HYDROLOGY M18/D3 1 PLAN

M18/D3

1 Plan

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

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

September 16, 1975

Mr. John Robert
AMAFCA
P. O. Box 25851
Albuquerque, New Mexico 87125

RE: DRAINAGE STUDY LAKE AND RACQUET APARTMENTS

Dear Mr. Robert:

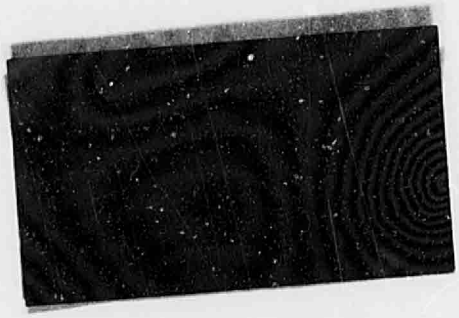
Attached is approved drainage study for the subject apartments on S.W. corner of San Pedro Drive and Gibson Blvd. S.W.

Very truly yours,

Kleston H Laws

Kleston H. Laws
Assistant City Engineer-Hydrology

KHL/fs
Enclosure
cc: Wilson & Co., P. O. Box 3305 - 87110



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ENGINEER'S DRAINAGE REPORT

FOR

LAKE AND RACQUET APARTMENTS

AT

S.W. CORNER OF SAN PEDRO DR.

AND GIBSON BLVD. S.W.

ALBUQUERQUE, NEW MEXICO

APPROVED FOR DRAINAGE

15 Sept 1975
DATE

K H Lewis ACE Hyd
SIGNATURE TITLE

CONTINGENCIES _____

RECEIVED
SEP 15 1975
CITY ENGINEERS

255-4350

WILSON & COMPANY

ALBUQUERQUE, NEW MEXICO

JULY 1975

REVISED SEPTEMBER 1975

REGISTERED STATE OF NEW MEXICO ENGINEER NO. 4591 ROBERT F. SYMS

ENGINEER'S DRAINAGE REPORT
FOR
LAKE AND RACQUET APARTMENTS
AT
S.W. CORNER OF SAN PEDRO DRIVE & GIBSON BOULEVARD S.E.
ALBUQUERQUE, NEW MEXICO

PURPOSE: The purpose of this report is to analyze the amount of run-off that is being discharged from the property in its undeveloped state and compare it with the amount of run-off that can be expected from the property when it is developed as an apartment complex. Then discuss what measures may be taken to reduce the run-off from the developed property so it does not exceed the run-off from the property as it now exists.

CLIMATOLOGICAL INFORMATION: A 100 year design frequency has been used to calculate the flow. The City of Albuquerque has adopted a drainage master plan which presents the following formula for calculating the probable intensity of rainfall for a 100 year design storm:

$$i_{100} = \frac{189}{t_c + 25}$$

i_{100} = Rainfall intensity inches per hour

t_c = Time of concentration in minutes

Certain climatological information was obtained from the U.S. Department of Agriculture, Soil Conservation Service publication, "Peak Rates of Discharge For Small Watersheds", Chapter 2, Revised 10/73 for New Mexico, Engineer Field Manual For Conservation Practices.

RUN-OFF CALCULATION: The Rational Method was used to calculate the run-off from the study area. The Rational Formula is:

$Q = CIA$

Q = Quantity of run-off in cubic feet per second

C = Coefficient of run-off expressed in a ratio of rainfall to run-off

i = Rainfall intensity expressed in inches per hour

A = Drainage area expressed in acres

DISCUSSION: The calculated rate of storm water discharge from the project site in undeveloped condition is 16.7 c.f.s. If control procedures were not incorporated as a part of the site development plan, the maximum rate of storm water discharge from the developed site is 34.5 c.f.s.

The maximum controlled storm water discharge from the developed site is 15.1 c.f.s. In order to reduce the maximum rate of discharge to 15.1 c.f.s., the following design features are incorporated as a part of the site development plan.

1. The courtyard, 30 percent of the roof area, and the west one-half of the south parking lot will drain to the lake. The lower lake will act as a detention pond with a maximum release discharge rate of 2.8 c.f.s. The critical storm duration is 50 minutes with a required storage volume of 17,251 cu.ft. The available storage area at elevation 08.0 is 18,054 cu.ft.

2. The east one-half of the north parking area is to be used as a ponding area with a maximum release discharge rate of 6.51 c.f.s. The critical storm duration is 17.5 minutes with a required storage volume of 4,334 cu.ft. The available storage area at elevation 06.0 is 5,413 cu.ft.

3. The west one-half of the north parking area is to be used as a ponding area with a maximum release discharge rate of 5.83 c.f.s. The critical storm duration is 10 minutes with a required storage volume of 1,782 cu.ft. The available storage area at elevation 04.2 is 1,801 cu.ft.

The offsite drainage is intercepted by San Mateo Blvd. on the east and Ridgecrest Drive on the south. The property between the south boundary of the project and Ridgecrest Drive contains approximately 4 acres and is undeveloped. The

drainage from this area flows from the southeast to the northwest. This sheet flow will be intercepted along the south boundary of the project and routed to Gibson Blvd. along the west boundary of the project.

The run-off and discharge calculations are attached as a part of this report along with a print of the Site Plan.

WILSON & COMPANY
ENGINEERS & ARCHITECTS
BOX 3303
ALBUQUERQUE
NEW MEXICO

DRW. RFS
CK.
DATE 7 July 1975

LOC. Albuquerque FILE 75-51d
PROJ. Lakes & Recreat Ad SHEET 1
SUBJ. Drainage Report OF

Site @ S.W. Cor. of San Pedro & Gibson

Area = 630 x 606 = 385,016 Sq. Ft. = 8.85 Ac.

Slope Ground = $\frac{12.-}{606}$ = .020 ft/ft = 1.8%

Classify as short grass pasture
SCS chart flow velocity = 1.00 ft/sec

Time Concentration = $t_c = \frac{600 \text{ ft}}{1.00 \text{ ft/sec}}$ = 606 sec = 10.1 min

Albuquerque 1950 Drainage Report

$i_{100} = \frac{189}{t_c+25} \quad \frac{189}{10.1+25} = \frac{189}{35.1} = 5.38$

C = .35 undeveloped

$Q_{100} = CiA$

$Q_{100} = .35 \times 5.38 \times 8.85 = 16.7$ cfs

For 100yr design storm Undeveloped $Q_{100} = 16.7$ cfs

Using New Mexico SCS Method.

P_{100} for 24 Hrs = 3.4 in 1 hr. rainfall/24 hr rainfall = .75

Soil = Type B Herbaceous Cover = 30%
Curve Number = 75.

Direct runoff = 1.4 inches

time concentration = .17 Hr.

cfs/ac/in = 1.52

$Q_{100} = 1.4 \times 1.52 \times 8.85 = 18.8$ cfs.

COMP. RFS

CK.

DATE 7 July 1975

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ALBUQUERQUE NEW MEXICO

LOC Albuquerque FILE 75-512
PROJ Lake & Bogue Apts SHEET 3
SUBJ Drainage Report

Runoff From Developed Property

Area Various Items

Roofs	63,953	sq ft	1.47
Parking	165,104		3.79
Tennis Court	12,960		.30
Swim Pool Area	5,001		.12
Lake	14,115		.33
Grass & Sidewalk	123,883		2.86
Σ	385,416	ft²	8.85

Runoff Factor = C For developed Property

Roof = $\frac{1.47}{8.85} \times .9$ = .15

Parking $\frac{3.79}{8.85} \times .9$ = .38

Tennis Court $\frac{.3}{8.85} \times .9$ = .03

Swim Pool $\frac{.12}{8.85} \times .6$ = .01

Lake $\frac{.33}{8.85} \times 0$ = .00

Grass & Sidewalk $\frac{2.86}{8.85} \times .35$ = .11

Σ = .68

Max. Time Concentration For Parking Lot

Slope = $\frac{10}{950}$ = .0105 ft/ft Sheet Flow on Parking Lot = 2 ft/sec

$t_c = \frac{950}{2}$ = 475 sec = 8 min

$i_{100} = \frac{189}{t_c + 25} = \frac{189}{8+25} = \frac{189}{33}$ = 5.73

Q_{100} = CiA = .68 × 5.73 × 8.85 = 34.5 cfs.

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NEW MEXICO

COMP. RFS
CK.
DATE 10 July 1975

LOC. Albuquerque FILE 75-516
PROJ. Lake & Rivet Apts SHEET 5
SUBJ. Drain Report OF

Assume The Following

(1) Courtyard including Swim Pool & Tennis Courts Drain to Lake

(2) 30% of roof area drains to the lake.

(3) W½ of South parking Lot drains to lake

(4) Retention area is constructed in E½ of north parking lot with a controlled discharge.

(5) Retention area is constructed in W½ of north parking lot with a controlled discharge.

AREA East ½ A = (218 x 326) + (285 x 388) = 181,608 Sq Ft = 4.17 Ac

AREA West ½ A = (218 x 310) + (388 x 351) = 203,768 Sq Ft = 4.68 Ac

AREA East ½

Roofs =	34,669	=	0.80 Ac
Parking =	81,604	=	1.87 Ac
Court Yard =	40,980	=	.90 Ac
Grass & Sidewalk =	24,395	=	.56 Ac
	Σ =		4.17 Ac

Area Draining to Gibson

Roofs (.7)(34669) =		24,268 =	.56
Parking	=	81,604 =	1.87
Grass & Sidewalk =		24,395 =	.56
		Σ =	2.99 Ac.

$$C = \frac{(.56 \times .9) + (1.87 \times .9) + (.56 \times .35)}{2.99} = .80$$

Time of concentration

Slope = $\frac{6}{930}$ = .0105 From SCS sheet flow from parking lots V = 2 ft/sec

COMP. RFS

CK.

DATE 11 Sept. 1975

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ENGINEERS & ARCHITECTS
P.O. BOX 3108
ALBUQUERQUE
NEW MEXICO

LOC. Albuquerque FILE 75-74
PROJ. Lake & Bryant Add. SHEET 9
SUBJ. Drainage Report

$t_c = \frac{950}{2} = 475$ sec $= 7.9$ min

$i_{100} = \frac{189}{t_c + 25} = \frac{189}{7.9 + 25} = 5.74$

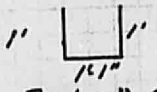
$Q_{100} = CIA = .80 \times 5.74 \times 2.99 = 13.73$ cfs

E½ Retention Area.

Volume $= V = \frac{1}{3}(A_1 + A_2 + \sqrt{A_1 A_2})h = \frac{1}{3}[1374 + 10980 + (1374 \times 10980)^{1/2}]1$
$= \frac{1}{3}(16238)1 = 5,413$ cf

Discharge From Retention Area.

Since the length of discharge section is approx. 12 ft or greater than .5 time its width we will consider the opening as a channel



Discharge Opening

A = Area = $1 \times 1.08 = 1.08$ ft²
Wetted Perimeter = $1 + 1 + 1.08 = 3.08$ ft
Hyd. Rad. = $A/WP = 1.08 \div 3.08 = .35$

Slope = .015 ft/ft.

V = Velocity = $\frac{1.486}{n} \cdot r^{2/3} s^{1/2} = \frac{1.486}{.015} \times .35^{2/3} \times .015^{1/2} = 6.03$ ft/sec

$Q = AV = 6.51$ cfs.

From attached Modified Hydrograph the critical storm duration is 17.5 min and required storage is 4,330 cu.ft. actual storage = 5613 cu.ft.

WILSON & COMPANY

FOR Albuquerque FILE 75-516

PROJ. Lobo Hill Apts SHEET 5

SUBJ. Drainage Report OF

CHIEF OF PARTY RFS

INST.

WEATHER

DATE 10 Sept 75

E½ Area. Retention

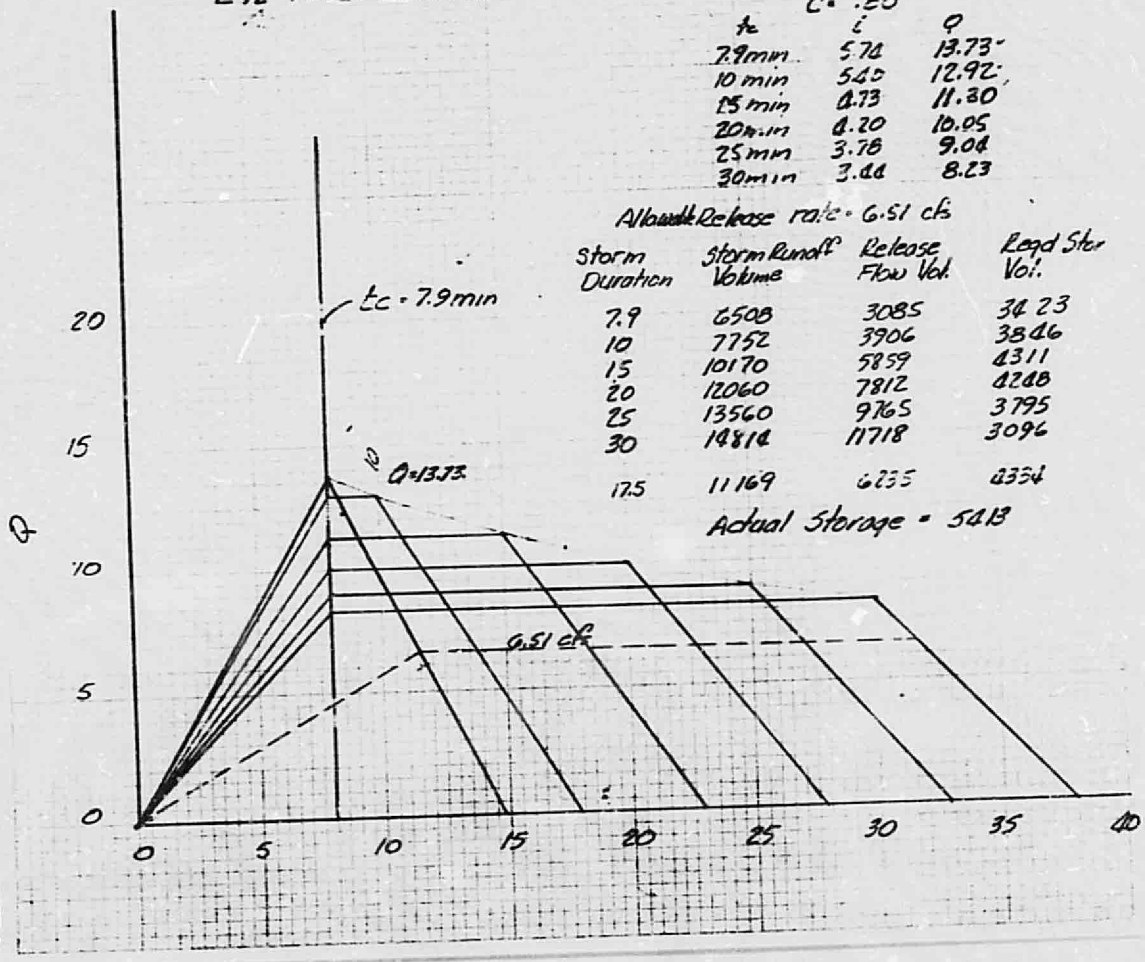
E½ A: 2.99
C: .80

tc	i	Q
7.9min	5.78	13.73
10 min	5.45	12.92
15 min	4.73	11.30
20 min	4.20	10.05
25 min	3.78	9.04
30 min	3.44	8.23

Allowable Release rate = 6.51 cfs

Storm Duration	Storm Runoff Volume	Release Flow Vol.	Reqd Stor Vol.
7.9	6508	3085	3423
10	7752	3906	3846
15	10170	5859	4311
20	12060	7812	4248
25	13560	9765	3795
30	14814	11718	3096
17.5	11169	6235	4934

Actual Storage = 5413



FORM 19

WILSON & COMPANY

LOC. Albuquerque FILE 75-516

PROJ. Lot 1 Bisquet Apts SHEET 5

SUBJ. Drainage Report OF

CHIEF OF PARTY RFS

INST.

DATE 10 Sept 75

WEATHER

E½ Area. Retention

E½ A: 2.99
C: .80

tc	i	Q
7.9 min	5.74	13.73
10 min	5.40	12.92
15 min	4.73	11.30
20 min	4.20	10.05
25 min	3.78	9.04
30 min	3.44	8.23

Allowable Release rate = 6.51 cfs

Storm Duration	Storm Runoff Volume	Release Flow Vol.	Reqd Stor Vol.
7.9	6508	3085	3423
10	7752	3906	3846
15	10170	5859	4311
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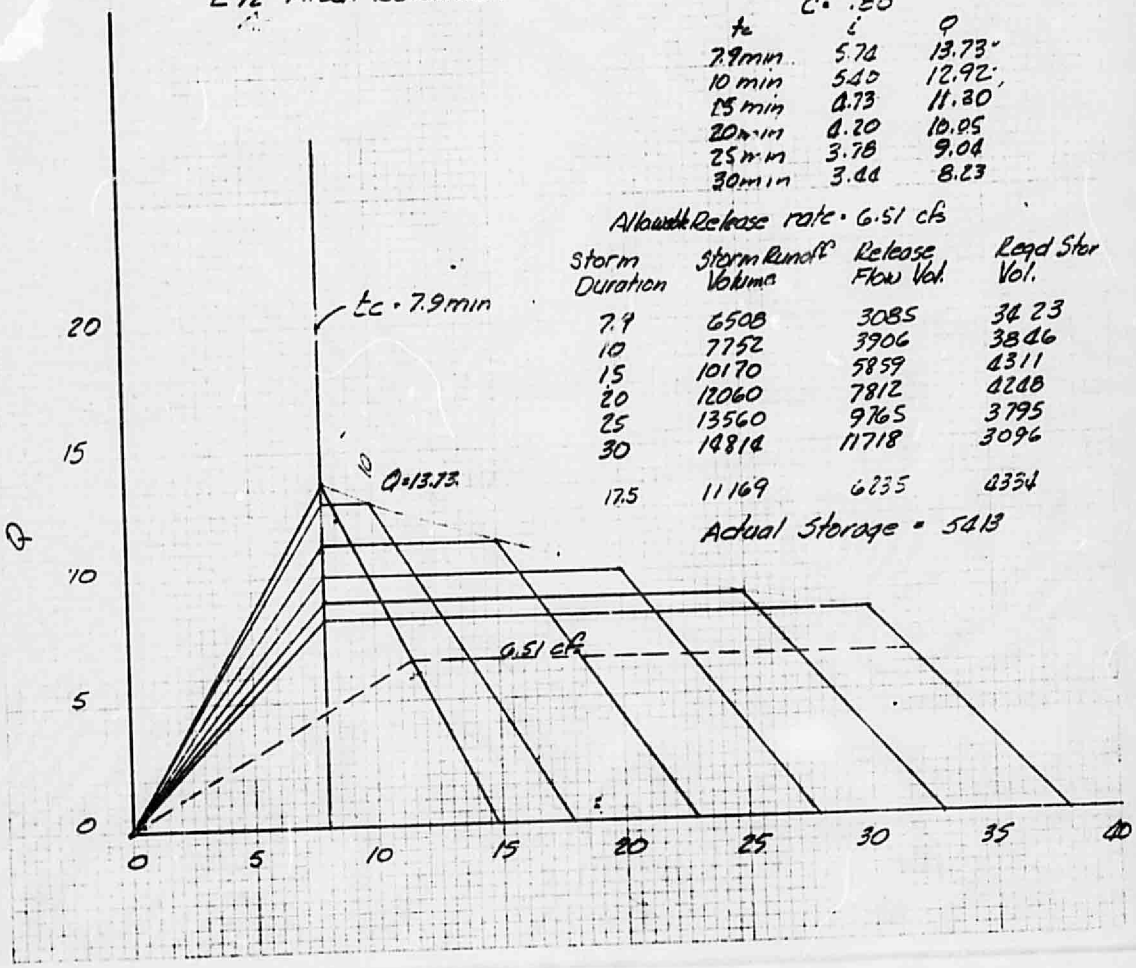


COMP. RFS

BY

DATE 10 July 75

WILSON & COMPANY ENGINEERS & ARCHITECTS ALBUQUERQUE NEW MEXICO

LOC. Albuquerque FILE 75-514

PROJ. Lake & Racquet SHEET 6

SUBJ. Drainage Report OF

AREA W½

Roofs =	29,248	Sq Ft =	.67 Ac
Parking =	86,491		= 1.99 Ac
Courtyard =	68,380		= 1.57 Ac
Grass & Sidewalk	19,609		= .45 Ac
		Σ =	4.68 Ac

Area Drained To Gibson

Roof = (.7)(29248) =	20474	ft² =	.47 Ac
Parking = 86,491 − 35,625 =	50,866	ft² =	1.17 Ac
Grass & Sidewalk =	19,609	ft² =	.45 Ac
		Σ =	2.09 Ac

$$C = \frac{(.47 \times .9) + (1.17 \times .9) + (.45 \times .35)}{2.09} = .78$$

Time of concentration:

Slope = $\frac{14}{695}$ = .0201 ft/ft. SCS chart: V = 2.8 ft/sec

$t_c = \frac{695}{2.8}$ = 248 sec = 4.1 min

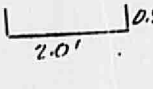
$i_{100} = \frac{189}{t_c + 25} = \frac{189}{4.1 + 25} = 6.49$

Q = CiA = .78 × 6.49 × 2.09 = 10.58 cfs.

W½ Retention Area

Volume = V = ⅓ (A)h = ⅓ · 7722 × .7 = 1801 cu ft.

Discharge From Retention Area.



Area = A = 0.5 × 2.0 = 1

Wetted Perimeter = .5 + .5 + 2.0 = 3.0

Hyd Radius = R = A/P = $\frac{1}{3}$ = .33

Slope = .015 ft/ft n = .015

Velocity = $V = \frac{1.486}{n} \cdot S^{1/2} \cdot r^{2/3} = \frac{1.486}{.015} \times .015^{1/2} \times .3333^{2/3} = 5.83$ ft/sec

Discharge Rate Q = AV = 1 × 5.83 = 5.83 cfs.

From attached Hydrograph

Required Volume = 1782 ft³ Actual = 1801

Albuquerque
Lot 1 Keppel Add
Drainage Report

7

EFS

10 Sept 75

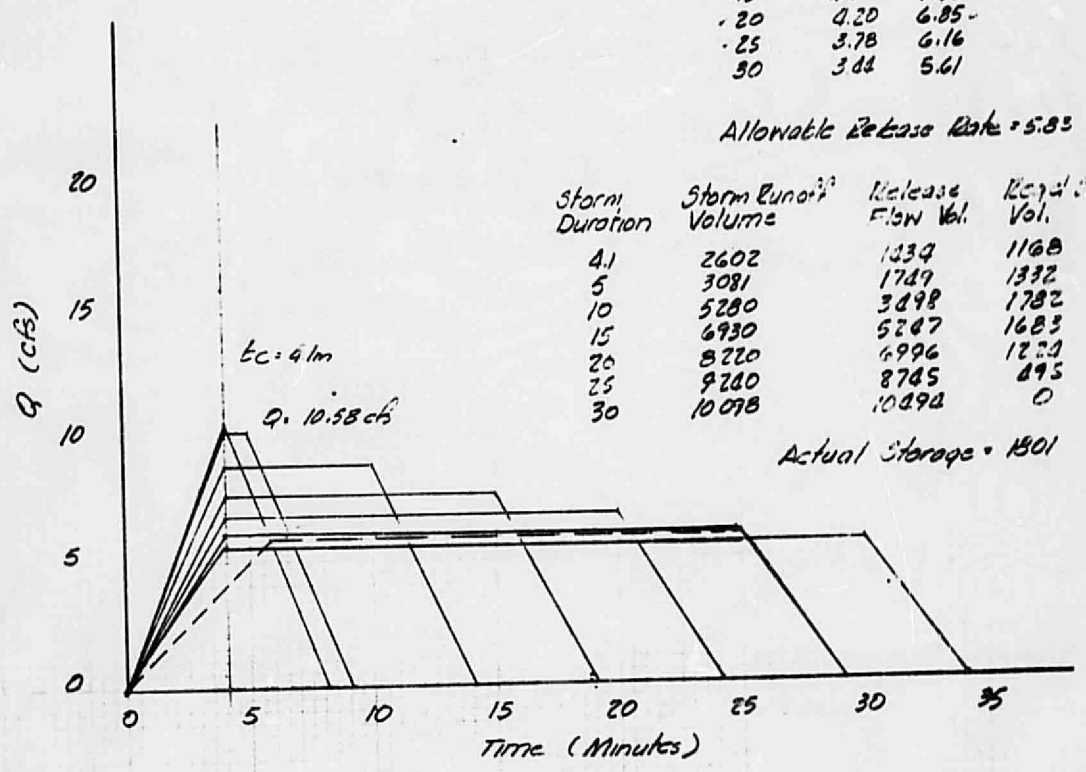
W½ A = 2.09 Ac
C = .78

tc	i	Q
4.1	6.41	10.58
5	6.30	10.27
10	5.40	8.80
15	4.73	7.70
20	4.20	6.85
25	3.78	6.16
30	3.44	5.61

Allowable Release Rate = 5.83

Storm Duration	Storm Runoff Volume	Release Flow Vol.	Required Stor Vol.
4.1	2602	1434	1168
5	3081	1749	1332
10	5280	3498	1782
15	6930	5247	1683
20	8220	6996	1224
25	9240	8745	495
30	10098	10494	0

Actual Storage = 1801



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ENGINEERS & ARCHITECTS
P.O. BOX 1305
ALBUQUERQUE
NEW MEXICO

COMP RFS
CK
DATE 12 Sept 75

LOC Albuquerque FILE
PROJ Lake & Project Ab SHEET 8
SUBJ Drainage Report OF

Volume Retention Reqd by lake
Given Information C=.9; Area = 3.77 Ac.
Release Discharge Rate = 2.8 cfs.
Storage Available = 18,054 ft³

$i = \frac{189}{Ec+25}$ Q = CiA

Storm Duration (Min)	i (in/hr)	Q (cfs)	Storm Runoff (ft³)	Release Flow Vol (ft³)	Reqd Storage (ft³)
7	5.91	20.04	8417	1176	7241
10	5.40	18.32	10993	1680	9313
15	4.73	16.03	14429	2520	11909
30	3.44	11.60	20987	5040	15947
45	2.70	9.16	24735	7560	17175
50	2.52	8.55	25651	8400	17251
55	2.36	8.02	26452	9240	17212
60	2.22	7.54	27160	10080	17080
90	1.64	5.58	30112	15120	14992
120	1.30	4.42	31842	20160	11682
150	1.08	3.66	32980	25200	7780
180	0.92	3.13	33784	30240	3544
210	0.80	2.73	34383	35280	—
240					

Volume Storage available

Assume only the lower lake will provide storage
The outlet pipe will be at elevation 06
and flooding will be at elevation 08

$$\text{Volume}_V = \tfrac{1}{3}(A_1 + A_2 + \sqrt{A_1 \cdot A_2})h = \tfrac{1}{3}(12303 + 6048 + \sqrt{12303 \cdot 6048})2 = 18054 \text{ ft}^3$$

Grade Outlet Pipe = $\frac{1.5}{240}$ = .0063 ft/ft
Assume n = .013 capacity = 2.8 cfs.

WILSON & COMPANY
ENGINEERS & ARCHITECTS

COMP RB
CK
DATE 12 Sept 75

LOC
PROJ Cabot Cabinet Site
SUBJ

FILE
SHEET 5
OF

Pipe From South Parking Lot

Slope = 6/180 = .0333 V = 3.7 ft/sec

t = 180/3.7 = 48 sec = .8 min

L100 = 184/Cot 25 = 184/25.81 = 7.12 C = .90 A = .82 Ac

Q = CiA = .90 x 7.12 x .82 = 5.4 cfs

18" Pipe @ 0.020 ft/ft n = .015
capacity = 7.1 cfs Flowing full without head or outlet constriction