCY APPROVAL

___ ROUGH GRADING PERMIT APPROVAL

___ GRADING/PAVING PERMIT APPROVAL

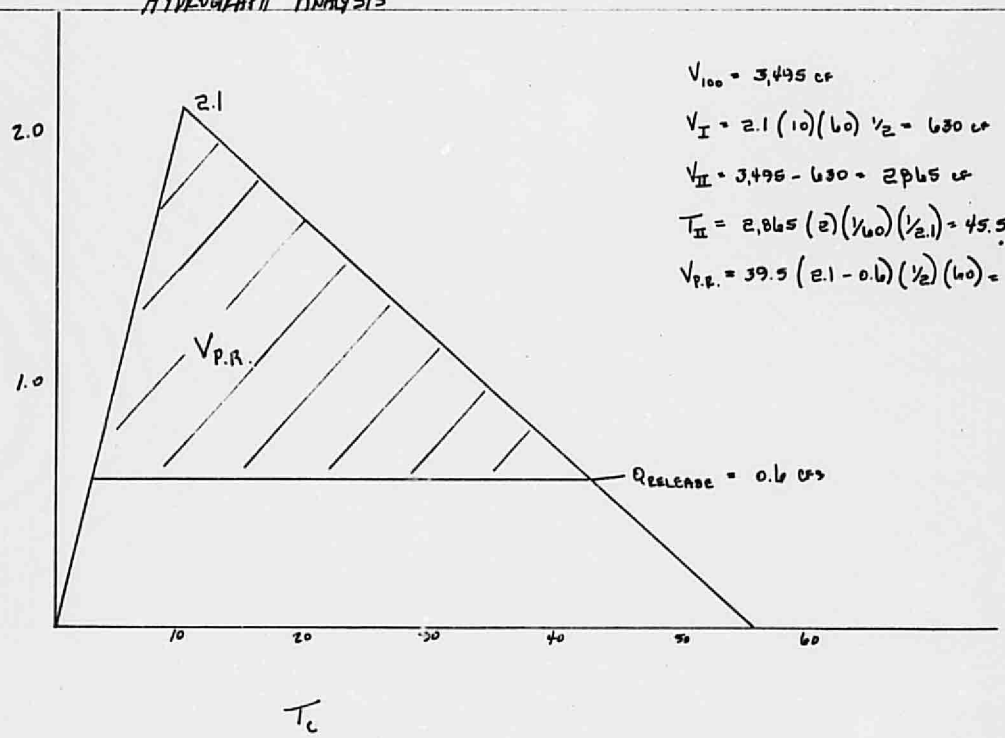
___ OTHER _____ (SPECIFY)

RECEIVED FEB 22 1985 HYDROLOGY SECTION

DATE SUBMITTED: FEBRUARY 22, 1985

BY: Jay T. Olson

LOT B
HYDROGRAPH ANALYSIS



V_{100} = 3,495 cf

V_I = 2.1 (10)(60) ½ = 630 cf

V_{II} = 3,495 - 630 = 2865 cf

T_{II} = 2,865 (2)(1/60)(1/2.1) = 45.5 min.

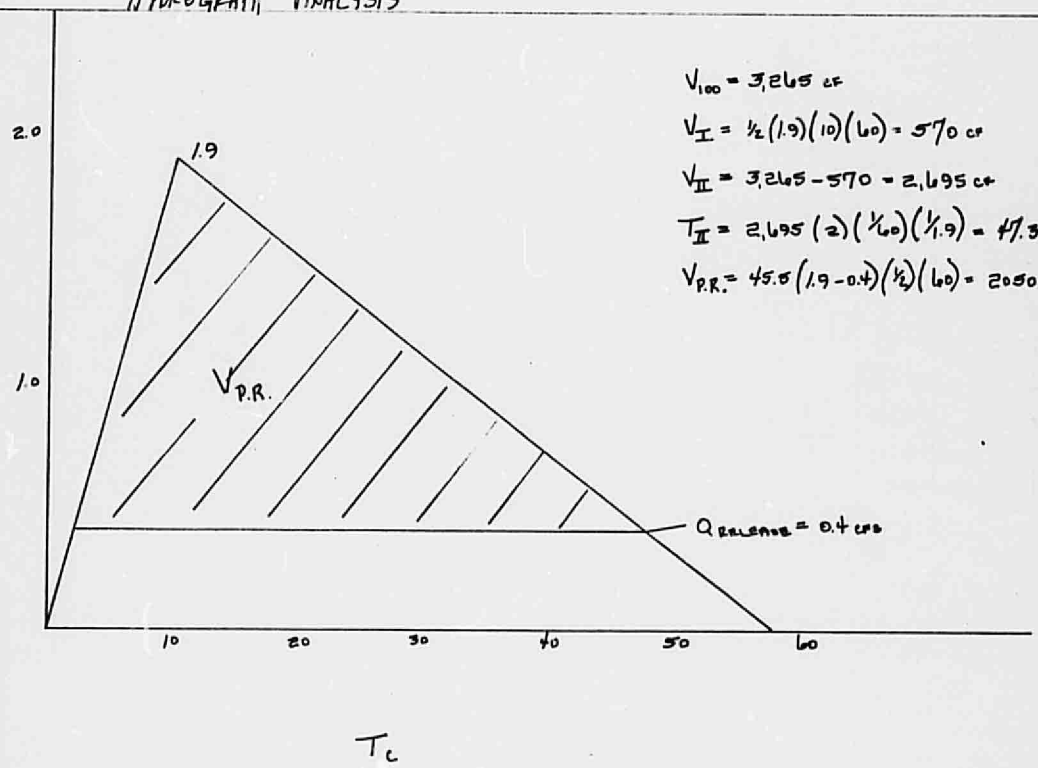
$V_{P.R.}$ = 39.5 (2.1 - 0.6)(½)(60) = 1,780 cf

RECEIVED
FEB 22 1985
HYDROLOGY SECTION

21222

LOT C

HYDROGRAPH ANALYSIS



$V_{100} = 3{,}265$ cf

$V_I = \frac{1}{2}(1.9)(10)(60) = 570$ cf

$V_{II} = 3{,}265 - 570 = 2{,}695$ cf

$T_{II} = 2{,}695\,(2)\left(\frac{1}{60}\right)\left(\frac{1}{1.9}\right) = 47.3$ MIN

$V_{P.R.} = 45.5\,(1.9 - 0.4)\left(\frac{1}{2}\right)(60) = 2050$ cf

RECEIVED
FEB 22 1985
HYDROLOGY SECTION

21222

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

G21 - D15

December 1, 1982

Mr. Jeff Mortensen
Tom Mann & Associates
811 Dallas N.E.
Albuquerque, N.M. 87110

RE: REVIEW OF TOLTEC PARK DRAINAGE PLAN

Dear Jeff:

The referenced plan dated 11/15/82 is approved. I do want to point out, however, that prior to a certificate of occupancy being issued for either Building A or Building C, the necessary drainage facilities for each structure must be constructed. In other words, all facilities (pond, outlet works, and paving) north of the lot line/drainage boundary must be installed in conjunction with Building A. Likewise, facilities south of the line must be installed in conjunction with Building C.

Please see that approved copies of Special Order No. 19 are attached to the City construction sets. Mr. Fred Aguirre will sign-off for Hydrology when this is done.

Very truly yours,

Brian G. Burnett
Civil Engineer/Hydrology

BGB/tsl

21221

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

DRAINAGE REPORT INFORMATION SHEET

PROJECT TITLE TOLTEC PARK - TRACT A

ZONE ATLAS PAGE NO. G-21 CITY ADDRESS MORRIS ST NE

LEGAL ADDRESS TRACT A TOLTEC PARK

ENGINEERING FIRM TOM MAHN & ASSOC. CONTACT J. MORTENSEN

ADDRESS 811 DALLAS NE PHONE 265-5611

OWNER JAMES JORY CONTACT DON KRUEGER

ADDRESS PHONE 293-7888

ARCHITECT/~~SURVEYOR~~ DON KRUEGER CONTACT DON KRUEGER

ADDRESS 126 GEN. CHENNAULT NE PHONE 293-7888

DATE SUBMITTED 11-~~16~~ 15-82

BY JEFFREY G. MORTENSEN

RECEIVED

NOV 15 1982

ENGINEERING

JOHN B. ROBERT
EXECUTIVE ENGINEER

B. H. SWINBURNE, CHAIRMAN
FRED LUTHY, JR., VICE-CHAIRMAN
RICHARD H. CLOUGH, SEC.-TREAS.
WILLIAM V. HEREFORD, DIRECTOR
FRANCES McCOY, DIRECTOR

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority
3112 GIRARD N.E.
P. O. BOX 25851 - ALBUQUERQUE, N. M. 87125
TELEPHONE 268-4519

February 20, 1974

Chambers, Campbell, Isaacson, Chaplin, Inc.
3500 Indian School Road, N. E.
Albuquerque, New Mexico 87106

Gentlemen:

I have reviewed the proposed drainage plan for the Toltec Park Development and find that the plan meets our requirements; therefore, when the plat is available for signature, this office will be happy to sign-off.

Very sincerely yours,

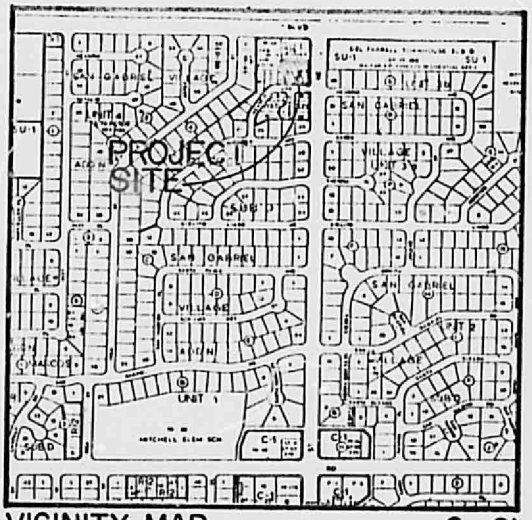
John B. Robert
Executive Engineer

JBR:gfm

CITY OF ALBUQUERQUE

DRAINAGE FACILITIES WITHIN CITY RIGHT-OF-WAY

RECEIVED
APR 08 1986
HYDROLOGY SECTION



VICINITY MAP **G-21**

SCALE : 1" = 800'

LEGAL DESCRIPTION
LOT C, TRACT A, TOLTEC PARK

JEFFREY G. MORTENSEN
NEW MEXICO
8547
02-27-85
REGISTERED PROFESSIONAL ENGINEER

NOTICE TO CONTRACTOR

1. An excavation/construction permit will be required before beginning any work within City right-of-way. An approved copy of these plans must be submitted at the time of application for this permit.

2. All work detailed on these plans to be performed, except as otherwise stated or provided hereon, shall be constructed in accordance with "Public Works Contract No. 8 - ".

3. Two working days prior to any excavation, contractor must contact Line Locating Service, 765-1234, for location of existing utilities.

4. Prior to construction, the contractor shall excavate and verify the horizontal and vertical locations of all obstructions. Should a conflict exist, the contractor shall notify the engineer so that the conflict can be resolved with a minimum amount of delay.

5. Backfill compaction shall be according to RESIDENTIAL street use.

CONTINENTAL CONCRETE G21-D15 E-27 JOB NO. 21222

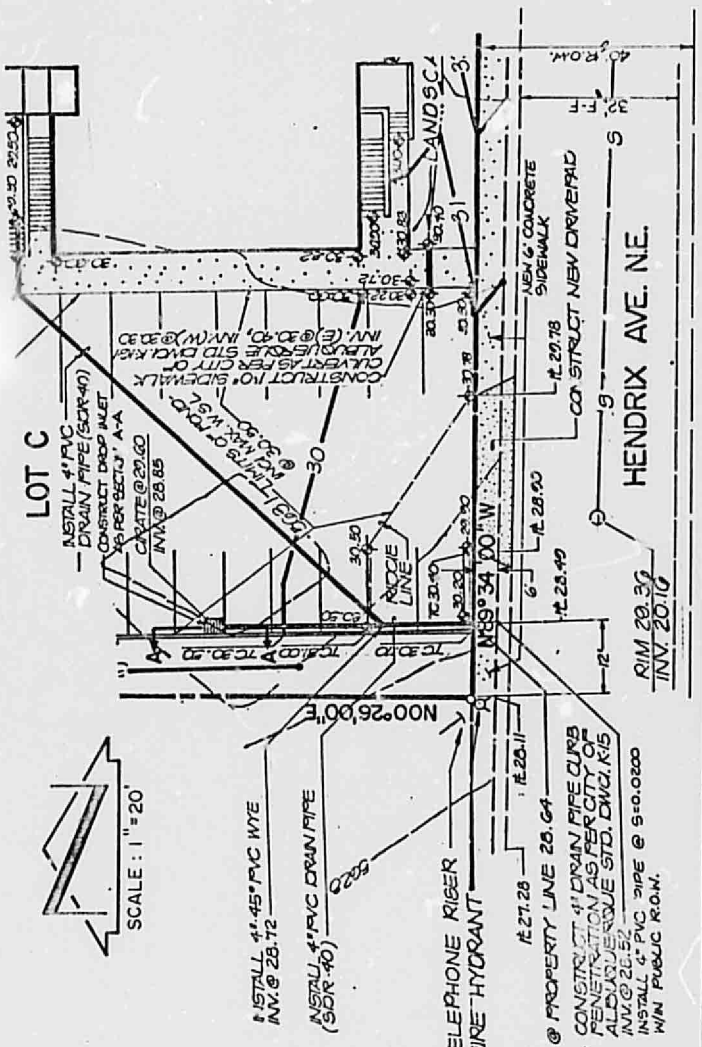
APPROVALS	NAME	DATE	TITLE: CURB PENETRATION MONTGOMERY PROFESSIONAL CENTER 10543 HENDRIX AVE.N.E.
A.C.E./DESIGN		02/28/85	
INSPECTOR			DRAWING NO. 26309 — MAP G-21

CITY OF ALBUQUERQUE

DRAINAGE FACILITIES WITHIN CITY RIGHT-OF-WAY

PROJECT BENCHMARK
AN ACS BRASS TABLET STAMPED "10-G21" SET FLUSH WITH THE CURB. LOCATED IN THE S.W. QUADRANT OF THE INTERSECTION OF MONTGOMERY BLVD., N.E. AND MORRIS ST., N.E. 48.2' SOUTH OF THE CENTERLINE OF MONTGOMERY AND 26.0' WEST OF THE CENTERLINE OF MORRIS.
ELEVATION = 5636.11 FEET (MSLD)

TBM
TOP OF CURB ELEVATION @ THE N.N.W. CURB RETURN IN THE NORTHWEST CORNER OF THE INTERSECTION OF MORRIS ST. NE AND HENDRIX AVENUE N.E. ELEV.=5638.51 FT. (MSLD)



JEFFREY G. MORTENSEN
NEW MEXICO
8547
12-27-85
REGISTERED PROFESSIONAL ENGINEER

CONTINENTAL CONCRETE

E-27

JOB NO. 21222

APPROVALS	NAME	DATE	TITLE: CURB PENETRATION MONTGOMERY PROFESSIONAL CENTER 10343 HENDRIX AVE. N.E.
A.C.E./DESIGN		02/20/85	
INSPECTOR			PERMIT NO. 26309
A.C.E./FIELD			MAP NO.

A

DRAINAGE STUDY

FOR

TOLTEC PARK

FEBRUARY 1974

A

DRAINAGE STUDY

FOR

TOLTEC PARK

APPROVED FOR DRAINAGE

22 Feb. 74
DATE

ACE
TITLE

SIGNATURE

CONTINGENCIES

PREPARED BY:
CHAMBERS, CAMPBELL, ISAACSON & CHAPLIN, INC.
3500 INDIAN SCHOOL ROAD, N.E.
ALBUQUERQUE, NEW MEXICO 87106

FEBRUARY 1974

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CALCULATIONS AND DERIVATIONS FOR AN ORIFICE OUTLET	13-18
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FIGURE I	Location and Drainage Map
FIGURE II	Location and Drainage Map, Scale 1"=2000'
FIGURE III	Location and Drainage Map, Plat G-21
FIGURE IV	Topographic Map and Drainage in Developed State
FIGURE V	Time of Concentration of Small Basins
FIGURE VI	Intensity-Duration Frequency Curves

BIBLIOGRAPHY OF REFERENCES

PURPOSE

The purpose of this report is twofold - to determine the drainage characteristics of the subject property in its undeveloped condition, and to analyze the internal flows in its developed state with recommendations for compliance to the Albuquerque Metropolitan Arroyo Flood Control Authorities (A.M.A.F.C.A.) requirements.

INTRODUCTION

The subject property, an SU-1 development with a power relay station planned in the northwest corner of the tract, is located in the Northeast Heights of Albuquerque at the southwest corner of the intersection of Montgomery Boulevard N.E., and Morris Boulevard N.E. (See Figure III).

The property, bordered on the north and east by paved streets, is isolated from any offsite drainage. The land slopes to the west-southwest and has no defined drainage course traversing the site. Precipitation falling on the site forms into sheet flow which is intercepted by a wall bordering the west side. The flow from the north half of the site appears to be ponded against the wall, while the flow from the south half travels southwesterly along the wall and exits at the southwest corner of the tract. (See Figure IV)

As it will be shown, these flows will be accommodated by a combination of ponding, controlled outlets and roof

storage.

DESIGN CRITERIA

In analyzing the storm runoff, 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 a duration equal to the time of accumulation (duration) measured in minutes and obtained from Chart 1, Appendix A, the "Master Plan of Drainage, City of Albuquerque, New Mexico" by Herkenhoff & Associates. (Note: where a Time of Concentration (Tc) is less than ten minutes from Figure V, the Intensity valve equal to ten minutes was used as shown on the curve for a 100 year storm in Figure VI.)

C = Runoff Coefficient (No Unit)

Quantities of runoff were computed on a 100 year storm frequency for both the undeveloped condition and the proposed final developed form.

PHASE I

Phase I consists of analyzing the site in the undeveloped form. In analyzing sheet flow, the south half of the tract was used to figure the Time of Concentration for the entire tract. The area used in the calculations differs from the boundary survey area in that the area between the property

line and the back of curb was incorporated into the design.

The runoff coefficient used for undeveloped areas = 0.30.[1]

TABULATION OF RESULTS - PHASE I. FIGURE IV

Undeveloped Site

Elev. Diff.	Length of Flow	Tc	I	C	Area	Q
Feet	Feet	Min.	"/Hr.		Acres	cfs
16'	520'	3.7 Use 10	5.4	0.30	4.33	7.01

PHASE II

Phase II consists of analyzing the site in its developed form. Only internal flows were considered in this phase. The resulting runoff flows and area contributing to this runoff are shown for each area on Figure IV.

Because of the nature of the SU-1 Development and the power-relay station, several approaches to meet A.M.A.F.C.A.'s requirements were needed. Generally speaking, A.M.A.F.C.A. requires that (1) the runoff from the developed tract does not exceed the runoff from the tract in its natural state. This can be achieved by utilizing on site ponding. (2) If this condition is impossible to meet because of high density parking and structures, which reduces the ponding areas needed, then one solution to meet A.M.A.F.C.A.'s requirements is for runoff flow to be detained on the site and released at a controlled rate. Generally, low flows will

1. Table XII, Master Plan of Drainage, City of Albuquerque, New Mexico and Environs, 1963, G. Herkenhoff & Associates.

not be detained. However, for larger inflows, a properly designed detention storage reduces the outflow from the storage to a rate much less than the inflow. The final results helps prevent overloading the drainage system downstream.

A combination of the two requirements was used here because of the different needs within the tract.

The need to isolate the power relay station, Section 5, from offsite drainage flows is evident from the nature of the equipment to be installed. Therefore the only drainage affecting this site will be from direct precipitation. On site ponding will be required rather than detention storage. Detention storage, because of the topography of the site, would have to be emptied onto Montgomery Boulevard. This would be unadvisable because of an extremely flat grade on Montgomery a block west of this site. Because of this flat slope, Montgomery Boulevard faces overloading as a drainage carrying street from existing contributing areas. The power relay site has adequate area to incorporate a ponding area without jeopardizing the equipment or the houses to the west. (See Figure IV)

The rest of the site incorporates a combination of direct runoff, detention storage, roof ponding and back yard ponding. (See Figure IV) This combination was used in an effort to realistically reduce the impact of the outflowing drainage on the downstream facilities. The following is a

breakdown of the individual areas and their relationship to the overall drainage picture.

Outflowing, uncontrolled runoff occurs from Sections 1, 2, 3, and 6. This runoff is uncontrolled in the sense that there are no orifice controls or ponding of the flow, other than roof and back yard ponding in Section 6, which will be dealt with later. The runoff from Section 2 is intercepted by an existing storm drainage inlet and thus should not affect the downstream carrying capacities of Morris Street. Areas 1 and 3 do not contribute sufficient flows to their respective streets to challenge their carrying capacities. Area 6 empties onto Hendrix Avenue and contributes approximately 1/20th of the maximum design drainage carrying capacity for this street. The overall effect of these four sections is a total runoff slightly more than one-half (1/2) of the total runoff of the site in its natural state before development.

It soon becomes obvious that if Sections 4 and 7 were allowed uncontrolled runoff, the total outflow would exceed the runoff of the site before development. Therefore, to prevent this condition from happening, detention storage for these two sections was incorporated into the design. The cul-de-sac and connecting drive will serve as the detention area with an orifice outlet on the south end of the cul-de-sac. While detaining water on a common use street might seem

objectionable to some, if done properly, it can be accomplished without interfering with the layout and functioning of the street. Furthermore, controlled rates of release are generally large enough so that water is ponded only during the larger storms.

Design criteria is based on the storage of three (3) inches of precipitation with a controlled rate of release of approximately one-half (1/2) inch per hour. On this basis, a design storm having a recurrence period of five years would result in the ponding of 0.8 inches. Once in 100 years the ponding volume would range up to three (3) inches. It should be evident that the inconvenience to the street users and owners bordering the street need not be significant.

Further reduction in runoff flows occur from the architectural design of the structure's roofs. All units, except the "S" unit, will pond a minimum of 2" of water. The only overflow will occur during a 3"-6 hr./100 year design storm. There are no down spouts provided for, so this one inch overflow will have to be uncontrolled in the sense that it can't be directed into a french-drain or some other infiltration area. The calculations relfect this situation.

Finally, all back yards and walled side yards are self-ponding. There is no contributing participation. (See Figure IV for pond sizes)

CALCUALTION SUMMARY FOR PHASE II

In order to arrive at a responsible "C" valve, each section was analyzed for its respective infiltration areas and impervious areas. The following table is a summary of these valves - refer to Page 12 for an example of the calculations.

Section	Total Area	By Area C=0.30	By Area C=0.90	Composite "C" Factor
1	0.17 Ac.	0.12 Ac.	0.05 Ac.	0.47 (no unit)
2	0.24 Ac.	0.18 Ac.	0.06 Ac.	0.46
3	0.09 Ac.	0.08 Ac.	0.01 Ac.	0.36
4	0.88 Ac.	0.10 Ac.	0.78 Ac.	0.83
5	0.74 Ac	0.59 Ac.	0.15 Ac.	0.42
6	0.66 Ac.	0.29 Ac.	0.37 Ac.	0.63
7	0.40 Ac.	0.08 Ac.	0.32 Ac.	0.78

The following table is a summary of the flows for each section by the Rational Formula Q = CIA. The flows for Sections 1, 6 and 7 do not reflect the flows from the roof areas of the structures. These flows will be accounted for later on in the report. Refer to Page 12 for an example

Section	Elev. Diff.	Length Flow	Tc	I	C	Area	Q
	Feet	Feet	Min.	"/Hr.	No Unit	Acres	cfs
1	3'	235'	2.8	5.4	0.47	0.17	0.43 Runoff
2	4'	290'	3.1	5.4	0.46	0.24	0.60 Runoff
3	8'	163'	1.3	5.4	0.36	0.09	0.17 Runoff
4	5'	284'	2.8	5.4	0.83	0.88	3.94 Controlled
5	5'	200'	1.8	5.4	0.42	0.74	1.68 Ponded
6	11'	308'	2.4	5.4	0.63	0.66	2.25 Runoff
7	10'	410'	3.2	5.4	0.78	0.40	1.68 Controlled

Use 10 Min.

In summary of the above table, it can be seen that the amount of direct runoff = 3.45 cfs; the amount of ponded storage = 1.68 cfs; the amount of runoff affected by the controlled outlet = 5.62 cfs.

As previously stated, the above figures do not reflect the flows from the roofs in Sections 1, 6, and 7. The roofs are designed to pond a total of two inches. Consequently, there will not be any outlet for this water other than evaporation. Therefore, for a design criteria of a 3"-6 Hr./ 100 year storm[1], there would be a one inch overflow, assuming dry conditions on the roof before the storm. Therefore, for a single 100 year storm condition, the ratio of 2/3 ponding to 1/3 runoff can safely be used in figuring the increase in runoff to areas 1, 6, and 7 from the roof areas. The following table reflects this increase.

Drainage Section	Tc	I	C	Area	Q	1/3 Q
Roof Area	Min.	"/Hr.	No Unit	Acres	cfs	cfs
1 - Roof	10	5.4	1.00	0.08	0.43	0.14
6 - Roof	10	5.4	1.00	0.38	2.05	0.68
7 - Roof	10	5.4	1.00	0.21	1.13	0.38

Therefore, the total runoff for a 100 year storm for

1. U.S. Department of Commerce, "Technical Paper #40, Rainfall Frequency Atlas of the U.S."

Sections 1, 6, and 7 is:

Section 1 = 0.43 + 0.14 + 0.57 cfs

Section 6 = 2.25 + 0.68 = 2.93 cfs

Section 7 = 1.68 + 0.38 = 2.06 cfs

SUMMARY OF RESULTS

1. Total Runoff Uncontrolled = Sections 1, 2, 3, and 6 = 4.27 cfs with 0.60 cfs being intercepted by an existing storm drainage system.

2. Total Runoff Controlled = Sections 4 and 7 = 6.00 cfs. This flow will be controlled through an orifice outlet. See calculations Pages 14-15.

3. Therefore, summing total runoff rates under developed conditions vs undeveloped conditions-

Developed Site			Undeveloped Site
Sections	Q		Total Site
1, 2, 3, & 6	= 4.27 cfs		
4 & 7	= 0.60 cfs		
Total	= 4.87 cfs	vs	7.01 cfs

The net result is a reduction of the runoff rate by 2.14 cfs.

RECOMMENDATIONS

The following recommendations are made to enable the developer of the SU-1 area and the Public Service Company of New Mexico to complete this project within the design framework stated above:

1. The power relay station site, Section 5, as stated

before, should be self contained with no outside runoff flow entering. Figure IV shows a suggested location for the ponding area. It is recommended that the area surrounding the transformers be landscaped with grass and trees. This will not only increase infiltration, but will also lessen the impact of the ponding area.

2. Section 4 is one of the areas contributing to the controlled orifice outlet. It is recommended that the parking area be sloped slightly toward the center as shown on Figure IV. This will further safeguard the power relay site and facilitate positive drainage away from building "S".

3. Section 7 doubles as an area contributing to the controlled orifice outlet and as the detention area for the water. The size of the orifice required is a four inch pipe (See page 15). Because the overall area of the cul-de-sac and connecting street is not adequate to safely detain the water without raising the surrounding structures, it is recommended that the volume of detention be increased by installing a six inch inverted crown as shown on Figure IV. This inverted crown plus a standard eight inch curb on the connecting street will be adequate for detention, which will peak at 8,954 ft.^{3}. (See Page 15) Because of the need to provide a positive slope of 0.5% maximum to the orifice, the header curb at the south end of the cul-de-sac needs to be increased to 1.5 feet. The curb should follow the slope of the inverted crown so as to provide a low spot or spillway directly above the orifice

outlet. If the orifice should clog, then the overflow will still exit down the drainage easement. To further reduce the Q, it is recommended that the drainage channel be grassed rather than lined with an impervious material.

4. Water blocks are recommended in the streets as shown in Figure IV to facilitate the movements of the runoff as stated above.

SUMMARY

The subject property, by utilizing ponding on the power relay site, back yard ponding for the SU-1 development, and roof ponding, will contribute less internal runoff to surrounding areas than that which existed before development. In addition, the controlled orifice outlet will handle the bulk of the runoff in such a manner as to relieve the congestion on the downstream facilities during the peak concentration of larger storms.

In conclusion, the development of Toltec Park should have a beneficial effect on the drainage characteristics of this area.

Respectfully submitted,

Thomas O. Isaacson

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#3895

CALCULATIONS FOR RATIONAL FORMULA

1. Sample calculation for arriving at a composite "C" factor.

   A = 0.88 Acres total Section 4

   = 0.10 Acres Turf

   = 0.78 Acres Pavement

   Where C = 0.90 for Pavement

   = 0.30 for Turf

   Average $C = \frac{0.10 \times 0.30}{0.88} + \frac{0.78 \times 0.90}{0.88} = 0.83$

2. Sample calculation for Rational Formula Q = CIA

   Section 4-where

   H = height above most remote point above outlet

   = 5' (based upon estimated development grades)

   L = distance most remote point

   = 284'

   Tc= 2.8 min. (use 10 min.) - Figure V

   $I = \frac{189}{T+25}$ for 100 year storm $= \frac{189}{35} = 5.4$"/Hr. (Figure VI)

   C = 0.83 (from 1. above) no unit

   A = 0.88 Acres

   Q = CIA

   = (0.83)(5.4)(0.88) = 3.94 cfs

3. Sample calculation for required ponding area.

   Section 5 - power relay station

Area = 0.74 Acres or 32,234.4 $ft.^2$

Design storm criteria = 3"-6 Hr./100 year

Therefore, Volume required for ponding = Area x Volume of Runoff x Composite "C" Factor = 32,234.4 $ft.^2$ x 0.25 ft. x 0.42 = 3385 $ft.^3$ storage required. Size of pond = 30' x 115' x 1'

CALCULATIONS AND DERIVATIONS FOR AN ORIFICE OUTLET

Definitions of Terms

A = Contributing acreage

a = Cross sectional area of outflow pipe ($Ft.^2$)

C = Coefficient of imperviousness

c = Coefficient of contraction for an orifice

g = Acceleration due to gravity (32.2 $ft/sec.^2$)

h = Head, defined as the distance from the water surface to the center line of the outflow pipe (ft.)

I = Rainfall intensity ($\frac{189}{T+25}$)

K_1= Constant (h/t)

K_2= Constant ($ca\sqrt{2gk}$)

Qi= Instantaneously changing outflow (CFS)

Qo= Maximum outflow per acre imperviousness (CFS/Ac)

T = Storage time, defined as the instant storage begins until until peak storage is attained (min.)

t = Instantaneous time of storage (min.)

Vn = Volume of water flowing into the retention basin per acre imperviousness (ft.^{3}/Ac.)

Vo = Volume of water flowing out of the retention basin per acre imperviousness (ft.^{3}/Ac.)

Vs = Maximum volume of water stored in the retention basin per acre imperviousness (ft.^{3}/Ac .)

Vt = Maximum volume of water stored in the retention basin (ft.^{3})

CALCULATIONS

1. From the design criteria, calculate Qo

$$Qo = \frac{\text{Allowable outflow}}{\text{acreage x runoff coefficient}}$$

$$Qo = \frac{0.60 \text{ cfs}}{1.49 \text{ Ac. x } 0.84} = 0.48 \text{ cfs/Ac. imp.}$$

2. Calculate the time in minutes that the maximum volume of storage will occur from the orifice outlet storage time equation.

$$T = -25 + \sqrt{\frac{7087.5}{Qo}} = -25 + \sqrt{\frac{7087.5}{0.48}}$$

$$= -25 + \sqrt{14,756.6} = -25 + 121.51 = 96.5 \text{ minutes}$$

3. Calculate the maximum volume of storage per acre imperviousness from the orifice outlet storage equation.

$$Vs = \frac{11,340T}{T + 25} - 40 \text{ Qo T}$$

$$Vs = \frac{11,340(96.5)}{121.5} - 40 (0.48)(96.5)$$

$$= 9006.67 - 1852.80$$

$$= 7153.87 \text{ ft.}^3\text{/Ac.Imp.}$$

4. Calculate the total volume of storage required for the contributing sections 4 and 7.

$Vt = Vs \times \#Acres \times$ Runoff Coefficient

$Vt = (7153.87)(1.49)(0.84)$

$Vt = 8953.78 \text{ ft.}^3$

5. Select an outflow pipe from the orifice formula that will yield the allowable outflow of 0.60 cfs under a head of 1.2 feet.

$Q = C\,a\sqrt{2gh}$ - note C = 0.80 from trial and error solutions from Table 4-10, Handbook of Hydraulics, King & Brater, 1963

Solving for a

$$a = \frac{Q}{C\sqrt{2gh}} = \frac{0.60}{0.80\sqrt{2(32.2)(1.2)}}$$

$$= \frac{0.60}{(0.80)(8.79)} = 0.0853 \text{ ft.}^2$$

Select a 4 inch pipe

Reference "Water & Sewage Works," December, 1973, Page 41.

Derivation for an Orifice Outlet.

Outflow

Orifice formula (P4-3, King's Handbook)

$$Qi = ca\sqrt{2gh}$$

"Assume that the storm that fills the basin to the peak volume causes the water level to rise at a constant rate ($h=k_1t$)"

$$Qi = ca\sqrt{2gk_1t}$$

Let $K_2 = ca\sqrt{2gk_1}$

$$Qi = K_2t^{1/2}$$

$$Vo = 60\int_0^T Qidt$$

"A conversion factor of 60 sec/min is required because Qi is in cfs and t is in minutes."

$$Vo = 60k_2\int_0^T t^{1/2}\,dt$$

$$Vo = 60k_2\ (2/3)T^{3/2}$$

$$Vo = 40k_2\ T^{1/2}(T)$$

"Assume the maximum outflow occurs only at the end of the peak storm such that $Qo = k_2T^{1/2}$"

$$\therefore Vo = 40\ Qo\ T$$

Inflow

Qn = CIA Rational Formula

Let C = 100%

A = 1 Acre

$I = \frac{189}{T+25}$ for a 100 year storm from Master Plan of Drainage, City of Albuquerque, New Mexico, 1963-Herkenhoff & Associates.

$$Qn = (100\%)\left(\frac{189}{T+25}\right)(1)$$

$$= \frac{189}{T+25}$$

$$Vn = Qn \times T \times 60 \text{ sec./min.}$$

$$Vn = \frac{11,340T}{T+25}$$

<u>Storage</u>

$$Vs = Vn - Vo$$

$$Vs = \frac{11,340T}{T+25} - 40\ QoT$$

"Since Qo is a fixed maximum outflow that will only occur for the peak storm, it is necessary to find the time from the instant the storage begins until the instant the peak storage is attained. This can be done by taking the first derivative of the storage volume equation and setting it equal to zero."

$$\frac{dVs}{dT} = \frac{d\ \frac{11,340T}{T+25}}{dT} - \frac{d(40\ Qo\ T)}{dT}$$

$$\frac{dVs}{dT} = \frac{(T+25)(11,340) - (11,340T)(1)}{(T+25)^2} - 40\ Qo$$

$$\frac{dVs}{dT} = \frac{283,500}{T^2+50T+625} - 40\ Qo = 0$$

$$T^2 + 50T + 625 - \frac{283,500}{40Qo} = 0$$

"This is a quadratic equation which may be reduced to the form: $ax^2 + bx + c = 0$"

Where x is T, a = 1, b = 50, and $c = 625 - \frac{283,500}{40Qo}$

The general solution is $x = \frac{-b \pm \sqrt{b^2 4ac}}{2a}$

$$T = \frac{-50 \pm \sqrt{(50)^2 - 4(1)(625 - \frac{283,500}{40Qo})}}{2(1)}$$

$$T = \frac{-50 \pm \sqrt{2500 - 2500 + \frac{28,350}{Qo}}}{2}$$

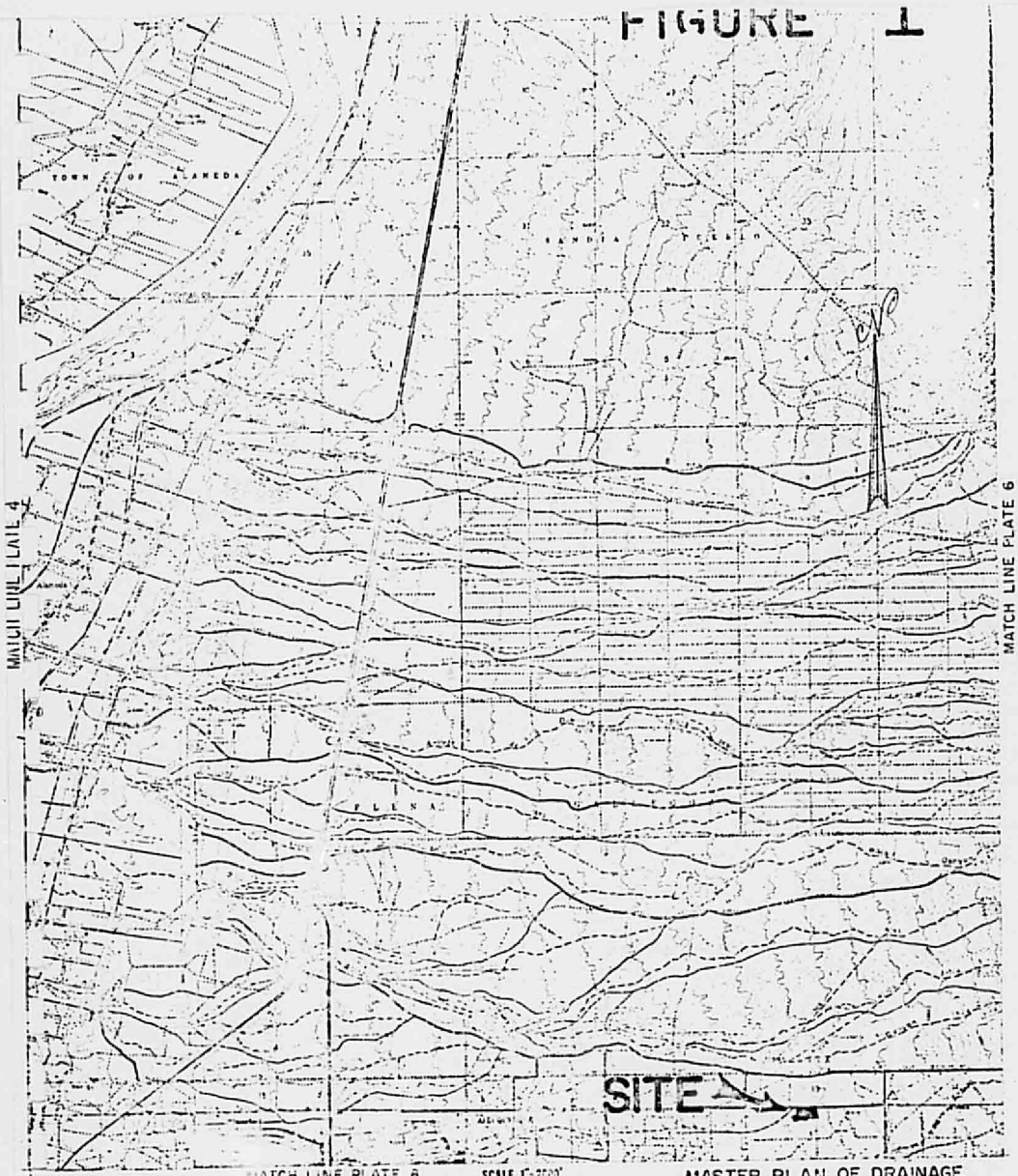
$$T = -25 + \sqrt{\frac{7087.5}{Qo}}$$

Table of Ponding Areas[1] - See Page 12 and 13 for sample calculations and Figure IV for location.

S.P. No.	Contributing Area	"C"	Volume Required	Size Pond
	Ft.^{2}	No Unit	Ft.^{3}	L x w x Depth
1	1,197	0.47	141	60 x 5 x 0.5
2	3,933	0.43	423	40 x 21 x 0.5
3	1,269	0.54	171	30 x 12 x 0.5
4	1,944	0.48	233	40 x 12 x 0.5
5	3,366	0.47	395	40 x 20 x 0.5
6	1,350	0.36	122	16 x 16 x 0.5
7	711	0.40	71	12 x 12 x 0.5
8	711	0.40	71	12 x 12 x 0.5
9	927	0.43	100	15 x 14 x 0.5
10	32,234	0.42	3,384	115 x 30 x 1.0

1. Based upon a 3" - 6 hr./100 year storm.

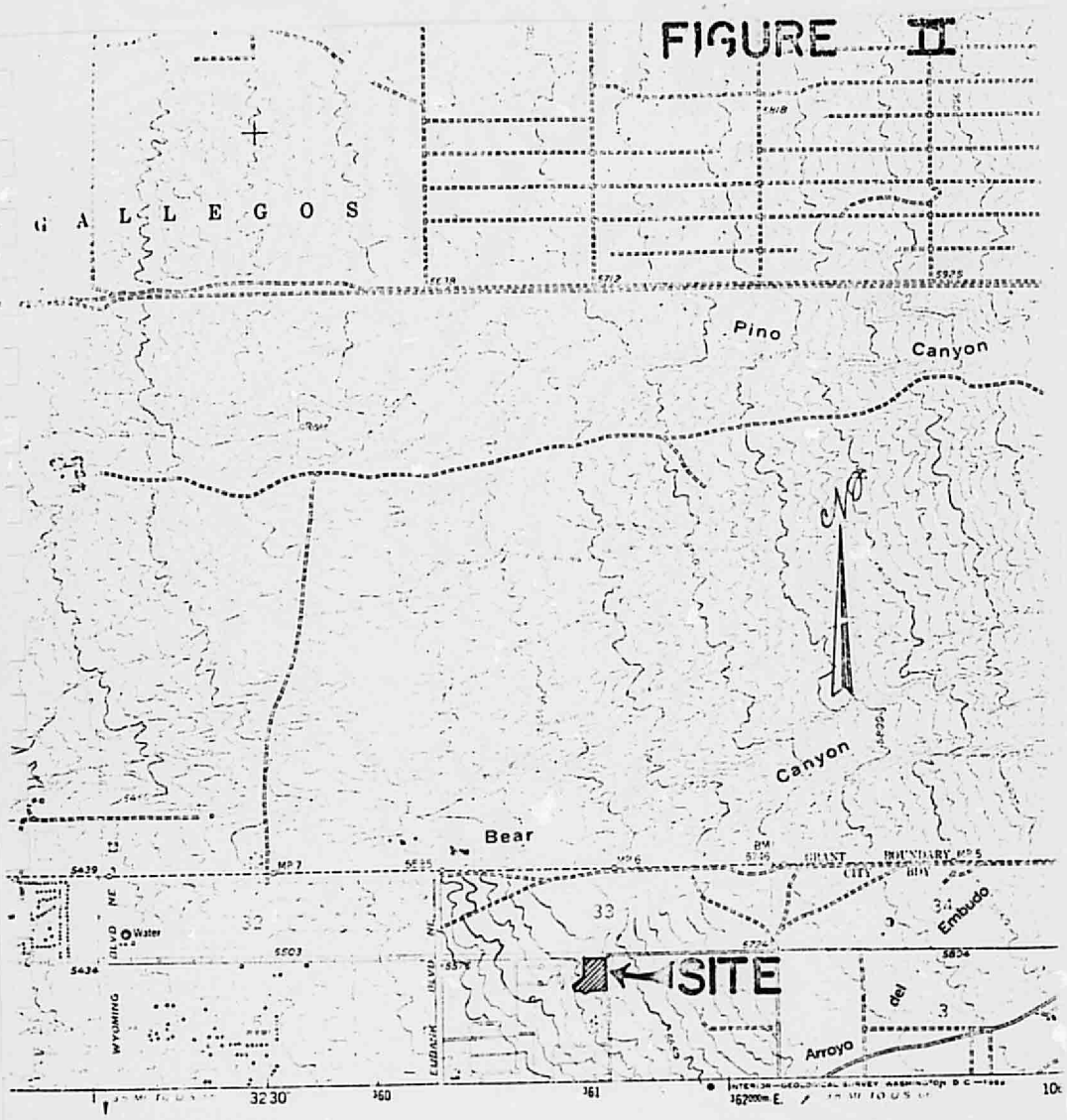
FIGURE 1



MASTER PLAN OF DRAINAGE
CITY OF ALBUQUERQUE, NEW MEXICO
AND ENVIRONS

TOLTEC PARK DRAINAGE REPORT

FIGURE II



1 MILE

6000 7000 FEET

1 KILOMETER

ROAD CLASSIFICATION

Heavy duty — Light duty

Medium duty — Unimproved dirt

Interstate Route — U.S. Route — State Route

QUADRANGLE LOCATION

ALAMEDA, N. MEX.

NE/4 ALBUQUERQUE 15' QUADRANGLE

N3507.5—W10630/7.5

1960

PHOTOREVISED 1967

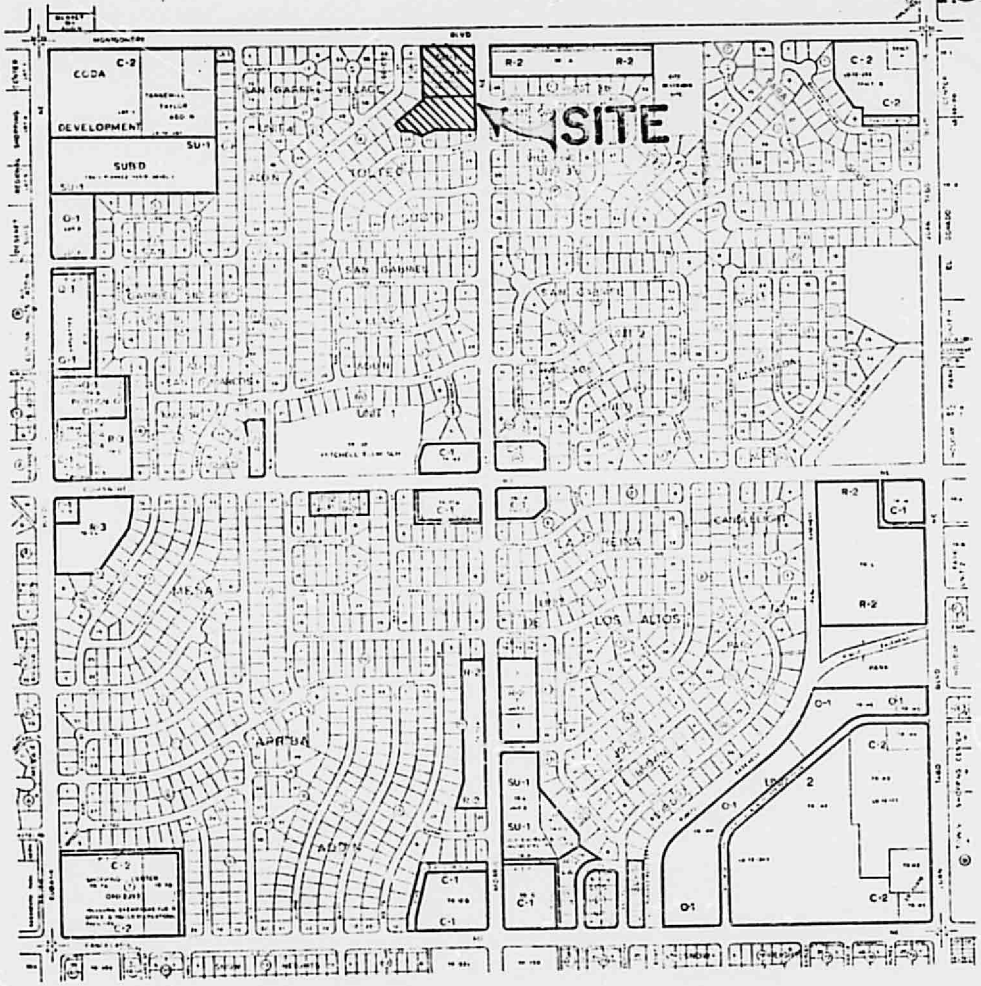
STANDARDS

FOR WASHINGTON, D. C. 20242

AVAILABLE ON REQUEST

TOLTEC PARK DRAINAGE REPORT

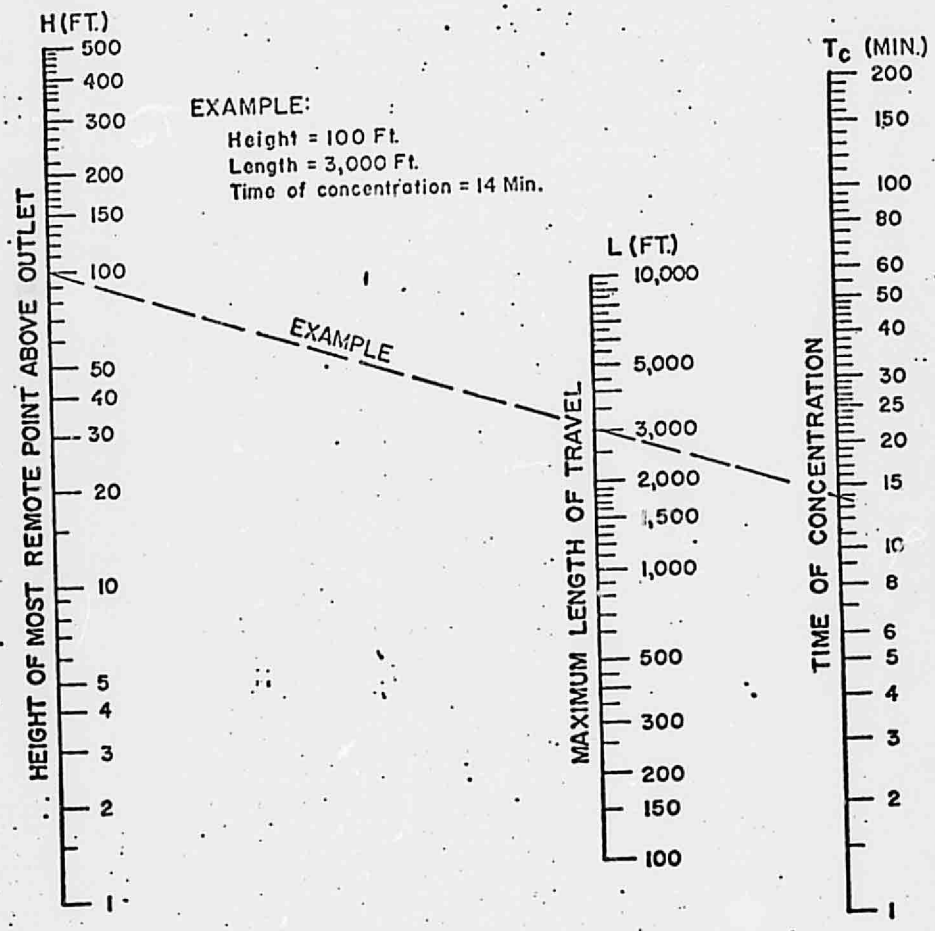
FIGURE III



C-21-7

TOLTEC PARK DRAINAGE REPORT

FIGURE V

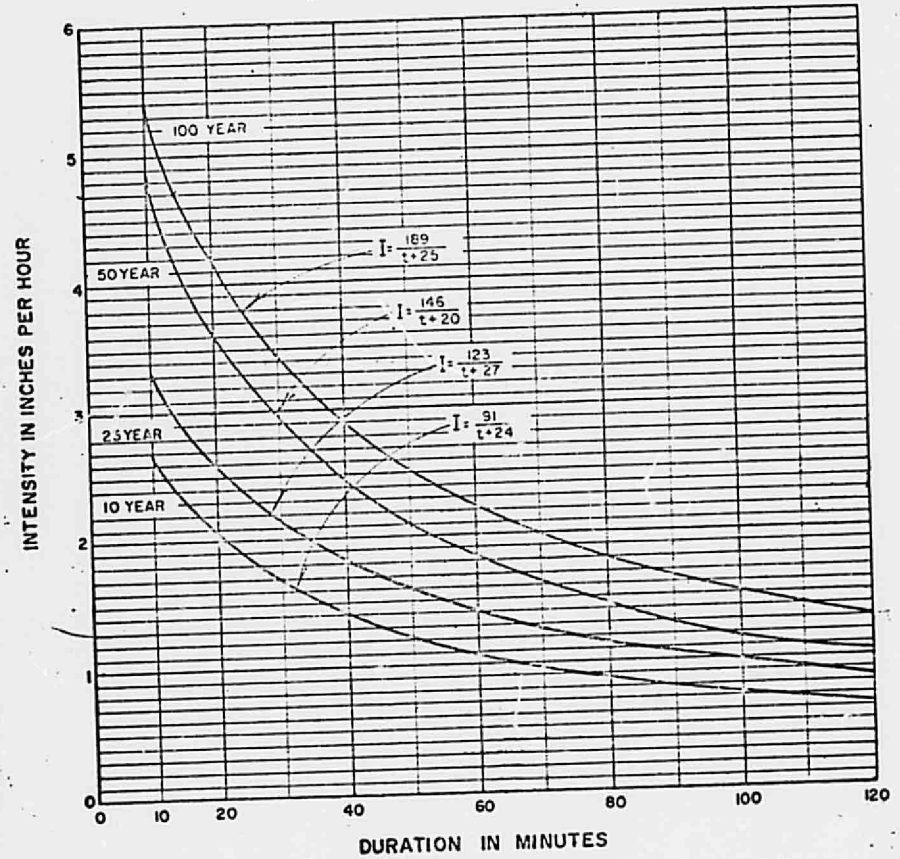


Based on study by P. Z. Kirpich,
Civil Engineering, Vol. 10, No. 6, June 1940, p. 332

FIG. 1 TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

Reprinted from "Design of Roadside
Drainage Channels - Hydraulic Engineering

FIGURE VI



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

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