DRAINAGE CALCULATIONS

I. REFERENCES:

A. CITY OF ALBUQUERQUE DEVELOPMENT PROCESS MANUAL (DPM) VOL. 2 DESIGN CRITERIA, CHAPTER 22: DRAINAGE, FLOOD CONTROL AND EROSION CONTROL.

B. SOIL SURVEY OF BERNALILLO COUNTY AND PARTS OF SANDOVAL AND VALENICA COUNTIES, NEW MEXICO, UNITED STATES DEPT. OF AGRICULTURAL, SOIL CONSERVATION SERVICE.

C. FLOODWAY, FLOOD BOUNDARY AND FLOODWAY MAP, CITY OF ALBUQUERQUE, NEW MEXICO, PANEL 16 OF 50.

D. URQUHART: CIVIL ENGINEERING HANDBOOK, McGRAW-HILL BOOK COMPANY, 4TH EDITION.

E. ZONE ATLAS PAGE F-16-Z.

F. ACCOMPANYING WORK SHEET ENTITLED "EXISTING DRAINAGE PATTERNS".

II. PRE-DESIGN CONFERENCE FINDINGS: (GILBERT ALDEZ, DATED 9-29-89)

A. LIMITED DOWNSTREAM CAPACITY BASED ON DRAINAGE REPORT SOUTH OF THIS PROPERTY (PREPARED BY ANDREWS, ASBURY & ROBERT), UNLESS CONSULTANT CAN DEMONSTRATE.

B. RECOMMEND DETENTION PONDS WITH DEMONSTRATION BY CONSULTANT FOR 6 HOUR OR 24 HOUR RELEASE.

III. RESPONSE TO PRE-DESIGN CONFERENCE FINDINGS:

A. CONTACTED JOHN ANDREWS REGARDING SUBJECT COMANCHE DRAINAGE REPORT. MR. ANDREWS INDICATED REPORT WAS BASED ON DEVELOPED CONDITIONS AND RECOMMENDED THAT WE NOT EXCEED EXISTING DISCHARGE RATES BASED ON LIMITED DOWNSTREAM CAPACITY.

CONTACTED GILBERT ALDEZ, CITY HYDROLOGY, AND INFORMED HIM OF MY DISCUSSION WITH MR. ANDREWS. HE CONCURRED: DO NOT EXCEED EXISTING DISCHARGE RATES.

B. ALL RUNOFF WILL BE DIRECTED THRU THE DETENTION POND. THE DISCHARGE RATE TO THE I-25 FRONTAGE ROAD BAR DITCH SHALL NOT EXCEED EXISTING. THE DIFFERENCE WILL BE PONDED AND RELEASED IN LESS THAN SIX HOURS.

IV. GENERAL INFORMATION:

A. SOIL TYPE (REF. B, SHEET NO. 21) SOIL TYPE IS WINK-EMBUDO COMPLEX (WeB), HYDROLOGIC SOIL GROUP "B".

B. IMPERVIOUSNESS: (REF. F FOR EXISTING DRAINAGE PATTERNS)

	EXISTING BASIN "A"		EXISTING BASIN "B"		PROPOSED	
TYPE OF SURFACE	SQ.FT.	ACRES	SQ.FT.	ACRES	SQ.FT.	ACRES
BUILDING ROOF	2586	0.0589	-0-	-0-	7140	0.1639
ASPHALT & CONCRETE	11404	0.2618	4524	0.1039	23691	0.5439
LANDSCAPING	587	0.0135	336	0.0077	13538	0.3108
UNDEVELOPED	21445	0.4923	3507	0.0805	-0-	-0-
SITE TOTAL	36002	0.8265	8367	0.1921	44369	1.0186

C. WEIGHTED "C" FACTORS:

1. EXISTING IMPERVIOUS SURFACES

	"C" FACTOR	BASIN "A" AREA	BASIN "A" C X A	BASIN "B" AREA	BASIN "B" C X A
BUILDING ROOF	0.90	0.0589	0.0530	-0-	-0-
ASPHALT & CONCRETE	0.95	0.2618	0.2487	0.1039	0.0987
LANDSCAPING	0.25	0.0135	0.0034	0.0077	0.0019
UNDEVELOPED	0.40	0.4923	0.1969	0.0805	0.0322
SITE TOTAL		0.8265	0.5020	0.1921	0.1328

EXISTING BASIN "A" WEIGHTED "C" FACTOR 0.5020/0.8265 = 0.61
EXISTING BASIN "B" WEIGHTED "C" FACTOR 0.1328/0.1921 = 0.69

2. PROPOSED IMPERVIOUS SURFACES

	"C" FACTOR	PROPOSED AREA	PROPOSED C X A
BUILDING ROOF	0.90	0.1639	0.1475
ASPHALT & CONCRETE	0.95	0.5439	0.5167
LANDSCAPING	0.25	0.3108	0.0795
UNDEVELOPED	0.40	-0-	-0-
SITE TOTAL		1.0186	0.7437

PROPOSED WEIGHTED "C" FACTOR 0.7437/1.0186 = 0.73

D. 100 YEAR RAINFALL, 6 HOUR, R(6); (REF. A, PLATE 22.2, D-1)
R(6) = 2.20 INCHES.

E. TIME OF CONCENTRATION:
Tc = 0.0078 X L(EXP. 0.77) / S(EXP. 0.385)

1. EXISTING BASIN "A":
WHERE L = 304 FEET & S = (5106.8-5099.5)/304 = 0.024 FT./FT.
Tc = 0.0078 X 304(EXP. 0.77) / 0.024(EXP. 0.385)
= 2.68 MINUTES (USE 10 MINUTES (MIN. VALUE) FOR CALCULATIONS).

2. EXISTING BASIN "B":
WHERE L = 115 FEET & S = (5106.5-5104.5)/115 = 0.017 FT./FT.
Tc = 0.0078 X 115(EXP. 0.77) / 0.017(EXP. 0.385)
= 1.00 MINUTE (USE 10 MINUTES (MIN. VALUE) FOR CALCULATIONS).

3. PROPOSED:
WHERE L = 432 FEET & S = (5106.5-5101.67)/432 = 0.0112 FT./FT.
Tc = 0.0078 X 432(EXP. 0.77) / 0.0112(EXP. 0.385)
= 4.70 MINUTES (USE 10 MINUTES (MIN. VALUE) FOR CALCULATIONS).

F. RAINFALL INTENSITY, I; (SEE REF. A, PLATE 22.2 D-2)
I = P(6) X 6.84 X Tc (EXP. -0.51)
= 2.20 X 6.84 X 10 (EXP. -0.51)
= 4.65 INCHES

V. PEAK DISCHARGE RATES: (RATIONAL METHOD)
Q(100) = CIA Q(10) = 0.657 X Q(100)

A. EXISTING BASIN "A":
Q(100) = 0.61 X 4.65 X 0.8265 = 2.34 CFS
Q(10) = 0.657 X 2.34 = 1.54 CFS

B. EXISTING BASIN "B":
Q(100) = 0.69 X 4.65 X 0.1921 = 0.62 CFS
Q(10) = 0.657 X 0.62 = 0.40 CFS

C. PROPOSED CONDITION:
Q(100) = 0.73 X 4.65 X 1.0186 = 3.46 CFS
Q(10) = 0.657 X 3.46 = 2.27 CFS

VI. VOLUME CALCULATIONS: (SCS METHOD)

A. CURVE NUMBERS (REF. A, PLATE 22.2, C-2, TYPE "B" SOIL):

BUILDING AND PAVED SURFACES CN=98
LANDSCAPING (PASTURE OR RANGE LAND, GOOD) CN=61
UNDEVELOPED (PASTURE OR RANGE LAND, POOR) CN=79

B. DIRECT RUNOFF VALUES (REF. A, PLATE 22.2, C-4):
WHERE Q = ((P-0.25)(EXP. 2) / (P+0.85)
AND S = (1000 / CN) - 10

BUILDING AND PAVED SURFACES Q=1.98 INCHES
LANDSCAPING Q=0.12 INCHES
UNDEVELOPED Q=0.64 INCHES

C. 100 YEAR AND 10 YEAR, SIX HOUR VOLUMES:
V(100) = AREA X Q / 12 V(10) = 0.657 X AREA X Q / 12

1. EXISTING BASIN "A":
V(100) = (13970x1.98+587x0.12+21445x0.64) / 12 = 3455 CU.FT.
V(10) = 0.657 X 3455 = 2270 CU.FT.
RUNOFF FROM EXISTING BASIN "A" FLOWS WEST TO THE BAR DITCH AT THE I-25 FRONTAGE ROAD.

2. EXISTING BASIN "B":
V(100) = (4524x1.98+336x0.12+3507x0.64) / 12 = 937 CU.FT.
V(10) = 0.657 X 937 = 616 CU.FT.
RUNOFF FROM EXISTING BASIN "B" FLOWS EAST TO THE AMAFCA EASEMENT.

3. PROPOSED CONDITION:
V(100) = (30831x1.98+13538x0.12) / 12 = 5222 CU.FT.
V(10) = 0.657 X 937 = 3431 CU.FT.
ALL RUNOFF WILL BE DIRECTED THRU THE DETENTION POND.

4. POND VOLUME REQUIRED:
5222 CU.FT. - 3455 CU.FT. = 1767 CU.FT. REQUIRED VOLUME.

VII. ACTUAL POND VOLUME:

POND TOP SURFACE AREA: 1808 SQ.FT.
POND BOTTOM AREA: 1054 SQ.FT.
AVERAGE POND AREA: 1431 SQ.FT.
1431 SQ.FT. X 1.25 FEET DEPTH = 1789 CU.FT. ACTUAL POND VOLUME

VIII. WEIR EVALUATION:
USE WEIR EQUATION, Q = CLH(EXP. 3/2)
WHERE "C" = 3.41 (REF. D, INTERPOLATED FROM TABLE 9. VALUES OF "K" IN THE FORMULA Q=KLH(EXP. 3/2)

Q = CLH(EXP. 3/2)
Q = 3.41 X 6 X 0.33(EXP. 3/2) = 3.88 CFS
WEIR CAPACITY OF 3.88 CFS EXCEEDS PEAK DISCHARGE RATE OF 3.46 CFS

IX. POND POSITIVE DISCHARGE:
4" PVC PIPE, INVERT FLUSH WITH POND BOTTOM, USE ORIFICE EQUATION
Q = CA X ((2GH)(EXP. 0.5))

WHERE "C" = 0.599 (REF. D, INTERPOLATED FROM TABLE 3. SMITH'S COEFFICIENTS OF DISCHARGE FOR CIRCULAR ORIFICES)

A = pi X 0.1667(EXP.2) = 0.09 SQ.FT.

FOR A POND DEPTH OF 18 INCHES, H = 1.5 - .17 = 1.33 FEET

Q = CA X ((2GH)(EXP. 0.5))
= 0.599 X 0.09 ((2 X 32.2 X 1.33)(EXP. 0.5)) = 0.35 CFS ✓

X. TIME REQUIRED TO DRAIN POND:
ASSUME A LINEAR DECREASE IN FLOW FROM H=FULL DEPTH TO H=0.
Q(AVERAGE) = 0.35 CFS / 2 = 0.18 CFS
1767 CU.FT. / 0.18 CFS = 9817 SECONDS = 2.73 HOURS

XI. FLOOD INFORMATION: (REF. C, SHEET 16 OF 50)
THIS SITE IS NOT LOCATED WITHIN A DESIGNATED 100 YEAR FLOOD ZONE. THE SITE IS IN ZONE "C", AN AREA OF MINIMAL FLOODING.

XII. OFF-SITE FLOWS:
THERE ARE NO OFF-SITE FLOWS DIRECTED TO THIS SITE.

XIII. CONSTRUCTION NOTES:

A. 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.

B. ALL WORK DETAILED ON THESE PLANS TO BE PERFORMED, EXCEPT AS OTHERWISE STATED OR PROVIDED HEREON, SHALL BE CONSTRUCTED IN ACCORDANCE WITH ARTERIAL STREET USE.

C. TWO (2) WORKING DAYS PRIOR TO ANY EXCAVATION CONTRACTOR MUST CONTACT LINE LOCATING SERVICE AT 765-1234 FOR LOCATION OF EXISTING UTILITIES.

D. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL EXCAVATE AND VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL POTENTIAL OBSTRUCTIONS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL NOTIFY THE ENGINEER SO THAT THE CONFLICT CAN BE RESOLVED WITH A MINIMUM AMOUNT OF DELAY.

E. BACKFILL COMPACTION SHALL BE ACCORDING TO ARTERIAL STREET USE.

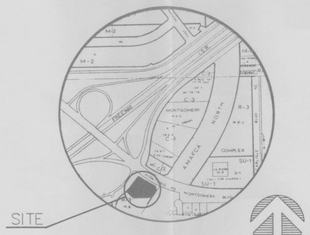
F. MAINTENANCE OF THIS FACILITY SHALL BE THE RESONSIBILTY OF THE OWNER OF THE PROPERTY SERVED.

SYMBOLS LEGEND

EXISTING CONTOUR LINE	— — —
DESIGN CONTOUR LINE	——(1)——
EXISTING SPOT ELEVATION	01.06 TA
DESIGN SPOT ELEVATION	@5.5 TA
FLOWLINE	FL
FINISHED GRADE	FG
TOP OF CURB	TC
TOP OF ISLAND	TI
TOP OF ASPHALT PAVING	TA
TOP OF CONCRETE PAVING	TCP
TOP OF SIDEWALK	TSW
TEMPORARY BENCHMARK	TBM
ROOF DRAIN	RD
TOP OF GRATE	GRT

HYDROLOGY APPROVAL & INSPECTION

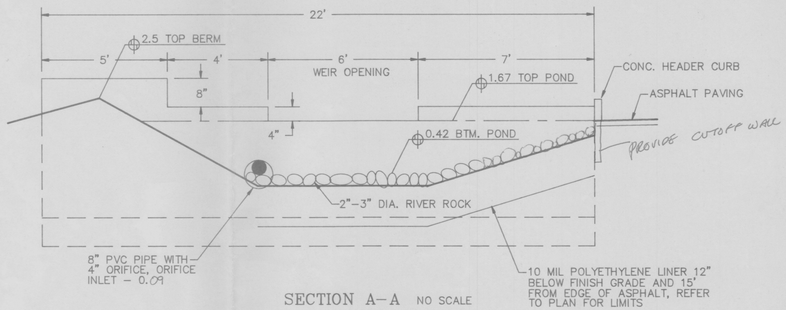
APPROVED FOR BUILDING PERMIT
ENGINEER _____ DATE _____
INSPECTION REQUESTED DATE _____
APPROVAL DATE 5-10-90 DISAPPROVED _____
S019 APPROVAL DATE N/A
SURVEY DATE 5-10-90
HYDROLOGY BOOK NO./PAGE NO. 89-1 pg 85 & 42
SURVEYED BY _____
COMMENTS _____



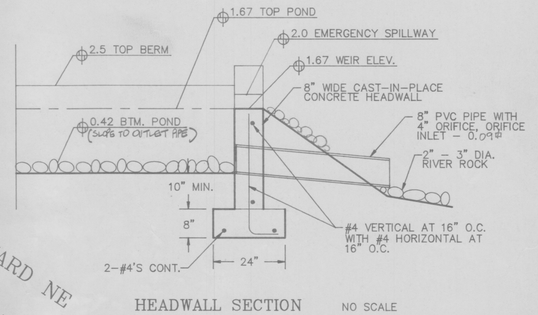
VICINITY MAP
ZONE ATLAS MAP #F-16-Z

LEGAL DESCRIPTION:
TRACT B
MONTGOMERY HEIGHTS ADDITION
BERNALILLO COUNTY

REFERENCE CITY DATUM:
ACS BRASS CAP "M-6"
ELEVATION : 5110.492 MSL



SECTION A-A NO SCALE



HEADWALL SECTION NO SCALE

GRADING & DRAINAGE PLAN

SCALE: 1"=20.0'

0 5' 10' 20' 40'