HYDROLOGY K17/D8 1 PLAN 1 of 2

3

K17/D8

1 PLAN

BOVAY ENGINEERS, INC.
HOUSTON • SPOKANE • BATON ROUGE
AUSTIN • ALBUQUERQUE • WASHINGTON, D. C.

September 29, 1981

Mr. Fred J. Aguirre, P.E.
Civil Engineer
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

Re: Proposed Grandy's Restaurant
4701 Central Avenue, N.E.
BEI No. 6014-179

Dear Mr. Aguirre:

I have enclosed a copy of the City approved design that complies with Special Order No. 19. Please attach this copy to the construction plan set that you have on file in your office.

If you should have any questions please don't hesitate to call.

Sincerely,

BOVAY ENGINEERS, INC.

Stephen F. Fritz, P.E.

SFF:mm
Enclosure

RECEIVED
OCT 1 1981
CITY ENGINEER

PROFESSIONAL ENGINEERS AND PLANNERS
P. O. BOX 30066 • 3125 CARLISLE BOULEVARD, N.E. • ALBUQUERQUE, NEW MEXICO 87190 • TEL. 505/884-0700 • CABLE BOVENG

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

K17-D8

September 4, 1981

Mr. Stephen F. Fritz
Bovay Engineers, Inc.
P. O. Box 30068
Albuquerque, New Mexico 87190

Re: GRANDY'S RESTAURANT

Dear Steve:

The referenced drainage report is hereby approved.

This letter will be forwarded to Mr. Fred Aguirre of our staff so that the construction plans may be approved without delay.

This office wishes to com[illegible] both you and Mr. Mark Goodwin on the excellent report and for y[illegible] cooperation throughout the course of the project.

Very truly yours,

Brian G. Burnett

Brian G. Burnett
Civil Engineer/Hydrology

BGB/fs

cc: Mr. Roger Finholt
Mr. Emmett Sacry
Mr. Fred Aguirre

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

K17-D8

August 17, 1981

Mr. Emmett Sacrey
Hamill and McKinney
P.O. Box 61563
DFW Airport, Texas 75261

Dear Mr. Sacrey:

Enclosed is a copy of the Drainage Packet which contains current drainage policy here in Albuquerque. I enjoyed our discussion concerning the Grandy's Restaurant site.

If I can be of further help, please call.

Sincerely,

Brian G. Burnett

Brian G. Burnett
Civil Engineer/Hydrology

BB:gc
8033A
cc f/Reading

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

K17-D8

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

MAYOR
David P. Rusk

K17-D8

August 3, 1981

Mr. Earl F. McKinney
Hamill & McKinney
P. O. Box 61563
DFW Airport, Texas 75261
Irving, Texas 75061

Re: GRANDY'S RESTAURANT DRAINAGE REPORT

Dear Mr. McKinney:

Enclosed is a copy of the Drainage Report Checklist Requirements. The items which are checked "NO" need to be addressed before this office can make a complete review of the report. I have also included a copy of the Construction Plan Checklist Requirements and Special Order No. 19 for your information.

If I can be of further help on this matter, please call.

Very truly yours,

Brian G. Burnett

Brian G. Burnett
Civil Engineer/Hydrology

BGB/fs
Enclosures

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

MAYOR
David P. Rusk

K17-D8

August 3, 1981

Mr. Earl F. McKinney
Hamill & McKinney
P. O. Box 61563
DFW Airport, Texas 75261
Irving, Texas 75061

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If I can be of further help on this matter, please call.

Very truly yours,

Brian G. Burnett

Brian G. Burnett
Civil Engineer/Hydrology

BGB/fs
Enclosures

HAMILL & McKINNEY
ARCHITECTS AND ENGINEERS, INC.

p.o. box 61563
dfw airport, texas 75261
1311 west irving blvd.
irving, texas 75061
tx(214) 253-5153
ky(606) 277-1174 ca(415) 932-4713

ALBUQUERQUE
BLDG. DEPT.
JUN 30 1981
U.B.C.
PLAN CHECK
SECTION

DRAINAGE REPORT

FOR:

GRANDY'S RESTAURANT

EAST CENTRAL @ MADISON ST.
ALBUQUERQUE, NEW MEXICO

JUNE 1981

EARL E. McKINNEY
NEW MEXICO
6924
REGISTERED PROFESSIONAL ENGINEER

REGISTRATIONS IN ALABAMA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, IDAHO, ILLINOIS, INDIANA, IOWA, KANSAS, KENTUCKY, LOUISIANA, MAINE, MARYLAND, MASSACHUSETTS, MICHIGAN, MINNESOTA, MISSISSIPPI, MISSOURI, MONTANA, NEBRASKA, NEVADA, NEW HAMPSHIRE, NEW JERSEY, NEW MEXICO, NEW YORK, NORTH CAROLINA, NORTH DAKOTA, OHIO, OKLAHOMA, OREGON, PENNSYLVANIA, RHODE ISLAND, SOUTH CAROLINA, SOUTH DAKOTA, TENNESSEE, TEXAS, UTAH, VIRGINIA, WASHINGTON, WEST VIRGINIA, WISCONSIN, WYOMING.

ON SITE RUNOFF DETERMINATIONS

TOTAL AREA = 0.828 AC

LANDSCAPED AREAS (100% RETENTION) = .101 AC

AREA CONTRIBUTING RUNOFF = .828 - .101 = 0.727 AC

AREA CONTRIBUTING RUNOFF IS ALL PAVED

C = 0.95

DETERMINE REQD. Q_D DEVELOPED PAVING:

VOLUME

C = 0.95

A = .727 AC

D = 2.05" W FROM NOAA ATLAS (50 YR., 6 HR. STORM)

VOLUME = CDA = (.95)(2.05)(.727)(43,560)(1/12)

= 5139.5 FT^3 → USE: 5140 FT^3

DETERMINE Q_1 DEVELOPED DISCHARGE RATE:

C = 0.95 W/ WEIGHTED "C" = .97 + .23

A = 0.727 AC Q_1 = CIA = 1.2 CFS

I = 1.62 IN/HR → (SEE FIG. 1) Q_1 = (.95)(1.62)(.727) = 1.118 CFS

(TAKEN FROM 10 YR)

USE 1.12 CFS

DETERMINE Q_1 UNDEVELOPED DISCHARGE RATE:

A = 0.828 AC

C = 0.35 UNDEVELOPED C = 0.95 DEVELOPED

I_1 = 1.62 IN/HR.

ON A PORTION OF EXISTING LOT IS A PAVED AREA

NEED TO DETERMINE A WEIGHTED "C"

Station: ALBUQUERQUE, BERNALILLO COUNTY, NEW MEXICO (CITY).
Latitude, 35° 05' N.; Longitude, 106° 39' W.; Elevation 4960 ft.

DURATION	RETURN PERIOD (YEARS) 1	2	5	10	25	50	100	I,
5 min.	0.28	0.33	0.50	0.55	0.44	0.49	0.55	2.17
10 min.	0.27	0.35	0.47	0.55	0.63	0.77	0.86	1.62
15 min.	0.35	0.44	0.59	0.70	0.86	0.97	1.03	1.40
30 min.	0.48	0.62	0.82	0.96	1.19	1.34	1.50	0.96
1 hr.	0.61	0.78	1.04	1.22	1.50	1.70	2.50	
2 hr.	0.63	0.81	1.09	1.23	1.57	1.73	1.92	
3 hr.	0.64	0.83	1.13	1.33	1.63	1.86	2.03	
6 hr.	0.68	0.90	1.25	1.47	1.80	2.05	2.30	
12 hr.	0.71	0.96	1.35	1.59	1.95	2.22	2.50	
24 hr.	0.75	1.02	1.46	1.72	2.10	2.40	2.70	

Rainfall intensity values

Figure 5b

DETERMINE Q_1 UNDEVELOPED DISCHARGE RATE, CONT.

PAVED AREA = 0.247 Ac

UNDEVELOPED = 0.828 − 0.247 = 0.581 Ac

	A	C	Ac
PAVED	0.247	0.95	.232
UNDEVELOPED	0.581	0.35	.204
TOTAL	0.828		.436

WEIGHTED "C" = $\frac{\Sigma Ac}{\Sigma A}$ = $\frac{.436}{.828}$ = .526

USE .53

$Q_1 = CIA = 0.53\,(1.62)(.828) = .71$ CFS

DEVELOPED Q_1 = 1.12 CFS

UNDEVELOPED Q_1 = 0.71 CFS

Q_1 VALUES FOR CONTROLLED & UNCONTROLLED RUNOFF

UNCONTROLLED AREA = 7,000 FT^2 = 0.161 Ac

PAVED = 6,000 FT^2 = .138 Ac

GRASS = 1,000 FT^2 = .023 Ac

DETERMINE WEIGHTED "C"

	A	C	Ac
PAVED	.138	.95	.131
UNPAVED	.023	.35	.008
TOTAL	.161		.139

WEIGHTED "C" = .863 = $\frac{\Sigma Ac}{\Sigma A}$ USE .86

$Q_1 = CIA$

$= (.86)(1.62)(.161) = .226$ CFS

USE .23 CFS

DUE TO LAYOUT OF SITE, THIS DISCHARGE IS CONTROLLED BY GRADE ONLY & WILL BE DISCHARGED INTO GRANDY'S SOUTH DRIVEWAY APPROACH ONTO MADISON ST. N.E.

CONTROLLED DRAINAGE AREA = .667 AC

PAVED = 26,672 FT^2 = .612 AC

UNPAVED = 2396 FT^2 = .055 AC

DETERMINE WEIGHTED "C"

	A	C	Ac
PAVED	.612	.95	.581
UNPAVED	.055	.35	.019
TOTAL	.667		.600

WEIGHTED "C" = $\frac{\Sigma Ac}{\Sigma A} = \frac{.600}{.667} = .899$

USE: 0.90

$Q_1 = CIA$

$= (.9)(1.62)(.667)$

$= .97$ CFS

DISCHARGE FROM THIS AREA BEFORE DEVELOPMENT WAS DETERMINED TO BE .71 CFS FOR RAINFALL INTENSITY VALUE OF 1.62 IN/HR. (SEE FIGURE 1). UNCONTROLLED RUNOFF USING SAME CRITERIA WAS DETERMINED AS .23 CFS LEAVING NO MORE THAN .48 CFS TO BE DISCHARGED ACCORDING TO CRITERIA SET FORTH IN THE CITY ENGINEERS, INTERIM GUIDELINES OF NOVEMBER 1979, FOR VALLEY AREA DEVELOPMENT

<u>CONTROLLED</u> DRAINAGE FOR THIS SITE INCLUDES A RUNOFF OF 0.97 CFS, OF WHICH ONLY .42 CFS (SEE FIG. 3) WILL BE DISCHARGED AT PEAK RAINFALL INTENSITY SHOWN ABOVE THRU. A 4" DIA. P.V.C. PIPE, → THIS LEAVES 0.55 CFS TO BE RETAINED ON SITE FOR MAXIMUM (PEAK RUNOFF) STORAGE, MAXIMUM IS REACHED AT 2.5 HRS. OR 150 MIN (SEE FIG. 2)

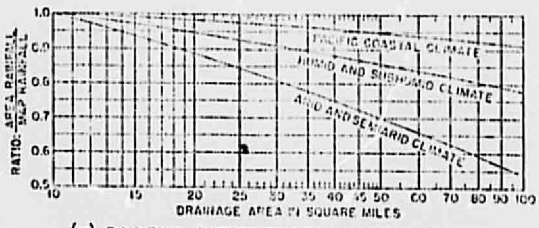
PEAK STORAGE REQUIRED FOR THIS SITE AT MAX. OF 2.5 HRS IS DETERMINED TO BE:

$S_1 = (Q_1)(t)$ WHERE Q_1 IS IN CFS AND t IS IN SEC.

$= (0.55)(9000)$

MAXIMUM STORAGE REQ'D. = 4950 FT^3

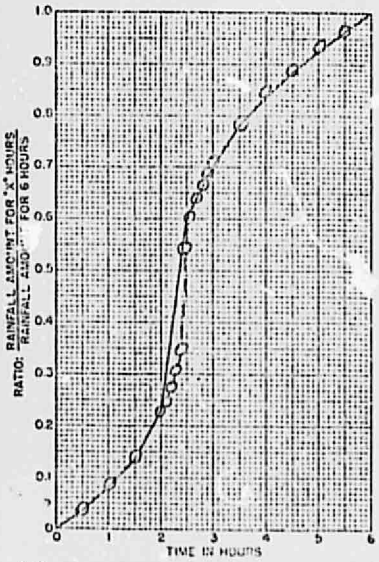
HYDROLOGY: CRITERIA FOR DESIGN STORMS USED IN DEVELOPING EMERGENCY SPILLWAY DESIGN AND FREEBOARD HYDROGRAPHS



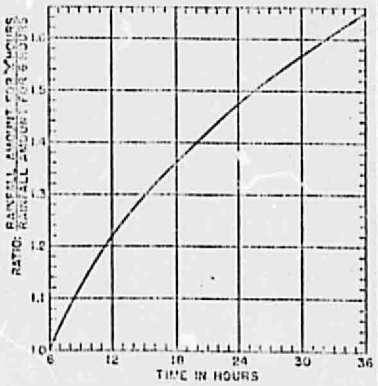
(a) RAINFALL RATIOS FOR DRAINAGE AREAS OF 10 TO 100 SQUARE MILES

$y = .48826\,x^{.46117}$

MAX @ 2.5 hrs



(b) SIX HOUR DESIGN STORM DISTRIBUTION



(c) RELATIVE INCREASE IN RAINFALL AMOUNT FOR STORM DURATIONS OVER SIX HOURS

FIGURE 21.2

REFERENCE	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING DIVISION - CENTRAL TECHNICAL UNIT	STANDARD DWG. NO. ES-1003 SHEET 1 OF 1 DATE 7-2-56

FIGURE 12

DISCHARGE THRU 4" Ø P.V.C. PIPE
USING ORIFICE EQUATION

$Q = .60\ A\ \sqrt{2gh}$ WHERE H = HEAD AND IS CONSIDERED TO BE NEGLIGIBLE OR = 1

A (A) IS IN FT²

$= (.6)(\pi)(.167^2)\ \sqrt{2(32.2)}$

$Q = .42$ CFS

FIGURE #3

RECOMMENDATIONS AND CONCLUSIONS

1. GRADE LOT AS SET FORTH IN HAWLL & McKINNEY SITE PLAN TO DRAIN RUNOFF NATURALLY TO GRANDY'S SOUTH DRIVEWAY APPROACH ONTO MADISON ST. N.E., .23 CFS FOR MAX Q, POSITIVE DISCHARGE.
2. GRADE NORTH EAST PORTION OF SITE (PARKING AREA AS SET FORTH IN HAWLL & McKINNEY SITE PLAN TO PROVIDE POSITIVE DRAINAGE SWALES TO CARRY STORM RUNOFF TO PONDING AREA (5,200 FT.³)
3. INSTALL 4" Ø P.V.C. TO ALLOW .42 CFS DISCHARGE FROM NORTH END OF SITE FROM PONDING AREA. (SEE SITE PLAN & ATTACHED FIG 4) FOR EXACT LOCATION AND LOCATION.

4) FOLLOWING THIS CRITERIA ONLY .23 CFS + .42 CFS WILL DRAIN OFF SITE AFTER DEVELOPEMENT. THIS EQUALS .65 CFS < .71 CFS.

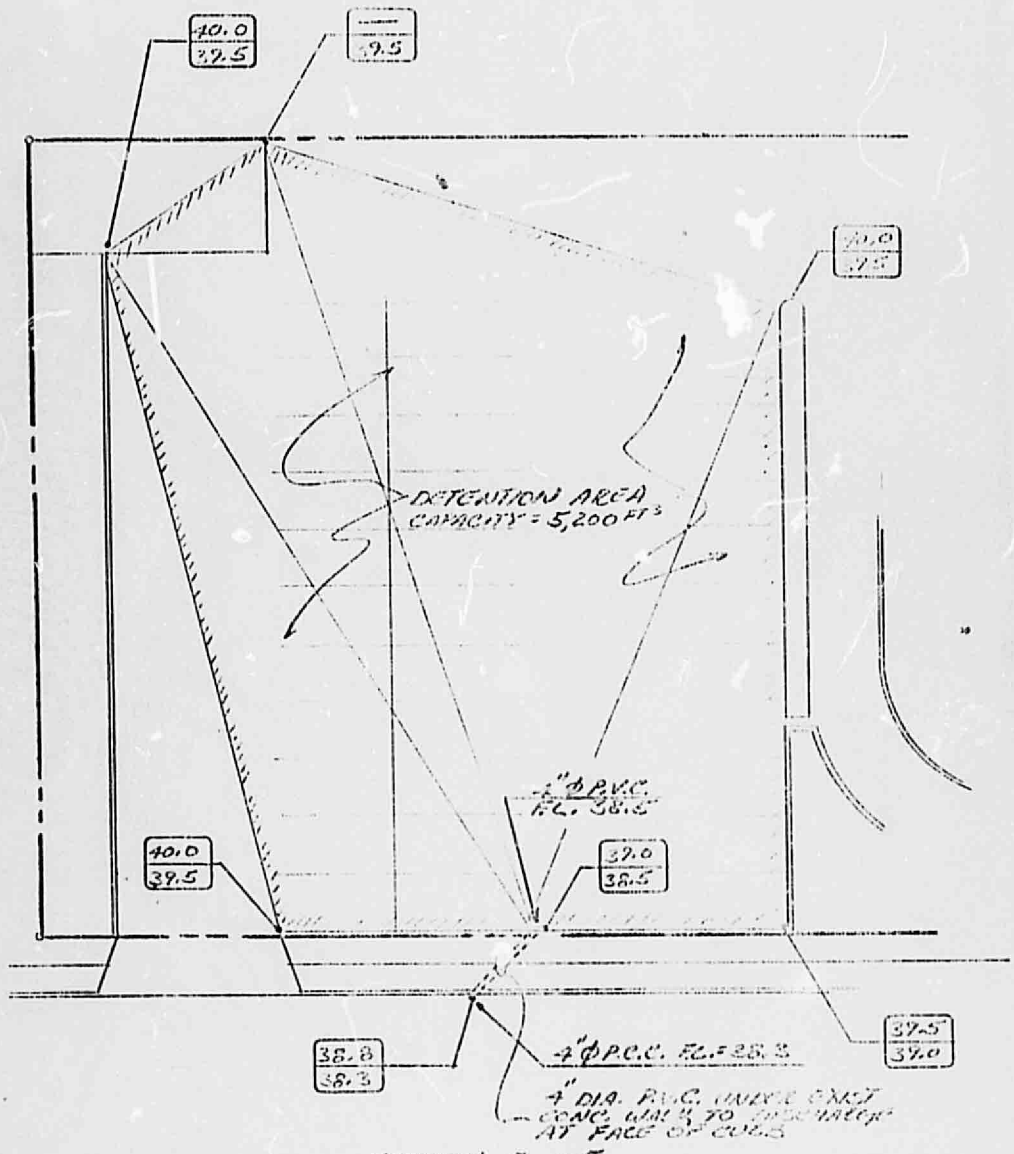

40.0
39.5
39.5
40.0
39.5
DETENTION AREA
CAPACITY = 5,200 FT³
4" ϕ P.V.C.
F.L. 38.5
40.0
39.5
39.0
38.5
38.8
38.3
4" ϕ P.C.C. F.L. = 28.3
37.5
37.0
4" DIA. P.V.C. INVERT CAST
CONC. WALL TO DISPLACE
AT FACE OF CURB
MADISON ST. N.E

FIG. 4

IN ACCORDANCE WITH THE ABOVE RECOMMENDATIONS, THE PROJECT SITE WILL DISCHARGE RUNOFF AT NO GREATER A RATE THAN THE COMBINED UNDEVELOPED 1-YR. DISCHARGE RATE OF (0.71) CFS THE PONDING VOLUME WILL EQUAL 5,200 FT^3 WHICH EXCEEDS THE REQUIRED 4,950 FT^3, AND WILL BE CONTAINED IN THE NORTH PARKING AREA. MAXIMUM PONDED DEPTH WILL BE LESS THAN 12 INCHES, AT OUTLET.

IT IS CONCLUDED THAT THE PROPOSED DEVELOPEMENT WILL NOT HAVE AN ADVERSE EFFECT UPON AREAS DOWNSTREAM FROM THE PROJECT SITE.

HAMILL & McKINNEY
ARCHITECTS AND ENGINEERS, INC.

p.o. box 61563
dfw airport, texas 75261
1311 west irving blvd
irving, texas 75061
tx(214) 253-5153
ky(606) 277 1174 ca(415) 92? 4713

DRAINAGE REPORT

FOR:

GRANDY'S RESTAURANT

EAST CENTRAL @ MADISON ST.
ALBUQUERQUE, NEW MEXICO

ALBUQUERQUE
BLDG. DEPT.
JUN 30 1981
U.B.C.
PLAN CHECK
SECTION

JUNE 1981

EARL E. McKINNEY
NEW MEXICO
6924
REGISTERED PROFESSIONAL ENGINEER

REGISTRATIONS IN ALABAMA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, IDAHO, ILLINOIS, INDIANA, IOWA, KANSAS, KENTUCKY, LOUISIANA, MAINE, MARYLAND, MASSACHUSETTS, MICHIGAN, MINNESOTA, MISSISSIPPI, MISSOURI, MONTANA, NEBRASKA, NEVADA, NEW HAMPSHIRE, NEW JERSEY, NEW MEXICO, NEW YORK, NORTH CAROLINA, NORTH DAKOTA, OHIO, OKLAHOMA, OREGON, PENNSYLVANIA, RHODE ISLAND, SOUTH CAROLINA, SOUTH DAKOTA, TENNESSEE, TEXAS, UTAH, VIRGINIA, WASHINGTON, WEST VIRGINIA, WISCONSIN, WYOMING.

ON SITE RUNOFF DETERMINATIONS

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(TAKEN FROM 10 MIN)

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12 hr.	0.71	0.96	1.35	1.59	1.95	2.22	2.50	
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Rainfall intensity values

Figure 4

DETERMINE Q_1 UNDEVELOPED DISCHARGE RATE, CONT.

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TOTAL	.667		.600

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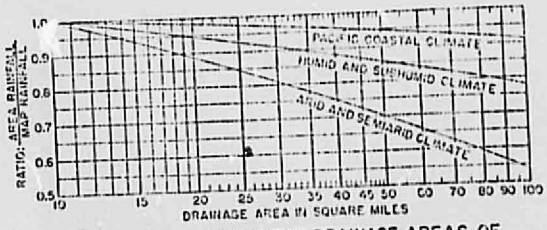
HYDROLOGY: CRITERIA FOR DESIGN STORMS USED IN DEVELOPING EMERGENCY SPILLWAY DESIGN AND FREEBOARD HYDROGRAPHS



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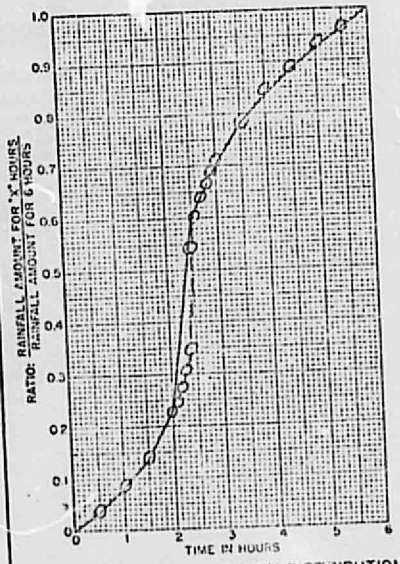
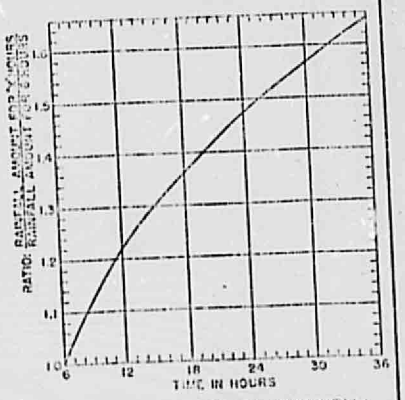
Max @ 2.5 hrs



(b) SIX HOUR DESIGN STORM DISTRIBUTION



(c) RELATIVE INCREASE IN RAINFALL AMOUNT FOR STORM DURATIONS OVER SIX HOURS

FIGURE 21.2

REFERENCE	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING DIVISION - CENTRAL TECHNICAL UNIT	STANDARD DWG. NO ES-1003 SHEET 1 OF 1 DATE 7 2 76

FIGURE 2

DISCHARGE THRU 4" Ø P.V.C. PIPE
USING ORIFICE EQUATION

$Q = .60\ A\ \sqrt{2gh}$ WHERE H = HEAD AND IS CONSIDERED TO BE NEGLIGABLE OR = 1

A(A) IS IN FT²

$= (.6)(\pi)(.167^2)\ \sqrt{2(32.2)}$

$Q = .42$ CFS

FIGURE #3

RECOMMENDATIONS AND CONCLUSIONS

1. GRADE LOT AS SET FORTH IN HAMLL & ALKINNEY SITE PLAN TO DRAIN RUNOFF NATURALLY TO GRANDY'S SOUTH DRIVEWAY APPROACH ONTO MADISON ST. N.E., .23 CFS FOR MAX Q, POSITIVE DISCHARGE.
2. GRADE NORTH EAST PORTION OF SITE (PARKING AREA AS SET FORTH IN HAMLL & ALKINNEY SITE PLAN TO PROVIDE POSITIVE DRAINAGE SWALES TO CARRY STORM RUNOFF TO PONDING AREA (5200 FT.²)
3. INSTALL 4" Ø P.V.C. TO ALLOW .42 CFS DISCHARGE FROM NORTH END OF SITE FROM PONDING AREA. (SEE SITE PLAN & ATTACHED FIG 4) FOR EXACT ELEVATION AND LOCATION.

4) FOLLOWING THIS CRITERIA ONLY .23 CFS + .42 CFS WILL DRAIN OFF SITE AFTER DEVELOPMENT. THIS EQUALS .65 CFS < .71 CFS.

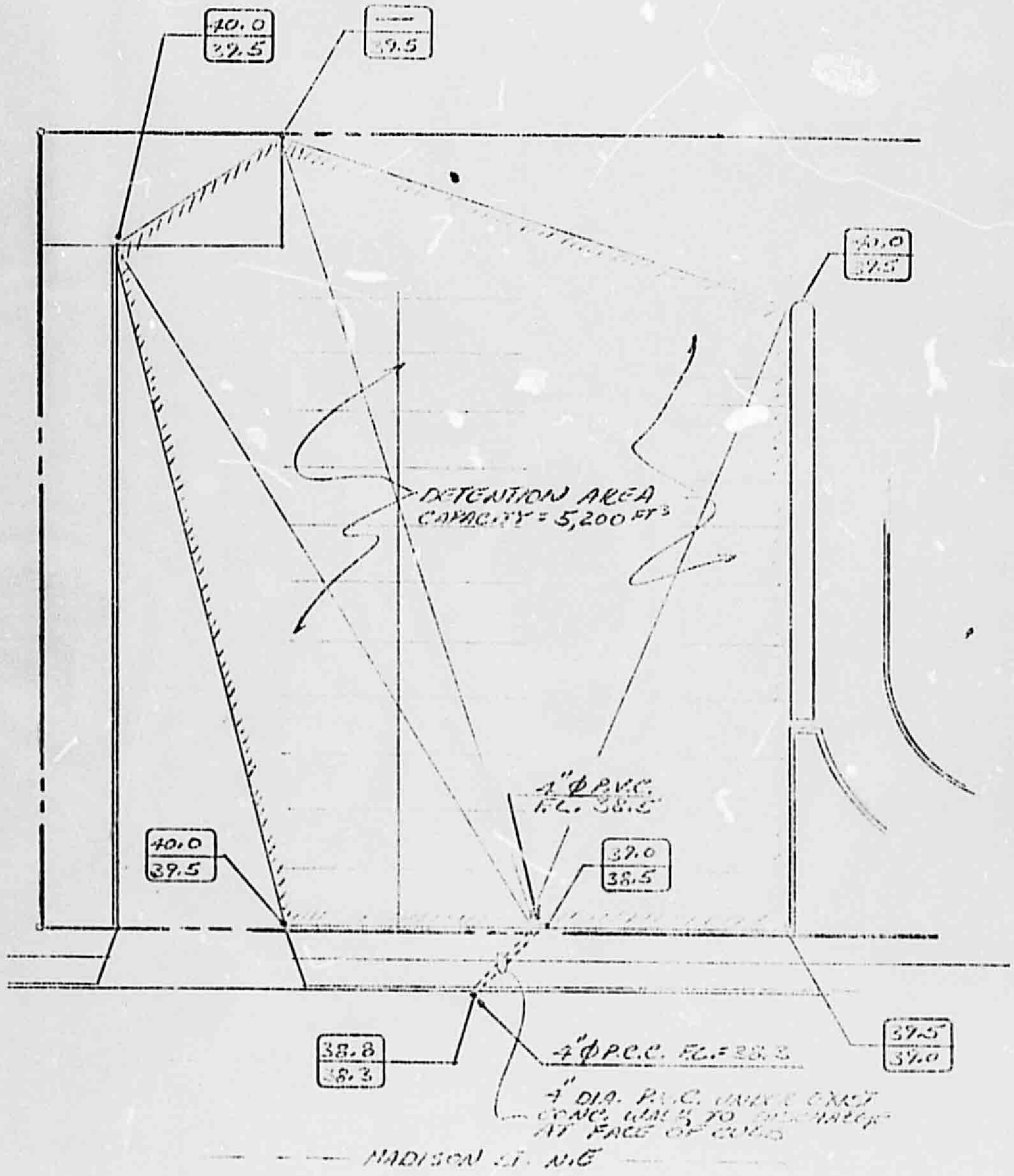

40.0
39.5
39.5
40.0
39.5
DETENTION AREA
CAPACITY = 5,200 FT³
4"ΦPVC
F.L. 38.0
40.0
39.5
37.0
38.5
38.8
38.3
4"ΦPCC. F.L.=38.3
37.5
37.0
4" DIA. PVC UNDER CONST
CONC. CAPS TO BE PLACED
AT FACE OF CURB
MADISON ST. N.E

FIG. 4

IN ACCORDANCE WITH THE ABOVE RECOMMENDATIONS, THE PROJECT SITE WILL DISCHARGE RUNOFF AT NO GREATER A RATE THAN THE COMBINED UNDEVELOPED 1-YR. DISCHARGE RATE OF (0.71) CFS THE PONDING VOLUME WILL EQUAL 5,200 FT^3 WHICH EXCEEDS THE REQUIRED 4,950 FT^3, AND WILL BE CONTAINED IN THE NORTH PARKING AREA. MAXIMUM PONDED DEPTH WILL BE LESS THAN 12 INCHES, AT OUTLET.

IT IS CONCLUDED THAT THE PROPOSED DEVELOPEMENT WILL NOT HAVE AN ADVERSE AFFECT UPON AREAS DOWNSTREAM FROM THE PROJECT SITE.

BOVAY ENGINEERS, INC.
HOUSTON • SPOKANE • BATON ROUGE
AUSTIN • ALBUQUERQUE • WASHINGTON, D. C.

August 27, 1981

Mr. Richard S. Heller, P.E.
City Engineer
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

Re: Proposed Grandy's Restaurant
4701 Central Avenue, N.E.
BEI No. 6014-179

Dear Mr. Heller:

Please find enclosed three copies of the Drainage Report for the project referenced above.

We have incorporated all of the criteria outlined in the City Engineer's Interim Drainage Guidelines, November 1979, regarding ponding and we request that you review and approve this report.

If you should have any questions, please do not hesitate to call.

Sincerely,

BOVAY ENGINEERS, INC.

Stephen F. Fritz 8-27-81

Stephen F. Fritz, P.E.
NM P.E. No. 6804

SFF:DMG:mm
Enclosure

PROFESSIONAL ENGINEERS AND PLANNERS TEL. 505/884-0700
P. O. BOX 30088 • 3125 CARLISLE BOULEVARD, N.E. • ALBUQUERQUE, NEW MEXICO 87190 • [redacted] • CABLE BOVENG

DRAINAGE REPORT

FOR

GRANDY'S RESTAURANT
4701 CENTRAL AVE. N.E.
ALBUQUERQUE, NEW MEXICO

PREPARED FOR

ROGER FINHOLT
DALLAS, TEXAS

AUGUST 1981
BEI 6014-179

BOVAY ENGINEERS, INC.

BOVAY

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

DRAINAGE REPORT INFORMATION SHEET

PROJECT TITLE GRANDY'S RESTAURANT

ZONE ATLAS PAGE NO. K-17 CITY ADDRESS 4701 Central Avenue NE

LEGAL ADDRESS Valley View Addition, Tract A, Block 42

ENGINEERING FIRM Bovay Engineers, Inc. CONTACT Stephen F. Fritz, P.E.

ADDRESS P. O. Box 30068, Albuquerque, NM 87190 PHONE 884-0700

OWNER Roger Finholt Enterprises CONTACT Roger Finholt

ADDRESS P. O. Box 340047, Dallas, TX 75234 PHONE (214) 256-1421

ARCHITECT/SURVEYOR Hamill & McKinney CONTACT Emmett Sacry

ADDRESS P. O. Box 61563 Dallas/Ft. Worth Airport, TX 75234 PHONE (214) 253-5153

DATE SUBMITTED August 27, 1981

BY Stephen F. Fritz, P.E.

Surveyor Hall Surveying Co. Contact Richard V. Hall

Address 2625 Pennsylvania Ave., Suite 350 Albuquerque, NM 87110 Telephone 884-6200

	Page No.
PURPOSE	1
BACKGROUND	1
PROJECT LOCATION AND DESCRIPTION	2
EXISTING DRAINAGE CONDITIONS	2
DRAWING 1 - LOCATION MAP	3
PHOTOGRAPHS	4
DEVELOPED DRAINAGE CONDITIONS	5
DRAWING 2 - TOPOGRAPHIC MAP	6
RECOMMENDATIONS AND CONCLUSIONS	7

TAB 1

CITY ENGINEER'S INTERIM DRAINAGE GUIDELINES, NOVEMBER 1979

TAB 2

MR. BRIAN G. BURNETT'S, CIVIL ENGINEER/HYDROLOGY, LETTER DATED AUGUST 3, 1981

TAB 3

DESIGN COMPUTATIONS

MAP POCKET

DRAWING C-1 - GRADING AND DRAINAGE PLAN

PURPOSE

The purpose of this report is to present the supporting engineering data for the most feasible solution for the proposed drainage plan consistent with DRAINAGE RESOLUTION 1980-15, ALBUQUERQUE METROPOLITAN FLOOD CONTROL AUTHORITY. This report follows the criteria outlined by the City Engineers' Interim Drainage Guidelines of November, 1979, a copy of which is located in TAB 1.

BACKGROUND

In June 1981, a drainage report prepared by Mr. Earl F. McKinney of Hamill & McKinney, Architects and Engineers, Inc., Dallas, Texas, was submitted to the City of Albuquerque for its' approval. This drainage report was not approved by Mr. Brian G. Burnett, Civil Engineer/Hydrology on August 3, 1981. See TAB 2 for a copy of Mr. Burnett's letter.

This letter requested that all of the City's Drainage Report Checklist Requirements be addressed. Subsequently, Roger Finholt Enterprises engaged Bovay Engineers, Inc. to prepare a drainage report that complied with the City's requirements. On August 18, 1981 a meeting was held between Mr. Brian Burnett from the City's Hydrology Engineering Division and Mr. Steve Fritz from Bovay Engineers, Inc. to discuss the city's requirements and to review the checklist.

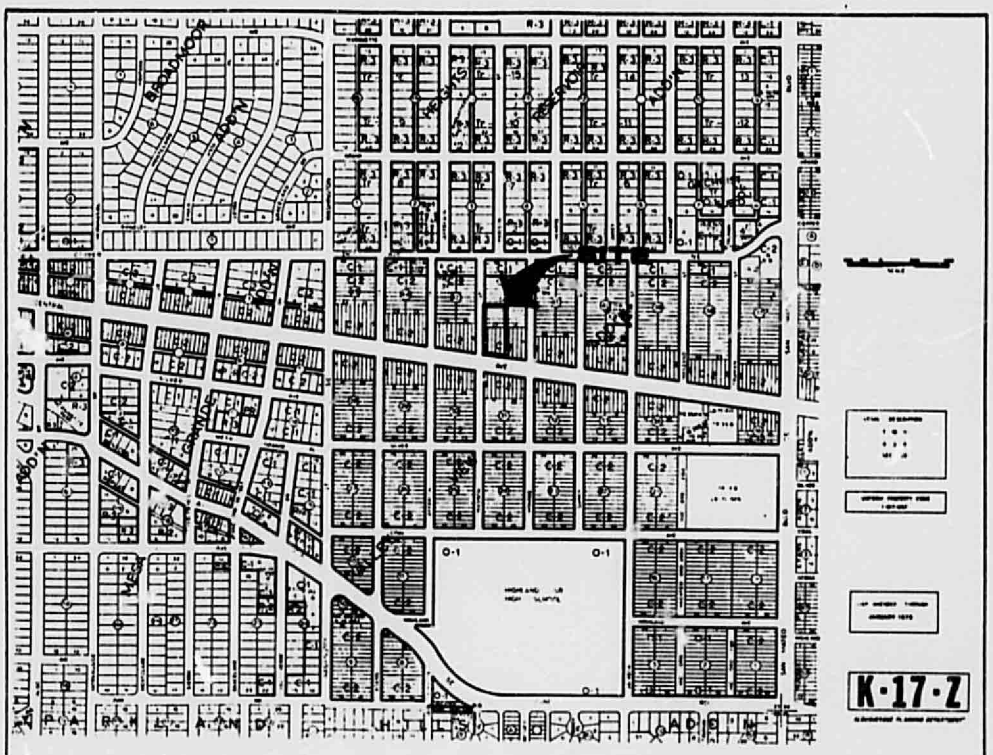
PROJECT LOCATION AND DESCRIPTION

The proposed Grandy's Restaurant, a one-story building, is planned for an approximately 36,000 square foot lot located at 4701 Central Ave. NE. Presently the front third of this lot is paved with the remainder being undevaloped. The area is shown in the City of Albuquerque's Zone Atlas, Map K-17. A location map is shown on Drawing 1.

The proposed project site contains approximately 0.831 acres of land. The slope of the project site is generally from southeast to northwest at about a 1.1% grade. The difference in elevation from the south property line to the north property line is 3.5 feet. The lowest elevation on the site is approximately 5238.20 feet above mean sea level.

EXISTING DRAINAGE CONDITIONS

The project site is bounded by paved, curbed, and guttered streets, Central Avenue on the south and Madison Street on the west; by undeveloped lands to the north; and by mostly undeveloped lands to the east. The front third of the lot to the east is paved and a used auto sales with a trailer for an office occupies this site. For the photography of the site, see page 4. Off-site storm water runoff enters the site from the east and this flow will be accommodated by this drainage plan. The present on-site drainage is characterized by overland sheet flow basically from south to north. Both the off-site flow and the on-site flow collect at the rear of the site of the proposed development and in



NORTH

LEGAL DESCRIPTION

TRACT A. BLOCK 42 OF VALLEY VIEW ADDITION TO THE CITY OF ALBUQUERQUE, NEW MEXICO AS THE SAME ARE SHOWN AND DESIGNATED ON THE MAP OF SAID ADDITION, FILED IN THE OFFICE OF THE COUNTY CLERK OF BERNALILLO COUNTY, NEW MEXICO, ON JUNE 19, 1981.

LOCATION MAP

DRAWING 1

Bovay Engineers, Inc.

FOLLOWING FRAME (S)

IS SHOT OF

PHOTOGRAPH (S)

Photo 1: Looking north at the proposed site from the corner of Central Avenue and Madison Drive. Highland Senior Center is in the background.

Photo 2: Looking southeast across the proposed site. Highland Shopping Center is on the south side of Central.

the undeveloped lot to the north in a depression where they remain until evaporation and infiltration finally remove them. The drainage areas contributing runoff to the site are outlined on Drawing 2. The combined existing undeveloped 100-year runoff for all three drainage areas is 2.43 cfs.

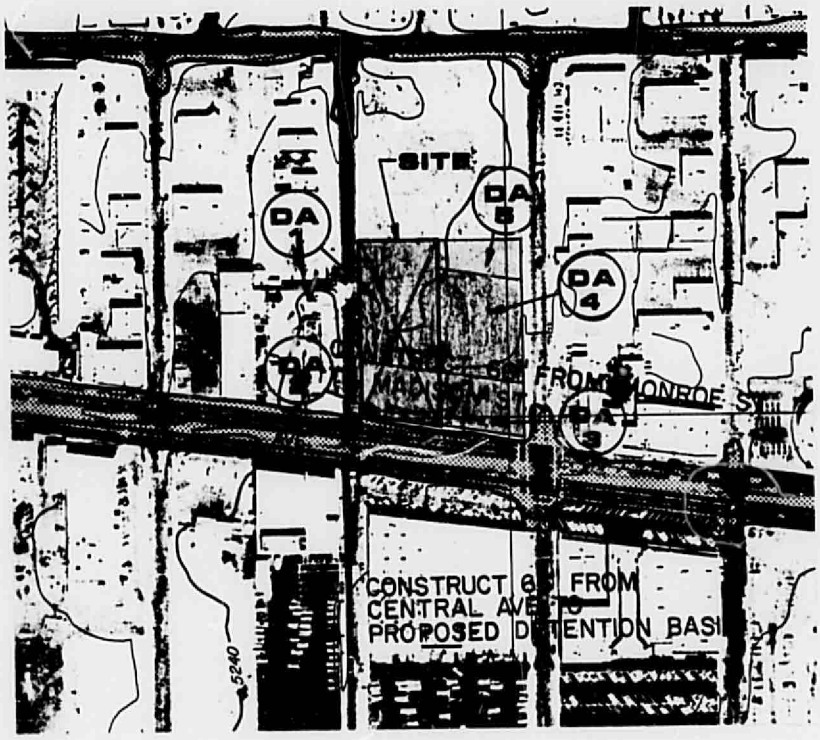
DEVELOPED DRAINAGE CONDITIONS

The roof of the proposed one-story building will comprise approximately 15 percent of the entire site, sidewalks, and paved parking 78 percent, and landscaped areas 7 percent.

As shown on Drawing C-1 (located in the map pocket), the proposed site has been graded so that most of the storm water runoff drains to the north parking lot detention area. Storm water runoff from portions of the driveway entrances and the parking area to the south of the proposed restaurant will drain directly off the site without being detained.

A three foot wide sod-lined swale will be constructed between the eastern property line and the proposed refuse bin enclosure to intercept the off-site sheet flow from Drainage Area No. 5 and to convey this runoff to the lot to the north of the project site. The 100-year runoff rate from Drainage Area No. 5 has been computed to be 0.32 cfs.

The off-site flows from Drainage Area Nos. 3 and 4 to the east of the proposed development will be intercepted by matching the asphalt



TOPOGRAPHIC MAP

DRAWING 2
Bovay Engineers, Inc.

pavement elevation to existing ground elevation along the eastern property line. The 100-year runoff rate from this area will be 2.11 cfs. Small flows from Drainage Area Nos. 3 and 4 will be accommodated by the sump pump located in the proposed developments' north parking area. Large flows including the 100-year storm will have to be discharged through the emergency spillway system as shown on drawing C-1.

Situated within the north parking lot detention area will be a standard pre-cast manhole with a grated cover. This manhole will contain an electric submersible dewatering pump. The discharge into Madison Street will be 0.38 cfs. This pump rate combined with the 100-year discharge rate from the driveway entrances and parking area that drains directly off of the site will not exceed the undeveloped 5-year discharge rate of 1.34 cfs, thus meeting the criteria set forth in the City Engineers' Interim Guidelines of November, 1979. The storm water runoff will be pumped through a 2½-inch, PVC, schedule 40 outlet pipe that will be buried beneath the parking lot and discharge through the curb face at Madison Street. The submersible pump will be equipped with level controls for automatic start/stop operations. A typical pump meeting these requirements is shown in the attached catalog cut-sheet located in TAB 3 with the design computations.

Based upon the Inflow-Outflow mass balance computation included in this report, the storage volume required for the 100-year storm will have to be 2839 cubic feet. The volume of storm runoff that can be ponded equals or betters the difference between the developed 100-year volume and the undeveloped 100-year volume. This storage volume, 2617 cf, has been provided entirely within the north parking lot area. The maximum ponded depth will be less than 10 inches.

RECOMMENDATIONS AND CONCLUSIONS

The following recommendations are proposed:

1. Intercept and convey the off-site storm water runoff from Drainage Area No. 5 to the lot to the north of the proposed site by means of a three foot wide sod-lined swale. This runoff has historically drained to this location.

2. Allow the off-site storm water runoff from the drainage area to the east of the proposed site to enter the parking lot and it shall either be accommodated by the sump pump and/or the emergency spillway.

3. Grade the parking areas to provide positive drainage swales to carry the storm runoff to the inlet structure of the submersible pump.

4. Provide an electric submersible dewatering pump with a 170 gpm capacity, 25.5 foot head, 1½ HP, three phase 60 Hertz motor.

5. Provide a 2½-inch, schedule 40 PVC storm drain line from the submersible pump to the face of curb along Madison Street.

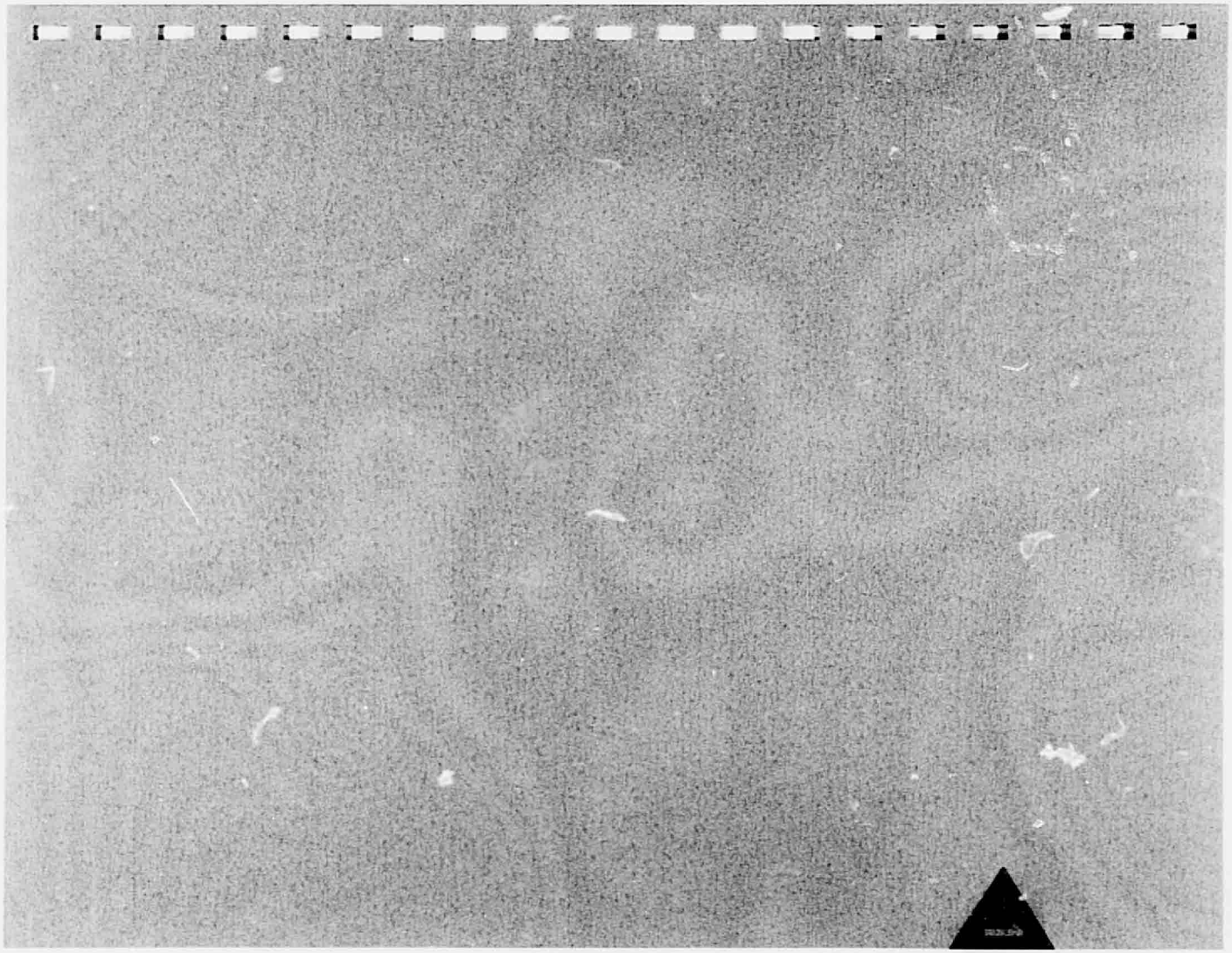
6. Grade the periphery landscaping areas to hold and retain all direct rainfall falling on them.

7. Provide 3222 cubic feet of storage volume in the north parking lot area.

8. Provide an emergency spillway system with a maximum capacity of 5.22 cfs.

In accordance with the above recommendations, the project site will discharge runoff at no greater rate than the undeveloped 5-year discharge rate of 1.34 cfs. The ponding volume provided will equal or better the required volume of 2839 cubic feet and will be contained in the north parking lot area. An electric, submersible pump will be provided to discharge the runoff to Madison Street.

It is concluded that the proposed development will not have an adverse effect on areas downstream from the site.



INTERIM DRAINAGE GUIDELINES
November 1979

Due to the time necessary in the publication of the Storm Drainage Manual, and at the request of various developers and the engineering community, the following are guidelines to be considered as aids in the preparation and approval of drainage reports and plans and their review:

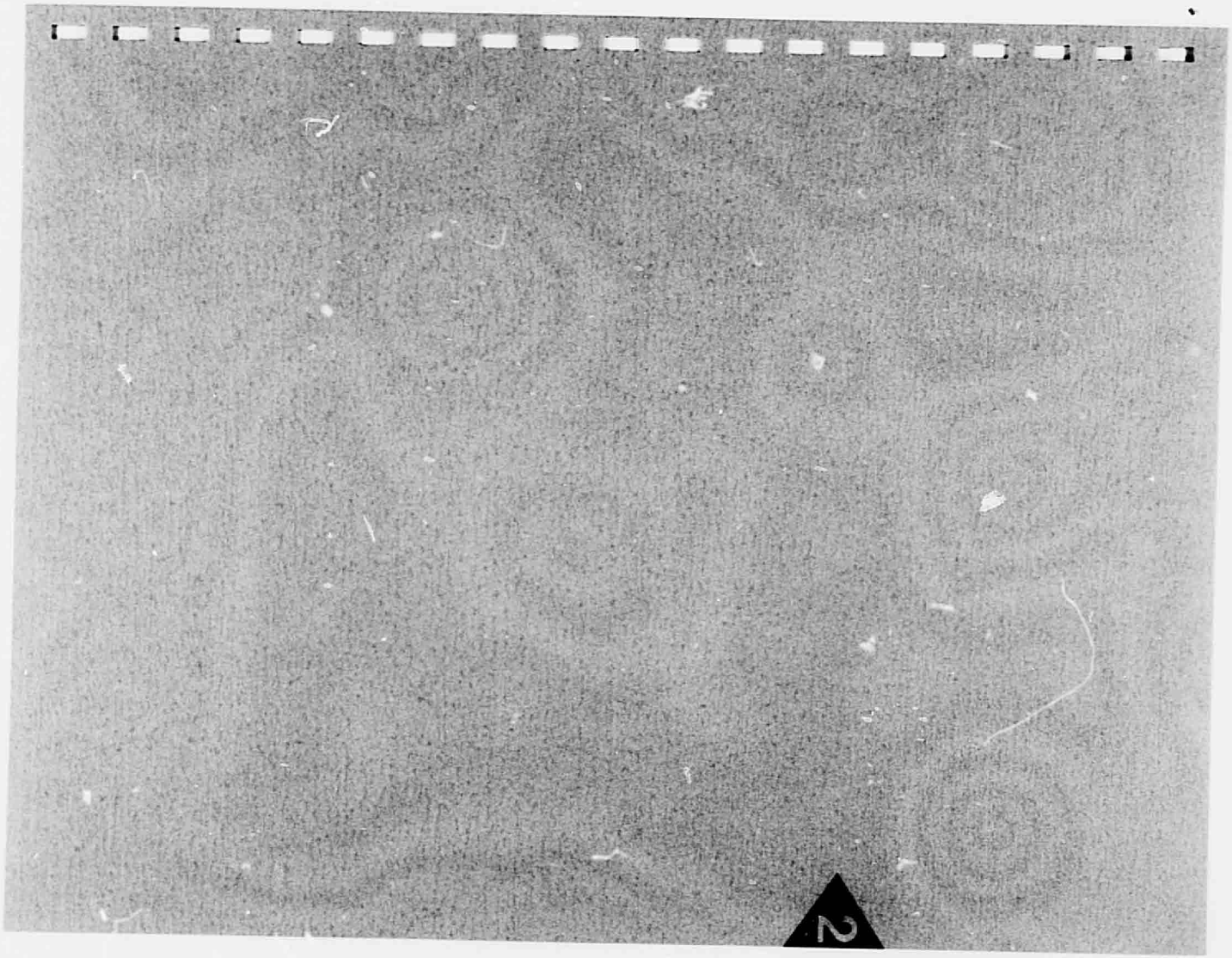
(A) Flow in Streets:

1) All flow in streets will be confined within the street R/W (Q_{100}).
2) The maximum flows (Q_{10}) in streets is established from the calculation of velocity times depth which may not exceed 4.8. When this parameter is exceeded, a storm drain is required. If downstream facilities are adequate, no interim ponding will be required; if downstream facilities are inadequate, a common pond meeting the criteria of Paragraph B5 will be required.
3) Special consideration must be given for all flows at T-intersections. Both the Q_{10} and Q_{100} must be analyzed to prove no encroachment at the R/W line on the downhill portion of the T-intersection and that the momentum will not carry the flow over the curb across from the intersecting street.

(B) Ponding:

1) No ponding will be required on any lot or development of less than one acre, unless said lot or development is part of a previously approved Master Drainage report or plan.
2) No ponding will be required for any development of less than five acres where the composite C-factor, including streets, is less than C=.50.
3) No ponding will be <u>required</u> on any individual lots within a subdivision. Common ponding areas are a preferred solution with the approval of the City Engineer.
4) As much as practicable, all flows for a development shall be routed through required pond(s).
5) Required ponds shall have the following general characteristics:
   a) Volume = Developed 100 year volume - Undeveloped 100 - year volume.
   b) Positive discharge = Q_5 undeveloped to street or storm drain.
   c) Overflow spillway = Q_{100} developed.
6) Developments within the valley area shall have ponding regardless of size. The pond(s) shall have a volume equivalent to the 50-year developed runoff volumes with Q_1 positive discharge. An overflow must be provided.

Approved:
Richard S. Heller
Richard S. Heller
City Engineer



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

MAYOR
David P. Rush

K17-D8

August 3, 1981

(505) 766-7467

Mr. Earl F. McKinney
Hamill & McKinney
P. O. Box 61563
DFW Airport, Texas 75261
Irving, Texas 75061

Re: GRANDY'S RESTAURANT DRAINAGE REPORT

Dear Mr. McKinney:

Enclosed is a copy of the Drainage Report Checklist Requirements. The items which are checked "NO" need to be addressed before this office can make a complete review of the report. I have also included a copy of the Construction Plan Checklist Requirements and Special Order No. 19 for your information.

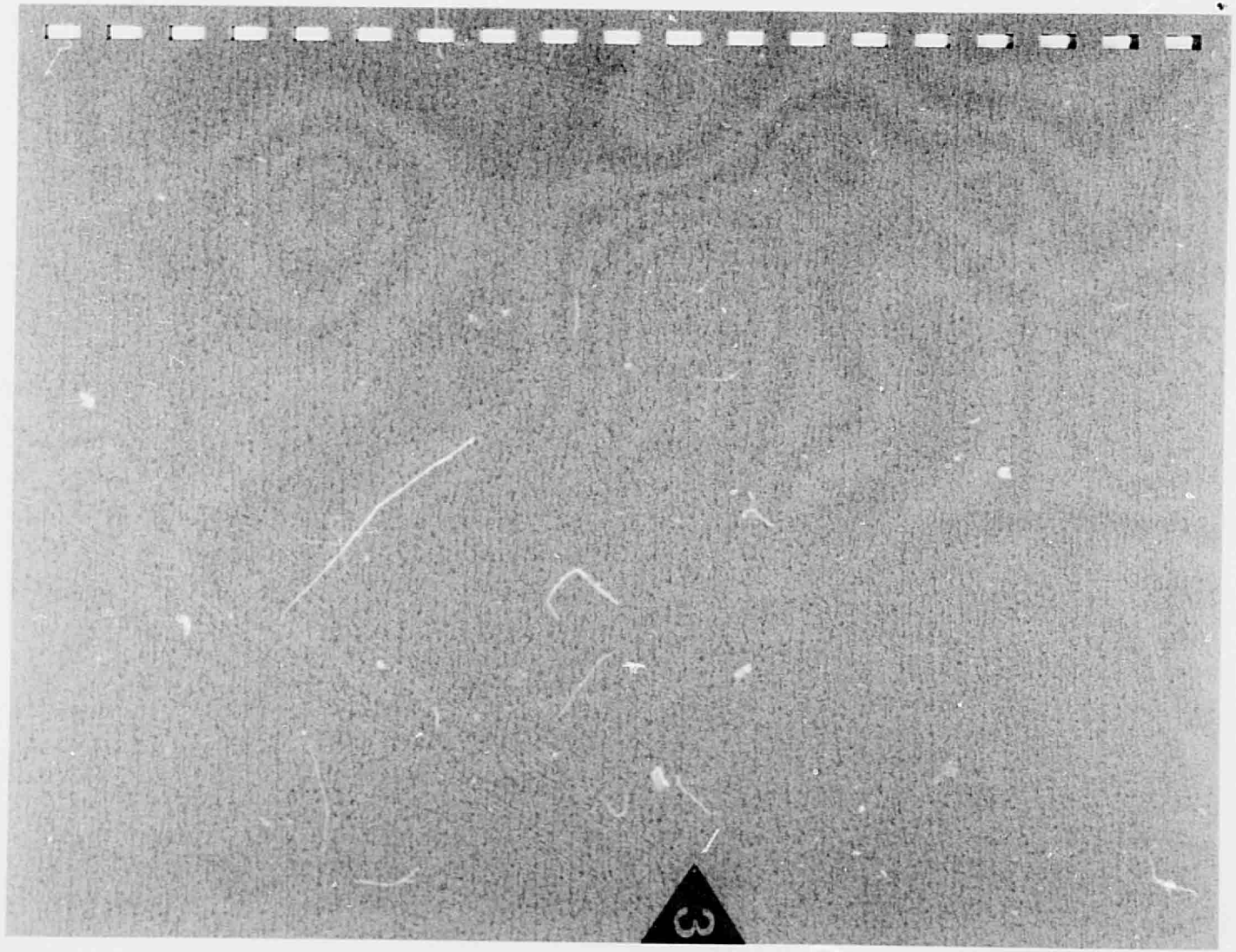
If I can be of further help on this matter, please call.

Very truly yours,

Brian G. Burnett

Brian G. Burnett
Civil Engineer/Hydrology

BGB/fs
Enclosures


3

Determination of undeveloped Drainage Areas:

Onsite Drainage Areas:

All Areas were planimetered twice & averaged

D.A. No. 1 - currently undeveloped

$$\begin{array}{r} 0.64 \\ \underline{1.28} \end{array}$$

$$0.64 \times \frac{(200\ Ft.)^2}{in} \times \frac{1}{43560} = 0.588\ Ac.$$

D.A. No. 2 - currently paved

$$\begin{array}{r} 0.26 \\ \underline{0.53} \end{array}$$

$$0.265 \times \frac{(200\ Ft.)^2}{in} \times \frac{1}{43560} = 0.243\ Ac. \checkmark$$

OFF-site Drainage Areas:

D.A. No. 3 - currently paved

$$\begin{array}{r} 0.26 \\ \underline{0.54} \end{array}$$

$$0.270 \times \frac{(200\ Ft.)^2}{in} \times \frac{1}{43560} = 0.248\ Ac \checkmark$$

D.A. No. 4 - currently undeveloped

$$\begin{array}{r} 0.46 \\ \underline{0.93} \end{array}$$

$$0.465 \times \frac{(200\ Ft.)^2}{in} \times \frac{1}{43560} = 0.427\ Ac \checkmark$$

FOR GRANDY'S E. CENT. DESCRIPTION DRAINAGE REPORT COMP.
DESIGNED MG DATE 8/24/01 CHECKED SFF DATE 8/25/01 FILE NO. 60147A SHEET 1 OF 28

BOVAY ENGINEERS, INC.

D.A. NO. 5 - currently undeveloped

0.18
0.36

$$0.18 \times \frac{(200\,ft)^2}{in} \times \frac{1}{43560} = 0.165\ AC.$$ ✓

FOR GRANDY'S E. CENTRAL DESCRIPTION DRAINAGE REPORT COMPS
DESIGNED MG DATE 8/24/81 CHECKED SCF DATE 8/25/81 FILE NO. 100A-179 SHEET 2 OF 28

BOVAY ENGINEERS, INC.

Determine off-site Undeveloped Flows Q_{10} & Q_{100}

Determine time of concentration:

Time of Concentration for small upland watersheds where overland flow exists:

$$t_c = \frac{L}{60 \frac{sec}{min} V}$$

D.A. NO. 3+4

D.A. NO. 3: currently paved → $C = 0.95$

Using FIG. 3-1, 'URBAN HYDROLOGY FOR SMALL WATERSHEDS', SCS Technical Release NO. 55:

ELEVATION DIFFERENCE = 5243.8 − 5242.3 = 1.5

Length = 100'

AVG. Slope $S = \Delta E / L = 1.5/100 = 1.50\%$

Velocity from FIG 3-1 = 2.45 ft./sec.
PAVED AREA (SHEET FLOW)

$$t_c = \frac{100}{60(2.45)} = 0.68 \text{ min}$$

D.A. NO. 4 - currently undeveloped → $C = 0.35$

Elev. difference = 5242.3 − 5240.0 = 2.3

Length = 200'

Slope = 2.3/200 = 1.15%

Velocity = 1.05 fps NEARLY BARE GROUND

$$t_c = \frac{200}{60(1.05)} = 3.17 \text{ min.}$$

Total t_c = 0.68 + 3.17 = 3.85 min use t_c = 10 min

FOR GRANDY'S-EAST CENT. DESCRIPTION DRAINAGE REPORT COMPS
DESIGNED MG DATE 8/24/81 CHECKED SFF DATE 8/25/81 FILE NO. 6014.179 SHEET 3 OF 28

BOVAY ENGINEERS, INC.

D.A. No. 5 – currently undeveloped → C = 0.35

Elev. difference = 5241.6 − 5239.9 = 1.7'

Length = 125'

Slope = $\frac{1.7}{125}$ = 1.36 %

Velocity = 1.15 fps NEARLY BARE GROUND

$t_c = \frac{125}{60(1.15)}$ = 1.81 min. USE t_c = 10 min.

Determine Q_{10}:

D.A. No. 3 & 4

$Q_{10} = CI_{10}A$ $CA_3 = 0.95(0.248) = 0.236$

$\Sigma CA = 0.386$ $CA_4 = 0.35(0.427) = 0.150$

"C" = 0.57

$Q_{10} = CI_{10}A = 0.386(3.54) =$ 1.37 CFS

D.A. No. 5:

$Q_{10} = 0.35(3.54)(.165) =$ 0.20 CFS

Determine Q_{100}:

D.A. No. 3 & 4

$Q_{100} = CI_{100}A$

$\Sigma CA = 0.386$

$Q_{100} = 0.386(5.46) =$ 2.11 CFS

D.A. No. 5:

$Q_{100} = 0.35(5.46)(.165) =$ 0.32 CFS

FOR GRANDY'S-EAST CENT DESCRIPTION DRAINAGE REPORT COMPS

DESIGNED MG DATE 8/24/81 CHECKED SFF DATE 8/25/81 FILE NO. 6014179 SHEET 4 OF 28

BOVAY ENGINEERS, INC.

Determine On-site undeveloped Q_5 for Positive discharge:

Determine time of concentration using same method as for off-site Areas:

D.A. No. 1 – currently undeveloped

Elev. difference = 5240.9 – 5238.2 = 2.7

Length = 215'

Slope = $\frac{2.7}{215'}$ = 1.26%

Velocity = 1.1 fps NEARLY BARE GROUND

$t_c = \frac{215'}{60(1.1)}$ = 3.26 min.

D.A. No. 2 – currently paved

Elev. difference = 5241.7 – 5240.9 = 0.8'

Length = 100

Slope = $\frac{0.8}{100}$ = 0.8 %

Velocity = 1.8 fps PAVED AREA (SHEET FLOW)

$t_c = \frac{100}{60(1.8)}$ = 0.93 min.

Total t_c = 3.26 + 0.93 = 4.19 min use t_c = 10 min.

Determine Q_5:

D.A. No. 1 & 2

$Q_5 = CI_5A$ $CA_1 = 0.35(0.588) = 0.206$

$CA_2 = 0.95(0.243) = 0.231$

FOR GRANDY'S E. CENT. DESCRIPTION DRAINAGE REPORT COMP

DESIGNED MG DATE 8/24/81 CHECKED SFF DATE 8/25/81 FILE NO. 014179 SHEET 5 OF 28

BOVAY ENGINEERS, INC.

$\Sigma CA = 0.437$ "C" = 0.53

$Q_5 = CI_5A = 0.437(3.06) = \underline{1.34 \text{ CFS}}$

Total Positive discharge rate equals Q_5 from D.A. NO. 1 & D.A. NO. 2.

→ $\underline{\underline{Q_5 = 1.34 \text{ CFS}}}$

OVERFLOW SPILLWAY = Q_{100} DEVELOPED.

THE OVERFLOW SPILLWAY HAS TO ACCOMODATE THE Q_{100} UNDEVELOPED OFFSITE RUNOFF FROM DRAINAGE AREAS 3 & 4

ONSITE DEVELOPED CA 0.95(.601) = 0.571

OFFSITE UNDEVEL CA 0.386

$\Sigma CA = 0.957$

$Q_{100} = CI_{100}A$

$= 5.46(0.957) = 5.225$ CFS

FOR GRANDY'S F. CENT DESCRIPTION DRAINAGE REPORT COMPS

DESIGNED MG DATE 8/24/81 CHECKED SEF DATE 8/25/81 FILE NO. 6014-179 SHEET 6 OF 28

BOVAY ENGINEERS, INC.

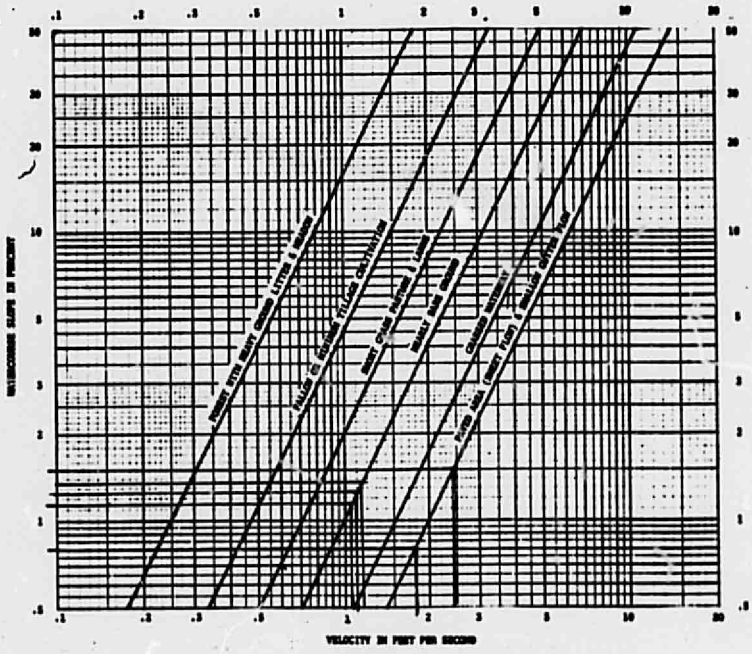


Figure 3-1.--Average velocities for estimating travel time for overland flow.

FOR GRANDY'S E. CENT DESCRIPTION DRAINAGE REPORT COMPS.
DESIGNED MG DATE 8/24/81 CHECKED SFF DATE 8/25/81 FILE NO. 6014179 SHEET 7 OF 28

BOVAY ENGINEERS, INC.

DETERMINE DISCHARGE THAT FLOWS FROM DEVELOPED SITE WITHOUT BEING DETAINED. THESE AREAS INCLUDE THE DRIVEWAY ENTRANCES AND THE PARKING AREA IN FRONT OF THE RESTAURANT.

DRAINAGE AREAS NO. B, C & D

TIME OF CONCENTRATION - ALL LESS THAN 10 MIN → USE t_c = 10 MIN

i_{100} FOR t_c = 10 min = 5.46 IN/HR.

DRAINAGE AREA NO.	AREA (ACRES)	RUNOFF COEF.	i_{100} (IN/HR)	Q_{100} (CFS)
B	0.008	0.95	5.46	0.04
C	0.135	0.95	5.46	0.70
D	0.004	0.95	5.46	0.02
TOTAL	0.147			0.76

TO DETERMINE ALLOWABLE PUMP DISCHARGE REDUCE Q_5 UNDEVELOPED DISCHARGE BY Q_{100} DEVELOPED / NO DETENTION DIRECT OFFSITE DISCHARGE

Q_{PUMP} = Q_5 UNDEVEL. − Q_{100} DEVEL. OFFSITE DISCHARGE

= 1.34 CFS − 0.76 CFS

= 0.58 CFS

FOR GRANDY'S - EAST CEN DESCRIPTION DRAINAGE REPORT COMPS

DESIGNED SFF DATE 8/26/81 CHECKED MG DATE 8/27/81 FILE NO. 6014-179 SHEET 8 OF 28

BOVAY ENGINEERS, INC.

DETERMINE WEIGHTED RUNOFF COEFFICIENT FOR DEVELOPED SITE

DRAINAGE AREA	AREA Ac.	C	AC
Roof	.033	0.95	.031
paved	.715	0.95	.679
landscaped	.083	0.35	.029
Total	.831		.739

weighted developed $C = \frac{\Sigma Ac}{\Sigma A}$

$C = \frac{.739}{.831} = 0.89$

Determine Actual Area draining to pond:

Total site Area = 0.831 Ac.
Landscaped Areas (total retention) = 0.083 Ac.
Paved Areas draining directly to street = .147 Ac.

Total Area draining to pond = .831 - .083 - .147
= 0.601 Ac.

"CA" = .601 (.96) = 0.571 to be used to determine runoff volume - see sht. 15

FOR Grandy's DESCRIPTION Dev. Runoff Coefficient
DESIGNED SFF DATE 8/25/21 CHECKED MG DATE 8/26/21 FILE NO. 6014-179 SHEET 9 OF 28

BOVAY ENGINEERS, INC.

Determine volume to be funded based upon Interim Drainage Guidelines. which state

V_p = 100 Yr. developed onsite volume − 100 Yr. undeveloped onsite volume.

100 Yr. − 6 Hr. undev. Vol. = $\frac{2.41 \text{ in.}}{12}(.53)(.881 \text{ Ac})(43560)$

= 3853 Ft.^{3}

100 Yr. − 6 Hr. dev. Vol. = $\frac{2.41}{12}(.89)(.881)(43560)$

= 6470 Ft.^{3}

Required Ponding Vol. = 6470 − 3853 = 2617 Ft.^{3}

FOR Grandy's DESCRIPTION Req'd. Ponding Volume

DESIGNED SFP DATE 8/26/81 CHECKED MG DATE 8/26/81 FILE NO. 4014-179 SHEET 10 OF 28

BOVAY ENGINEERS, INC.

DEVELOP INTENSITY-DURATION-FREQUENCY CURVE FOR GRANDY'S EAST CENTRAL

FROM THE USGS ALBUQUERQUE EAST QUAD MAP. THE SITE IS LOCATED @ CENTRAL & MONROE

FROM NOAA ATLAS 2 VOLUME IV - NEW MEXICO

X_1 = 2YR. 6HR. VALUE = 1.07 IN.
X_2 = 2YR. 24HR. VALUE = 1.30 IN.
X_3 = 100YR. 6HR. VALUE = 2.41 IN.
X_4 = 100YR. 24HR. VALUE = 2.85 IN.

EQUATION FOR ESTIMATING 1 HR VALUES IN N.MEX. WEST OF GENERALIZED CREST OF SANGRE DE CRISTO RANGE AND SACRAMENTO MOUNTAINS FROM PG. 15 NOAA ATLAS

$Y_2 = -0.011 + 0.942\,[(X_1)(X_1/X_2)]$
$Y_{100} = 0.494 + 0.755\,[(X_3)(X_3/X_4)]$
$Y_2 = -0.011 + 0.942\,[(1.07)(1.07/1.30)] = 0.82$
$Y_{100} = 0.494 + 0.755\,[(2.41)(2.41/2.85)] = 2.03$

Y_2 = 2YR 1HR ESTIMATED VALUE = 0.82 IN.
Y_{100} = 100YR 1HR ESTIMATED VALUE = 2.03 IN.

USE FIGURE 6 NOMOGRAPH ON PAGE 6 OF NOAA ATLAS TO DETERMINE PRECIP.-FREQ. VALUES FOR RETURN PERIODS BETWEEN 2-100 YRS.

5YR RETURN PERIOD - PRECIPITATION - 1.13
10YR RETURN PERIOD - " - 1.32
25YR RETURN PERIOD - " - 1.59
50YR RETURN PERIOD - " - 1.81

ADJUSTMENT FACTORS TO OBTAIN ESTIMATES FOR DURATIONS LESS THAN 1 HR FROM TABLE 12 NOAA ATLAS

DURATION (MIN)	5	10	15	30
	0.29	0.45	0.57	0.79

DRAINAGE AREA LESS THAN 10 SQ.MI. - AREAL REDUCTION FACTOR NOT APPLIED

FOR Grandy's DESCRIPTION intensity - duration
DESIGNED SFF DATE 8/25/11 CHECKED MG DATE 8/26/11 FILE NO. 0014-179 SHEET 11 OF 28

BOVAY ENGINEERS, INC.

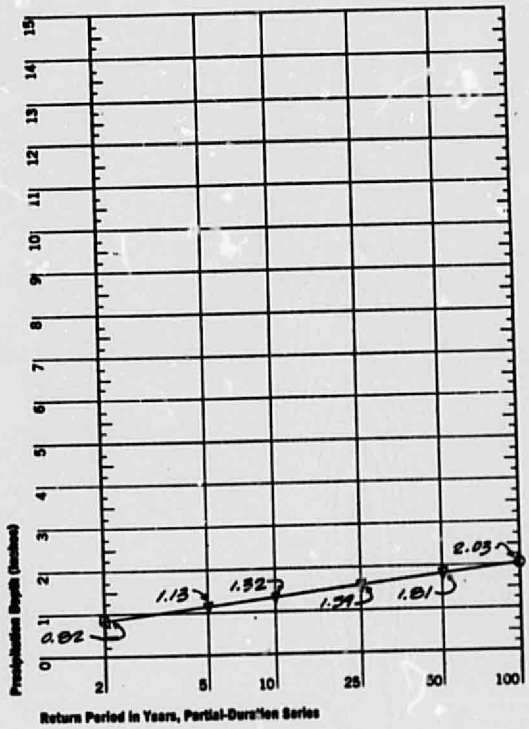


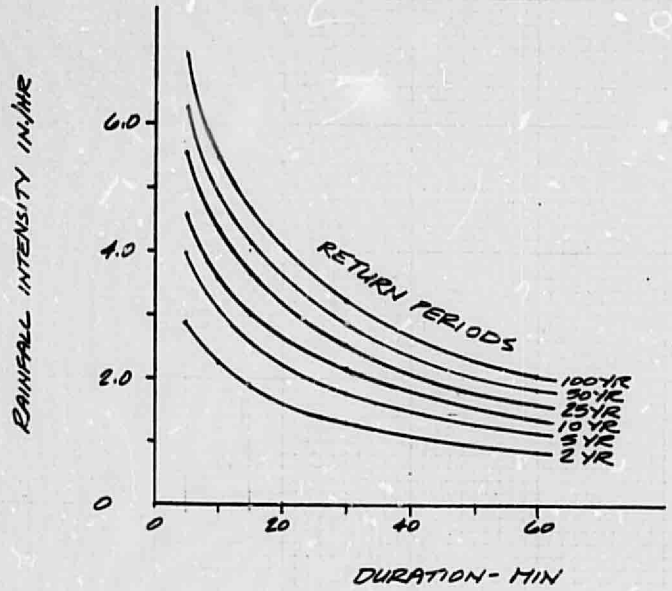
Figure 6. *Precipitation depth versus return period for partial-duration series.*

FOR Grady's DESCRIPTION Drainage Report Camps
DESIGNED SEF DATE 8/25/81 CHECKED MB DATE 8/26/81 FILE NO. 1014-179 SHEET 12 OF 28

BOVAY ENGINEERS, INC.

HYDROLOGY K17/D8 1 PLAN 2 of 2

DURATION	2 YEARS IN.	2 YEARS IN/HR	5 YEARS IN.	5 YEARS IN/HR	10 YEARS IN.	10 YEARS IN/HR	25 YEARS IN.	25 YEARS IN/HR	50 YEARS IN.	50 YEARS IN/HR	100 YEARS IN.	100 YEARS IN/HR
5 MIN	0.24	2.88	0.33	3.96	0.38	4.56	0.46	5.52	0.52	6.24	0.59	7.08
10 MIN	0.37	2.22	0.51	3.06	0.59	3.54	0.72	4.32	0.81	4.86	0.91	5.46
15 MIN	0.47	1.88	0.64	2.56	0.75	3.00	0.91	3.64	1.03	4.12	1.16	4.64
30 MIN	0.65	1.30	0.89	1.78	1.04	2.08	1.26	2.52	1.43	2.86	1.60	3.20
1 HR	0.82		1.13		1.32		1.59		1.81		2.03	
6 HR	1.07	0.18	1.38	0.23	1.61	0.27	1.90	0.32	2.22	0.37	2.41	0.40
24 HR	1.30	0.05	1.69	0.07	1.92	0.08	2.40	0.10	2.64	0.11	2.85	0.12

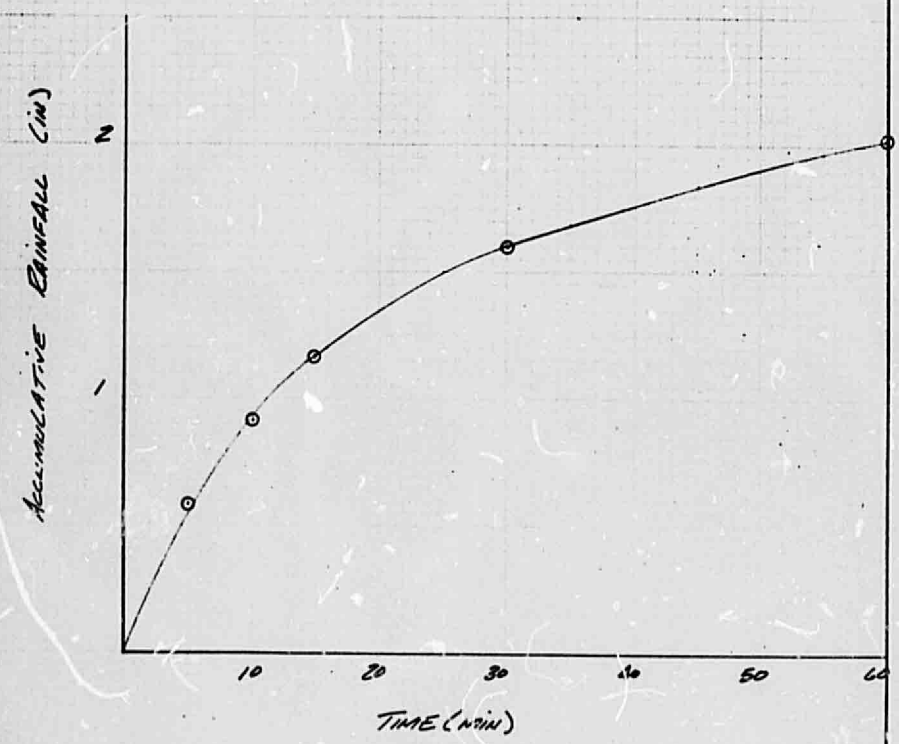


FOR Grundy's DESCRIPTION intensity - duration

DESIGNED SFF DATE 8/26/81 CHECKED MG DATE 8/26/81 FILE NO. 6018-179 SHEET 13 OF 28

BOVAY ENGINEERS, INC.

MASS RAINFALL CURVE



FOR GRANDY'S DESCRIPTION MASS RAINFALL

DESIGNED MG DATE 8/26/81 CHECKED SFF DATE 8/27/81 FILE NO. 4004-179 SHEET 14 OF 28

BOVAY ENGINEERS, INC.

INFLOW - OUTFLOW DETERMINATION

TIME (MIN)	* ACCUM. RAINFALL (IN)	Δ RAINFALL (IN)	INFLOW ($FT.^3$)	OUTFLOW (FT^3)	Δ STORAGE (FT^3)	ACCUM. STORAGE (FT^3)
0	0.	0.	0	0	0	0
5	.59.	.59.	1223	114	1109	1109
10	.91.	.32.	663	114	549	1658
15	1.16	.25	518	114	404	2062
20	1.35.	.19.	394	114	280	2342
25	1.50.	.15.	311	114	197	2539
30	1.60.	.10.	207	114	93	2632
35	1.68.	.08.	166	114	52	2684
40	1.76.	.08.	166	114	52	2736
45	1.83.	.07.	145	114	31	2767
50	1.90.	.07.	145	114	31	2798
55	1.97.	.07.	145	114	31	2829
60	2.03.	.06.	124	114	10	2839
120	2.11.	.08.	166	1364	-1198	1641
180	2.18.	.07.	145	1364	0	277
240	2.26.	.08.	166	1364	0	0
300	2.34.	.08.	166	1364	0	0
360	2.41.	.07.	145	1364	0	0

Peak storage reqd = 2839 $FT.^3$

Inflow = DCA = Δ Rainfall × (.571) × $\frac{43560}{12}$

OUTFLOW

PUMP GPM = 170

170 GPM × 0.002228 $\frac{CFS}{GPM}$ × Δt $\frac{60\ SEC}{MIN}$ = OUTFLOW

* Taken from MASS Rainfall curve

FOR Grandy's DESCRIPTION INFLOW vs. OUTFLOW

DESIGNED MG DATE 8/26/81 CHECKED SFF DATE 8/27/81 FILE NO. 6004-179 SHEET 15 OF 28

BOVAY ENGINEERS, INC.

DETERMINE STORAGE CAPACITY OF NORTH PARKING LOT AREA

(Planimetered area twice and averaged)

Elev. (Ft.)	Elev. Diff. (Ft.)	Surface Area (SF)	Average Area (SF)	Volume (Ft.)^3	Cum. Vol. (Ft.)^3
38.35		0			0
	0.05		79	4	
38.40		158			4
	0.10		475.75	48	
38.50		793.5			52
	0.10		1317.75	132	
38.60		1842			184
	0.10		2583.5	258	
38.70		3325			442
	0.10		4246	425	
38.80		5167			867
	0.10		6050.5	605	
38.90		6934			1472
	0.10		7835.50	784	
39.00		8737			2256
	0.10		9664.25	966	
39.10		10,591.5			3222

Volume needed for storage = 2839 Ft.^{3}

Volume available = 3222 Ft.^{3}

FOR Grandy's DESCRIPTION Storage Capacity

DESIGNED PSM DATE 8/26/81 CHECKED MG DATE 8/26/81 FILE NO. 4012-179 SHEET 16 OF 28

BOVAY ENGINEERS, INC.

HEAD LOSSES

Discharge line from sump pump is to have a 1/4" ϕ hole drilled into it for draining purposes.

By use of the orifice equation we determine losses:

FOR 2½"ϕ PIPE

$Q = 0.60 A \sqrt{2gH}$

Head = H = 25.5'

A of 1/4" ϕ orifice = 0.000341

$Q_{lost} = 0.60(.000341)\sqrt{2(32.2)(25.5)} = 0.008\ CFS$
$= 3.72\ GPM$

USE 4 GPM

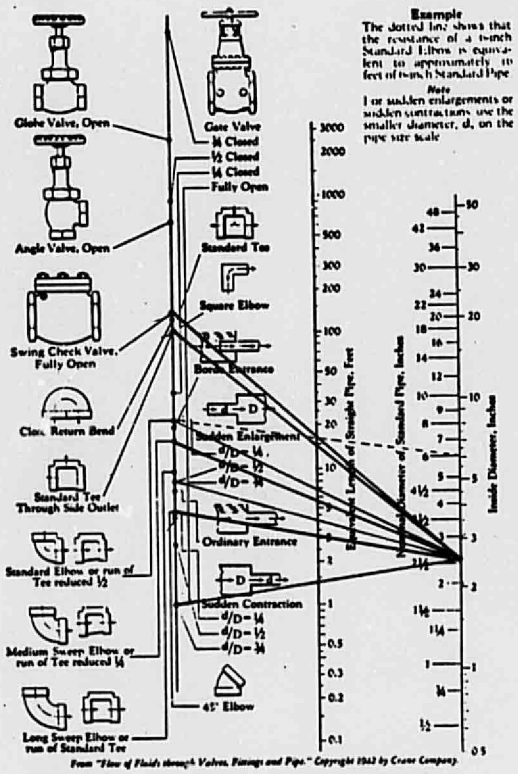
Determine equivalent lengths of straight pipe for losses due to fittings:

	2"	3"	2½"
CHECK VALVE	13.5	19	17.
SUDDEN ENLARGEMENT CURB FACE d/D = 1/4	5.2.	8.0.	6.8.
45° ELBOW	2.5.	3.8.	3.
SUDDEN CONTRACTION d/D = 1/2 (2") d/D = 3/4 (2½")	1.9	—	1.4
3-90° Medium Sweep	12.0	21.0	15.75
	35.10	51.80	43.95

FOR Grandy's DESCRIPTION HEAD LOSSES

DESIGNED MG DATE 8/26/81 CHECKED SEE DATE 8/27/81 FILE NO. 6004-179 SHEET 17 OF 28

BOVAY ENGINEERS, INC.



From "Flow of Fluids through Valves, Fittings and Pipe." Copyright 1942 by Crane Company.

FIGURE 4
FLOW OF WATER THROUGH VALVES & FITTINGS

FOR Grandy's DESCRIPTION Head Losses
DESIGNED MG DATE 8/26/81 CHECKED SFF DATE 8/26/81 FILE NO. 6004-179 SHEET 18 OF 28

BOVAY ENGINEERS, INC.

2-INCH PIPE OR HOSE.

(Actual diameter, 2.00 ins.)

Discharge in Gallons.		Velocity in Feet per Second.	Velocity Head, Feet.	Loss of Head in Feet per 1000 feet of length.						
Per Minute.	Per 24 Hours.			Very Smooth and Straight Brass, Tin, etc. c=140	Ordinary Straight Brass, Tin, etc. c=130	Smooth New Iron. c=120	Ordinary Iron. c=100	Old Iron. c=80	Very Rough. c=60	Badly Tuberculated. c=40
6	8,640	0.61	0.01	1.0	1.2	1.4	2.0	2.9	5.0	10.7
8	11,520	0.82	0.01	1.8	2.0	2.4	3.3	5.0	8.6	18.2
10	14,400	1.02	0.02	2.7	3.1	3.6	5.0	7.6	12.9	27.4
12	17,280	1.23	0.02	3.8	4.3	5.0	7.0	10.7	18.1	38.5
14	20,160	1.43	0.03	5.0	5.8	6.7	9.4	14.2	24.1	51
16	23,040	1.63	0.04	6.4	7.4	8.6	12.0	18.2	30.9	66
18	25,920	1.84	0.05	8.0	9.2	10.7	14.9	22.7	38.6	82
20	28,800	2.04	0.03	9.8	11.2	12.2	18.2	27.5	46.8	99
25	36,000	2.55	0.10	14.8	16.9	19.6	27.3	41.6	71	150
30	43,200	3.03	0.15	20.7	23.8	27.3	38.4	58	99	210
35	50,400	3.57	0.20	27.5	31.5	36.0	51	78	132	280
40	57,600	4.08	0.26	35.1	40.2	46.8	66	99	168	359
45	64,800	4.60	0.33	43.8	50	58	82	123	210	446
50	72,000	5.11	0.40	53	61	71	99	150	257	540
55	79,200	5.62	0.49	64	73	84	118	179	305	640
60	86,400	6.13	0.58	74	83	99	139	210	359	760
65	93,600	6.64	0.68	83	99	115	161	244	416	880
70	100,800	7.15	0.79	99	114	132	184	280	477	1010
75	108,000	7.66	0.91	113	129	149	209	318	540	1150
80	115,200	8.17	1.04	127	146	169	237	358	610	1290
90	129,600	9.19	1.31	158	182	210	294	447	760	1610
100	144 000	10.21	1.62	192	221	256	358	540	920	1960
110	158,400	11.23	1.93	230	262	306	429	650	1110	2330
120	172,800	12.25	2.33	271	310	360	500	760	1300	2760
130	187,200	13.28	2.73	312	360	418	580	880	1510	3190
140	201,600	14.30	3.17	360	413	479	670	1020	1730	3670
150	216,000	15.32	3.64	407	465	540	760	1140	1950	4180
160	230,400	16.34	4.14	460	530	610	860	1290	2210	4690
170	244,800	17.35	4.67	520	590	690	960	1460	2480	5300
180	259,200	18.38	5.23	570	650	760	1070	1620	2730	5800
190	273,600	19.40	5.84	630	720	840	1180	1780	3030	6400
200	288,000	20.42	6.46	690	800	920	1290	1960	3330	7100
220	316,800	22.47	7.82	830	950	1110	1540	2340	3990	8400
240	345,600	24.51	9.31	980	1120	1300	1820	2760	4700	9900
260	374,400	26.55	10.90	1130	1290	1510	2110	3190	5400	11500

FOR Grandy's DESCRIPTION Head Losses

DESIGNED MG DATE 8/26/81 CHECKED SEF DATE 8/27/81 FILE NO. 6004-177 SHEET 19 OF 28

BOVAY ENGINEERS, INC.

2½-INCH PIPE OR HOSE.

(Actual diameter, 2.50 ins.)

Discharge in Gallons.		Velocity in Feet per Second	Velocity Head, Feet.	Loss of Head in Feet per 1000 feet of length						
Per Minute.	Per 24 Hours.			Very Smooth and Straight Brass, Tin, etc. c=140	Ordinary Straight Brass, Tin, etc. c=130	Smooth New Iron. c=120	Ordinary Iron. c=100	Old Iron. c=80	Very Rough. c=60	Badly Tuberculated. C=40
8	11,520	0.52	0.00	0.6	0.7	0.8	1.1	1.7	2.9	6.1
10	14,400	0.65	0.01	0.9	1.0	1.2	1.7	2.6	4.3	9.2
12	17,280	0.78	0.01	1.3	1.4	1.7	2.4	3.6	6.1	12.9
14	20,160	0.92	0.01	1.7	2.0	2.3	3.2	4.7	8.2	17.4
16	23,040	1.05	0.02	2.2	2.5	2.9	4.1	6.2	10.5	22.2
18	25,920	1.18	0.02	2.7	3.1	3.6	5.0	7.6	12.9	27.3
20	28,800	1.31	0.03	3.3	3.8	4.3	6.1	9.2	15.7	33.2
25	36,000	1.63	0.04	4.9	5.7	6.6	9.2	13.9	23.7	50
30	43,200	1.96	0.06	6.9	8.0	9.2	12.9	19.5	33.2	70
35	50,400	2.29	0.08	9.2	10.6	12.3	17.2	26.0	44.1	94
40	57,600	2.61	0.11	11.8	13.5	15.7	22.0	33.2	57	120
50	72,000	3.27	0.17	17.8	20.6	23.8	33.2	51	86	182
60	86,400	3.92	0.24	24.9	28.7	33.2	46.5	70	120	254
70	100,800	4.58	0.33	33.2	38.1	44.2	62	94	160	338
80	115,200	5.23	0.43	42.5	48.8	56	79	120	204	433
90	129,600	5.88	0.54	53	61	70	98	149	254	540
100	144,000	6.54	0.66	64	74	86	120	182	309	660
120	172,800	7.84	0.95	90	103	120	168	254	433	920
140	201,600	9.15	1.30	120	138	159	223	339	580	1220
160	230,400	10.46	1.70	156	178	207	290	440	750	1570
180	259,200	11.76	2.15	191	219	254	357	540	920	1940
200	288,000	13.07	2.66	232	267	309	431	660	1120	2370
220	316,800	14.38	3.22	277	318	369	520	780	1330	2820
240	345,600	15.69	3.82	330	376	438	610	920	1570	3340
260	374,400	16.99	4.48	378	432	500	700	1070	1810	3860
280	403,200	18.30	5.20	432	497	580	810	1220	2080	4400
300	432,000	19.61	5.98	493	570	660	920	1390	2370	5000
320	460,800	20.92	6.80	560	640	740	1030	1570	2670	5700
340	489,600	22.22	7.68	620	710	820	1160	1750	2980	6400
360	518,400	23.53	8.60	690	790	920	1290	1940	3310	7100
380	547,200	24.84	9.60	780	890	1020	1420	2160	3670	7800
400	576,000	26.14	10.62	840	960	1120	1560	2370	4020	8600
420	604,800	27.45	11.70	920	1050	1220	1710	2590	4400	9300
440	633,600	28.76	12.85	1000	1150	1330	1880	2810	4800	10200
460	662,400	30.07	14.00	1110	1260	1460	2050	3100	5300	11200

FOR Grandy's DESCRIPTION Head Losses

DESIGNED MG DATE 8/27/81 CHECKED SEF DATE 8/27/81 FILE NO. 6014-179 SHEET 20 OF 28

BOVAY ENGINEERS, INC.

3-INCH PIPE.

(Actual diameter, 3.00 ins.)

Discharge in Gallons.		Velocity in Feet per Second.	Velocity Head, Feet.	Loss of Head in Feet per 1000 feet of length.						
Per Minute.	Per 24 Hours.			Very Smooth and Straight Brass, Tin, etc. c=140	Ordinary Straight Brass Tin, etc. c=130	Smooth New Iron. c=120	Ordinary Iron. c=100	Old Iron. c=80	Very Rough. c=60	Badly Tuberculated. c=40
10	14,400	0.45	0.00	0.37	0.43	0.50	0.7	1.0	1.8	3.8
15	21,600	0.68	0.01	0.79	0.91	1.06	1.5	2.2	3.8	8.1
20	28,800	0.91	0.01	1.35	1.55	1.80	2.5	3.8	6.5	13.8
25	35,000	1.13	0.02	2.04	2.34	2.71	3.8	5.8	9.8	20.8
30	43,200	1.35	0.03	2.87	3.29	3.81	5.4	8.1	13.8	29.2
35	50,400	1.59	0.04	3.81	4.38	5.1	7.1	10.7	18.3	38.9
40	57,600	1.82	0.05	4.89	5.6	6.5	9.1	13.8	23.5	49.7
50	72,000	2.27	0.08	7.4	8.5	9.8	13.8	20.8	35.5	75
60	86,400	2.72	0.12	10.3	11.8	13.7	19.2	29.1	49.6	105
70	100,800	3.18	0.16	13.8	15.8	18.3	25.7	38.8	66	140
80	115,200	3.63	0.20	17.6	20.2	23.4	32.8	49.6	84	179
90	129,600	4.09	0.26	21.9	25.1	29.1	40.8	62	105	223
100	144,000	4.54	0.32	26.7	30.6	35.2	49.6	75	128	271
120	172,800	5.45	0.46	37.2	42.8	49.7	70	106	179	380
140	201,600	6.35	0.63	49.6	57	66	92	139	238	510
160	230,400	7.26	0.82	64	73	84	118	179	306	650
180	259,200	8.17	1.04	79	91	106	148	223	380	810
200	288,000	9.08	1.28	96	110	128	178	271	461	980
220	316,800	9.99	1.55	114	132	153	213	323	550	1170
240	345,600	10.89	1.84	134	154	179	251	380	650	1370
260	374,400	11.80	2.16	156	179	208	291	440	750	1590
280	403,200	12.71	2.51	179	206	238	334	510	860	1830
300	432,000	13.62	2.88	204	233	271	380	580	980	2080
320	460,800	14.52	3.28	229	263	306	428	650	1110	2330
340	489,600	15.43	3.71	257	294	342	479	720	1230	2610
360	518,400	16.34	4.15	286	328	380	530	800	1370	2910
380	547,200	17.25	4.62	317	361	420	590	890	1520	3210
400	576,000	18.16	5.11	348	399	461	650	980	1670	3520
420	604,800	19.06	5.64	380	436	510	710	1070	1830	3870
440	633,600	19.97	6.20	414	475	550	770	1170	1980	4220
460	662,400	20.88	6.78	449	520	600	840	1270	2160	4570
480	691,200	21.79	7.38	488	560	650	910	1370	2330	4960
500	720,000	22.70	8.00	530	600	700	980	1480	2520	5400
550	792,000	24.96	9.70	620	720	830	1170	1770	3010	6400
600	864,000	27.23	11.50	740	840	980	1370	2070	3520	7400

FOR Grandy's DESCRIPTION Head Losses

DESIGNED MG DATE 8/26/81 CHECKED SEE DATE 8/27/81 FILE NO. 6004-179 SHEET 21 OF 28

BOVAY ENGINEERS, INC.

TOTAL HEAD LOSS

LINE SIZE (in)	FLOW RATE (GPM)	FRICTION LOSS FOR 65' PIPE + 4' S.H.	EQUIV. LOSS FOR FITTINGS (Ft.)	TOTAL HEAD (Ft.)
2"	0	4	0	4
	50	7.97	2.14	10.11
	100	18.30	7.72	26.02
	150	34.23	16.32	50.55
	200	56.0	28.08	84.08
	260	87.85	45.28	133.13
3"	0	4	0	4
	50	4.55	.44	5.01
	100	5.97	1.59	7.66
	160	8.75	3.78	12.53
	200	11.15	5.70	16.85
	260	15.64	9.27	24.91
2½"	0	4	0	4
	50	5.34	.91	6.23
	100	8.81	3.25	12.00
	160	15.57	7.82	23.39
	200	21.36	11.73	33.10
	260	32.08	18.99	51.07

P.V.C. pipe C = 130

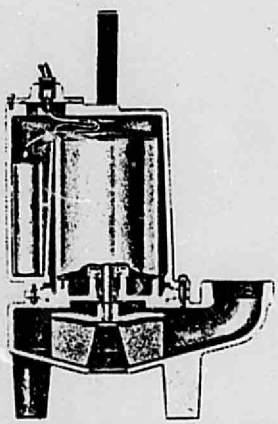
FOR Grandys DESCRIPTION Head Losses

DESIGNED MG DATE 8/26/81 CHECKED SFF DATE 8/27/81 FILE NO. 6004-179 SHEET 22 OF 28

BOVAY ENGINEERS, INC.

Heavy Duty Submersible Wastewater Pumps

3" Discharge Medium Head



Models

3SE151
3SE153
3SE154
3SE201
3SE203
3SE204

Size

3" Discharge

2-1/2" Spherical Solids Handling

Pump Specifications

Size: 3" Discharge, 2½" Suction Opening
Impeller: 2 Vane, Cast Iron with Pressure Vanes on Back Side
Seal: Mechanical Type in Oil-Filled Chamber with Secondary Exclusion Seal, Ceramic and Carbon Faces
Pump Body: Cast Iron
Motor Housing: Cast Iron
Hardware: 300 Series Stainless Steel
Suitable For: 160°F. Liquids

Standard Equipment: All Models Equipped with Legs.

Models 3SE151, 201 - Equipped with 30' of 10/3 SO Cable
Models 3SE153, 154, 203, 204 - Equipped with 30' 10/4 SO Cable

Additional cable available.
Carbide seal faces available.

Motor Specifications

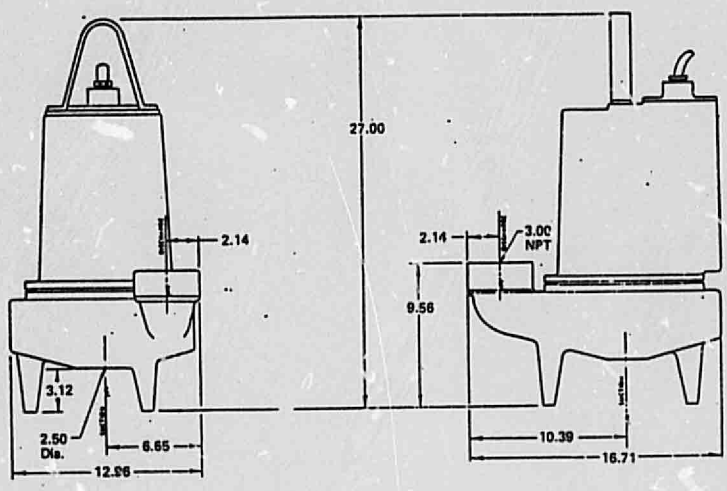
Model 3SE151 - 1½ HP, 230 Volt, Single Phase
Model 3SE153 - 1½ HP, 200-230 Volt, Three Phase
Model 3SE154 - 1½ HP, 460 Volt, Three Phase
Model 3SE201 - 2 HP, 230 Volt, Single Phase
Model 3SE203 - 2 HP, 200-230 Volt, Three Phase
Model 3SE204 - 2 HP, 460 Volt, Three Phase

Single Phase: PSC (Permanent Split Capacitor) Completely Oil-Filled and Overload Protection in Motor — 1625 RPM
Three Phase: Completely Oil-Filled, Overload Protection Required in Control Box 1750 RPM
Shaft: 416 Stainless Steel
Thrust Bearing: Ball
Radial Bearing: Sleeve-Permanent Lubrication

Models

3SE151
3SE153
3SE154
3SE201
3SE203
3SE204

AMPERAGE		
MODEL NO.	MAX. RUN AMPS	LOCKED ROTOR AMPS
3SE151	12.6	23.0
3SE153	8.0	35.0
3SE154	4.0	17.5
3SE201	14.5	29.0
3SE203	14.0	50.8
3SE204	7.0	25.4



Submersible Wastewater Pump Association SWPA MEMBER

Peabody Barnes

Form No. 206 - 1080

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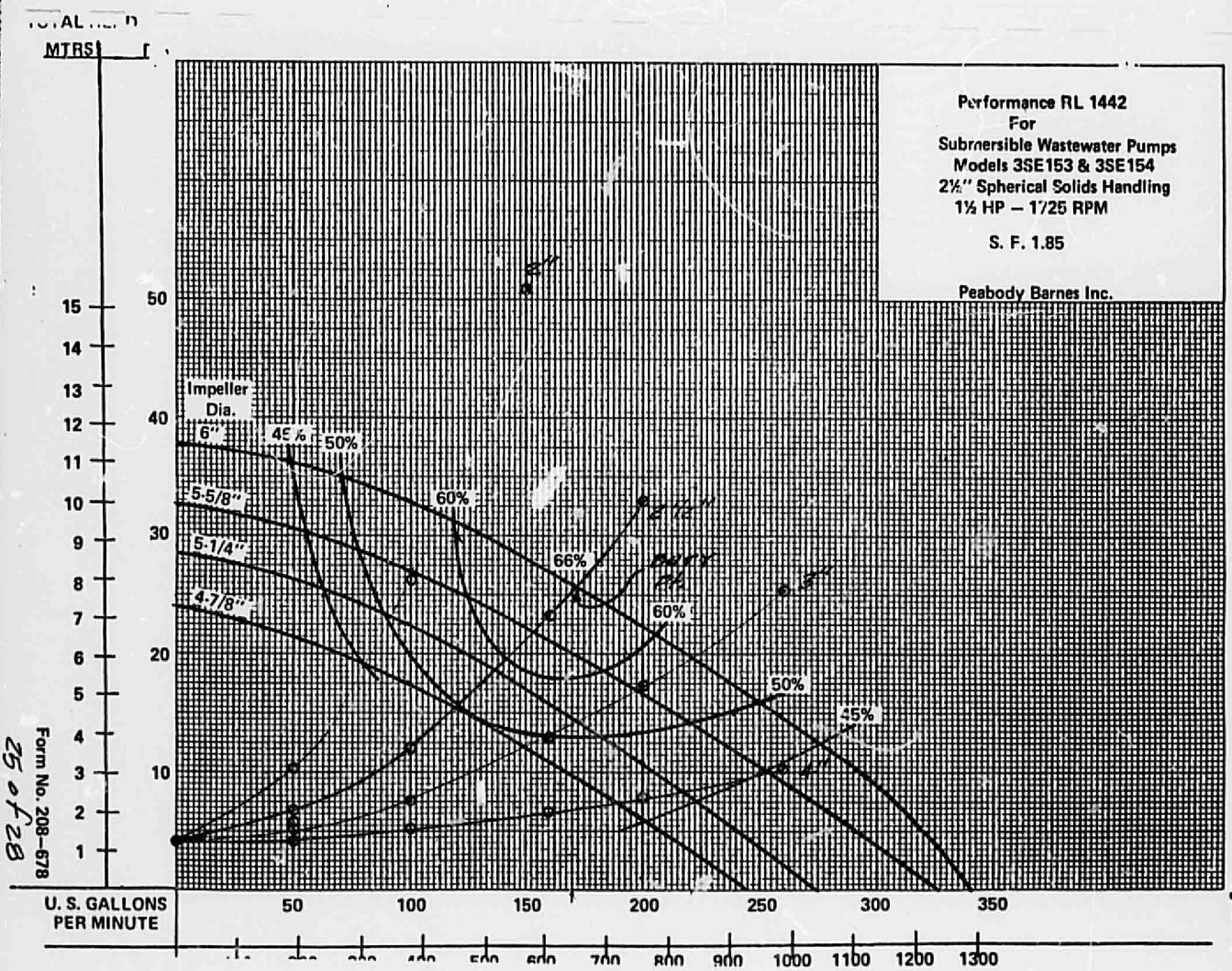

Form No. 208–678

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```
CUL S2/CAP
JOB
          6314.179*
STA
             1.000*
PUT
1 IF G=
0 IF G?
             1.000*
Q
             5.225*
YR
           100.000*
INV
            38.590*
MN FBI
             0.000*
MX HW/D
             1.000*
PUT
1 IF EX
0 IF FREL
             1.000*
PUT
0 IF CMP
1 IF RCP
2 IF EX
             2.000*
BX K
             0.500*
D
B
             0.500*
             2.000*
```

```
#
             3.000*
R. EL
             0.000*
AHW
             0.500*
TW
             0.100*
L
            10.000*
S
             0.021*
N
             0.015*
IC
DU
             0.205
HW/D
             0.965
HW
             0.483
HW EL
            39.173
V
             1.248
```

Required Q= 5.225 CFS
ALLOWABLE Head Water = 0.5'

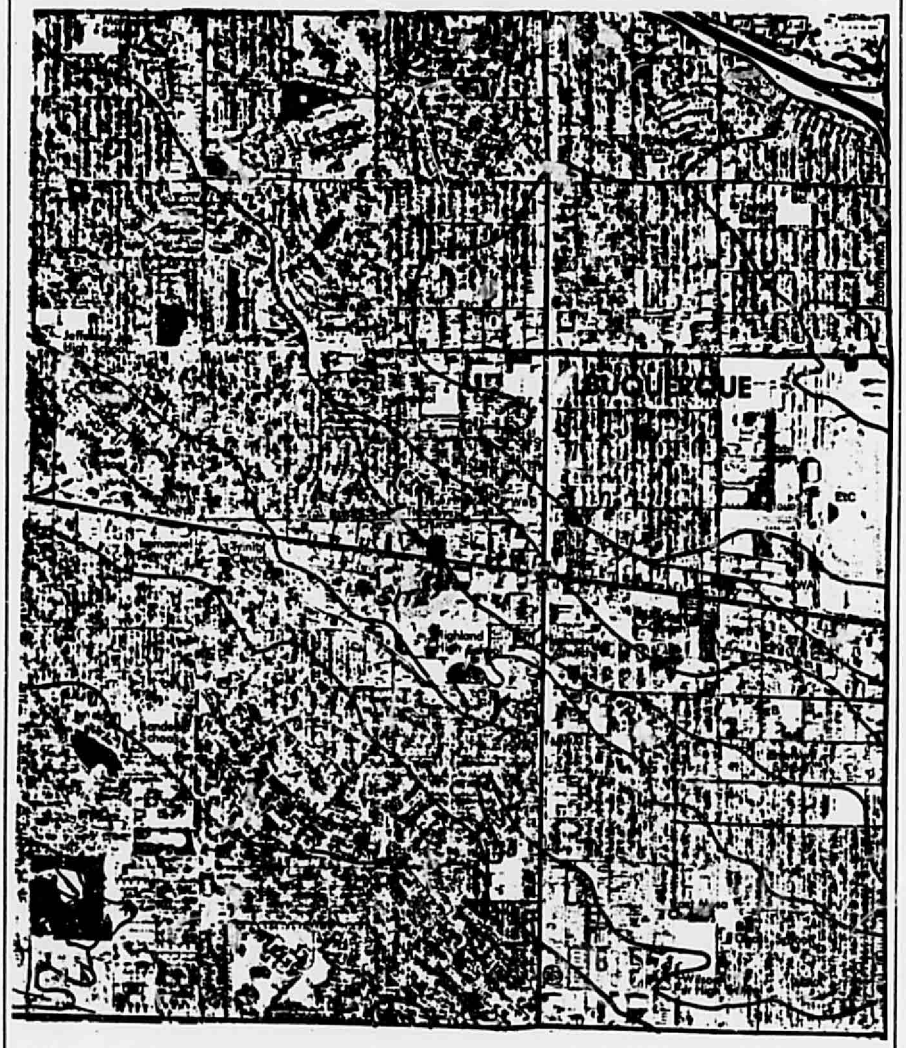
By using 3 City of Albuquerque standard Sidewalk culverts in series, 2' wide, 6" deep, Q=5.225 is carried @ a depth of 0.48'.

FOR Grandy's DESCRIPTION EMERGENCY SPILLWAY
DESIGNED MG DATE 8/20/81 CHECKED ____ DATE ____ FILE NO. 0-014-179 SHEET 26 OF 28

BOVAY ENGINEERS, INC.

THIS MICROIMAGE IS THE BEST POSSIBLE
REPRODUCTION DUE TO THE POOR QUALITY
OF THE ORIGINAL DOCUMENT

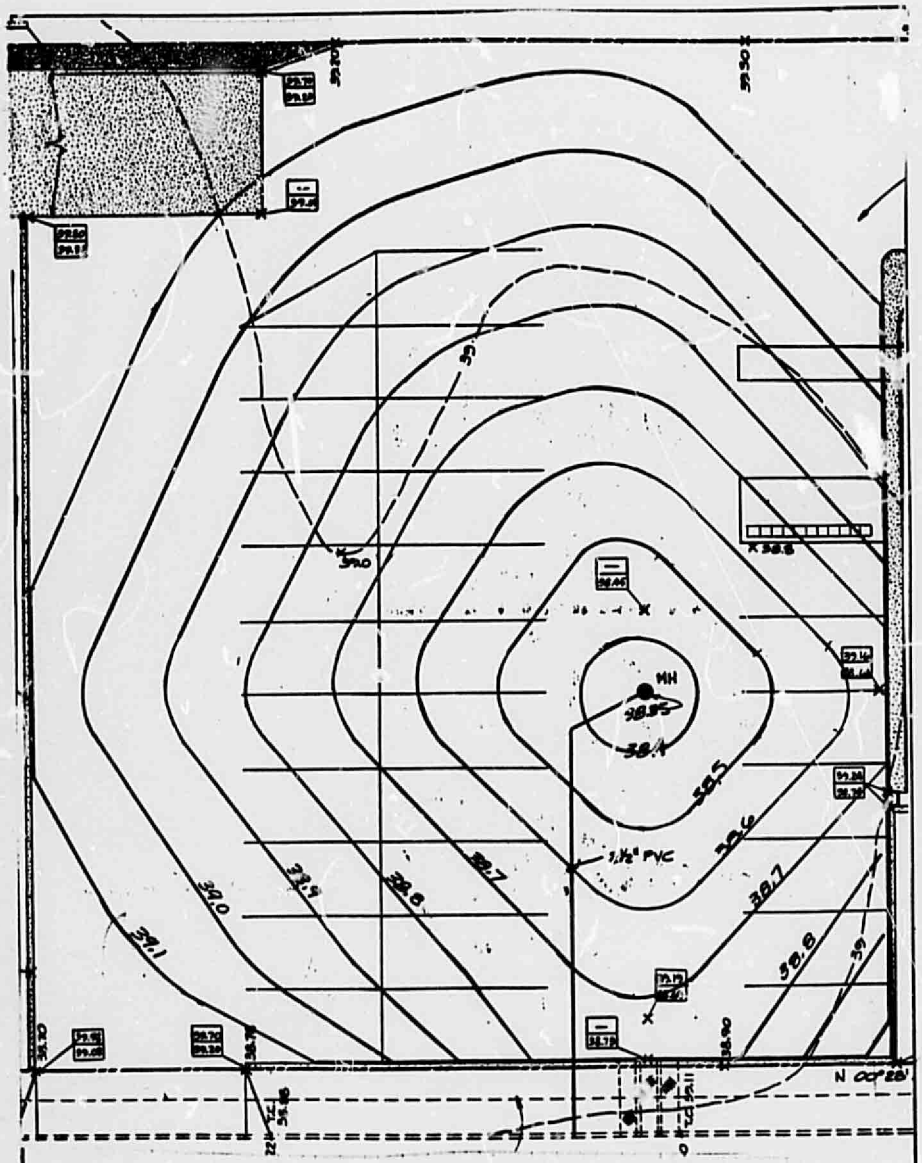
SCS Soil CLASSIFICATION MAP



FOR Grandy's DESCRIPTION SCS Soil Classification

DESIGNED — DATE — CHECKED — DATE — FILE NO. 6018-179 SHEET 27 OF 28

BOVAY ENGINEERS, INC.

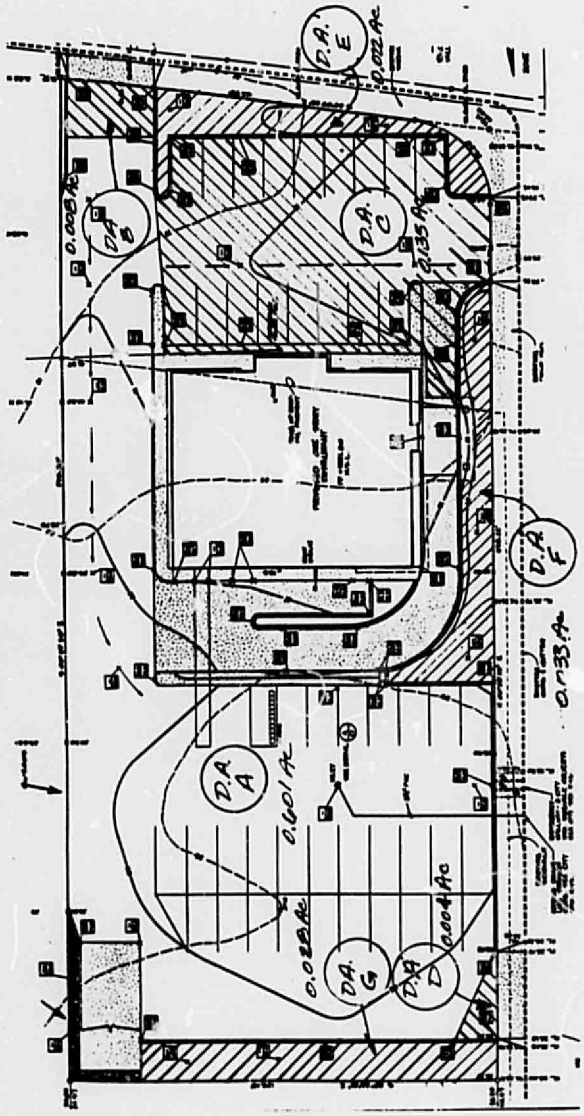


CONTOUR MAP FOR DETERMINING DETENTION VOL.

FOR GRANDY'S EAST CENT DESCRIPTION DRAINAGE REPORT COMPS

DESIGNED SFF DATE 8/27/81 CHECKED ____ DATE ____ FILE NO. 6014179 SHEET 22 OF 28

BOVAY ENGINEERS, INC.



FOR GRANDY'S E. CENTRAL DESCRIPTION ON SITE DRAINAGE AREAS

DESIGNED SEE DATE 8/27/81 CHECKED _____ DATE _____ FILE NO 0014179 SHEET 1 OF 1

BOVAY ENGINEERS, INC.