M-4

HYDROLOGIC ANALYSIS

FOR THE

McCARRAN BLVD. EXTENSION BETWEEN SKYLINE BLVD. AND MAYBERRY DRIVE

PREPARED FOR

REGIONAL TRANSPORTATION COMMISSION
2050 VILLANOVA DRIVE
RENO, NEVADA 89502

PREPARED BY

SUMMIT ENGINEERING CORPORATION

FEBRUARY 1987

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5045 Mae Anne Avenue
Reno, NV 89523

February 1987

Robert G. FYI 4-18-88

Please hold onto this. When RTC submits plans for this phase of McCarran we need to check if they have addressed this problem.

[signature]

CONTENTS

HYDROLOGIC ANALYSIS FOR THE McCARRAN BOULEVARD EXTENSION BETWEEN SKYLINE BOULEVARD AND MAYBERRY DRIVE

Introduction

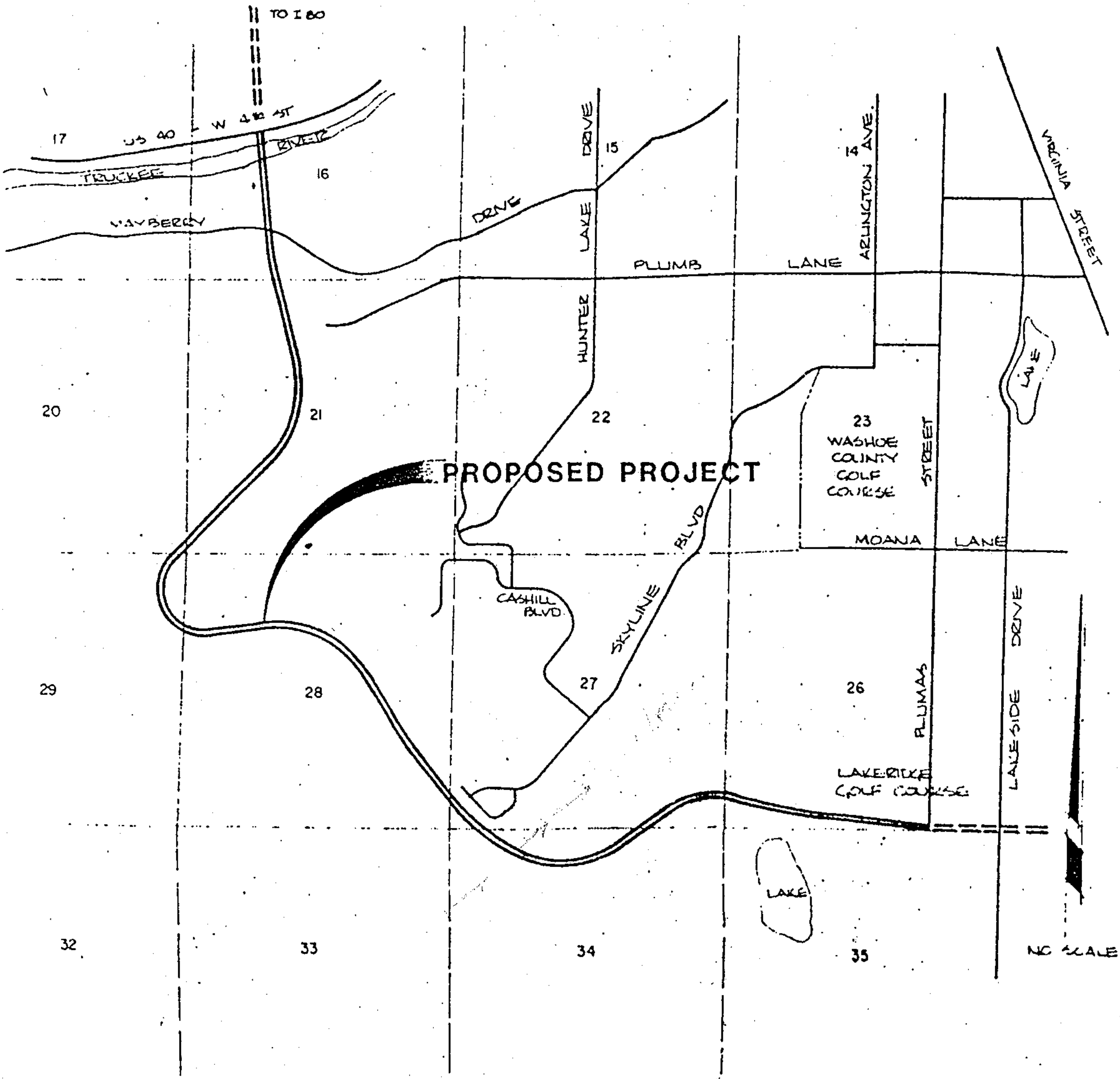
This hydrologic analysis was developed to determine stormwater peak discharges crossing the McCarran Boulevard extension between Skyline Boulevard and Mayberry Drive. This McCarran Boulevard extension is located in the southwest quadrant of Reno, Nevada; Sections 16, 20, 21, 27, 28, 29, 34, Township 19 North, Range 19 East, M.D.B.&M. A stormwater peak discharge was calculated for each natural drainage crossing (control point) for the 100-year, 24-hour storm event. The 100-year, 24-hour storm event produces the largest peak discharge when compared to the 100-year, 6-hour and the 100-year, 3-hour storm event. The 100-year event was used because McCarran Boulevard is a major arterial roadway required to be functionable at all times. These stormwater peak discharges will be used to determine the size of the required McCarran Boulevard stormwater facilities. Reference Figure 1 for the Vicinity Map.

Hydrology

The Soil Conservation Service (SCS) methodology for analyzing urban hydrology (TR-20) was used to establish the hydrograph data for each subarea. To be able to attenuate the stormwater flows from one subarea to and through another subarea, the Muskingum routing method was used.

The SCS TR-20 model is designed to simulate the surface runoff response of a basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. Representation of a component requires a set of parameters which specify the particular characteristics of the component and the mathmatical relations which describe the physical processes. The

huh?



VICINITY MAP

McCARRAN BOULEVARD EXTENSION

FIGURE 1

results of the modeling process is the computation of stream flow hydrographs at desired locations within the basin. The major components represented by SCS TR-20 are drainage area, precipitation, SCS curve number, and SCS watershed lag time.

The sub-basins were determined by outlining the tributary area required for each control point on U.S.G.S. quad maps of scale one-inch to 2000 feet (reference Figure 2). The area of each sub-basin was then calculated by using a Digital Planimeter (reference Table 1 for each subarea's area).

The precipitation values were established using the NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Nevada, Isopluvials. The precipitation values were selected at the approximately centroid of each subarea. The precipitation values used as the model input parameter for a 100-year, 24-hour storm are in Table 1.

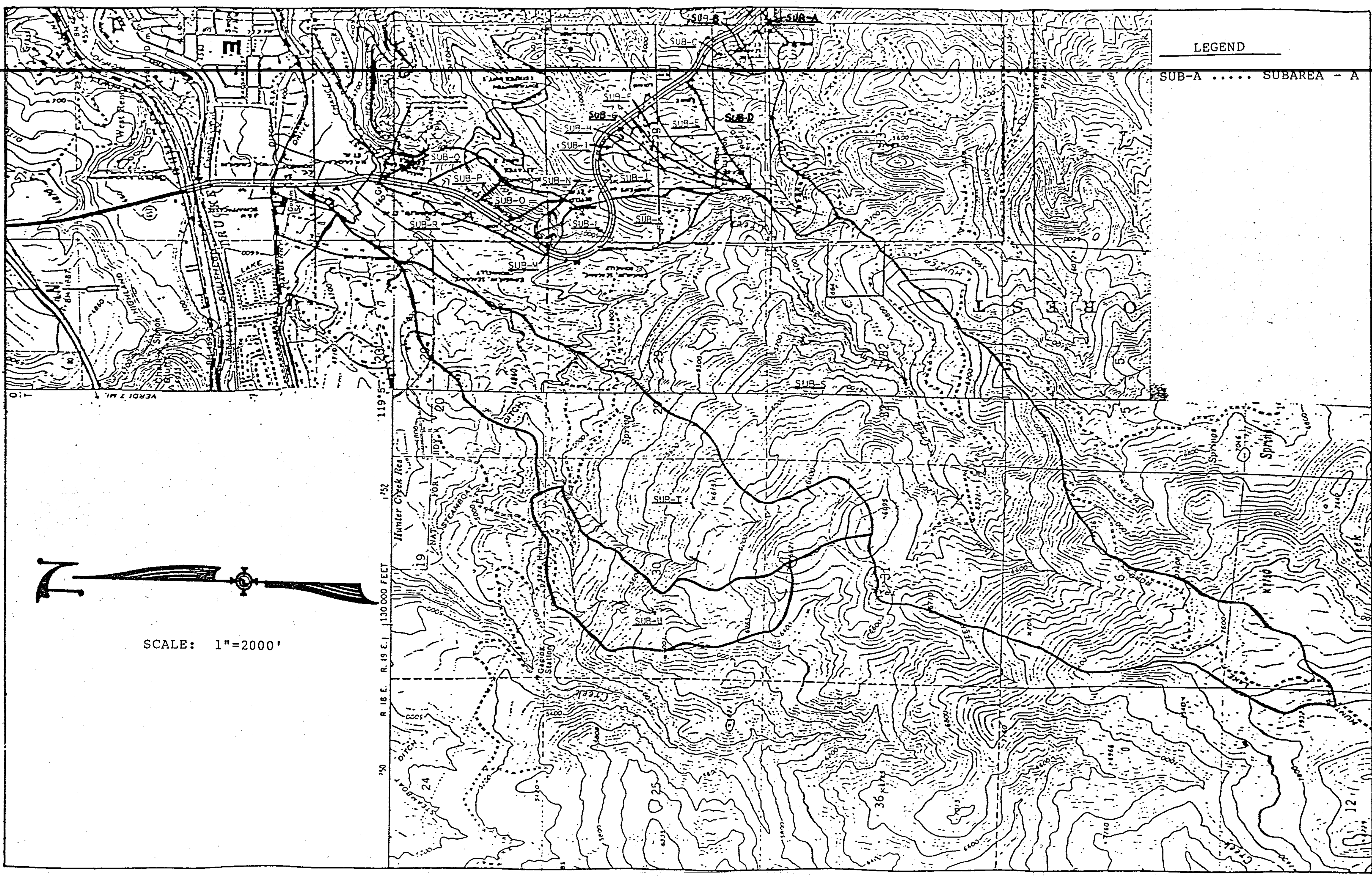
The subarea curve number depends on the following four considerations:

1. Soil Type - Soils are classified according to their hydrologic behavior. The four classes in the SCS analysis are A, B, D, and D, with A being the most pervious and D the least.

2. Vegetative Type - Vegetation type affects runoff rates and SCS has grouped this variable by adjective descriptions, such as "sage grass," "forests," etc.

3. Cover - Curve number is influenced by the extent of protective cover on the receiving watershed. Cover is usually defined as the percent of surface covered by vegetation. These percentages are related to adjectives, "good," "fair," or "poor."

4. Soil moisture is expressed in antecedent precipitation (AMC). The effects of soil moisture on storm runoff are dealt with



EXISTING CONDITION SUBAREA FIGURE - 2

TABLE 1

MODEL INPUT PARAMETERS FOR SUBAREAS

Subarea	Area MI^2	Curve Number	Lag Time (Hours)	100-Yr, 24-Hr Precipitation
A	0.0253	80	0.02	2.79"
B	0.0067	80	0.02	2.79"
C	0.0163	80	0.02	2.79"
D	0.2061	80	0.12	2.79"
E	0.080	80	0.09	2.79"
F	0.0363	80	0.08	2.79"
G	0.0261	80	0.11	2.79"
H	0.0171	80	0.05	2.79"
I	0.0059	80	0.02	2.79"
J	0.0562	80	0.07	2.79"
K	0.0875	80	0.06	2.79"
L	0.0319	80	0.02	2.79"
M	0.0096	80	0.01	2.79"
N	0.0245	80	0.04	2.79"
O	0.0282	80	0.04	2.79"
P	0.0311	80	0.03	2.79"
Q	0.0274	80	0.03	2.79"
R	0.040	80	0.12	2.79"
S	3.1115	76	1.54	2.80"
T	1.040	76	0.53	2.80"
U	0.3900	74	0.18	2.80"

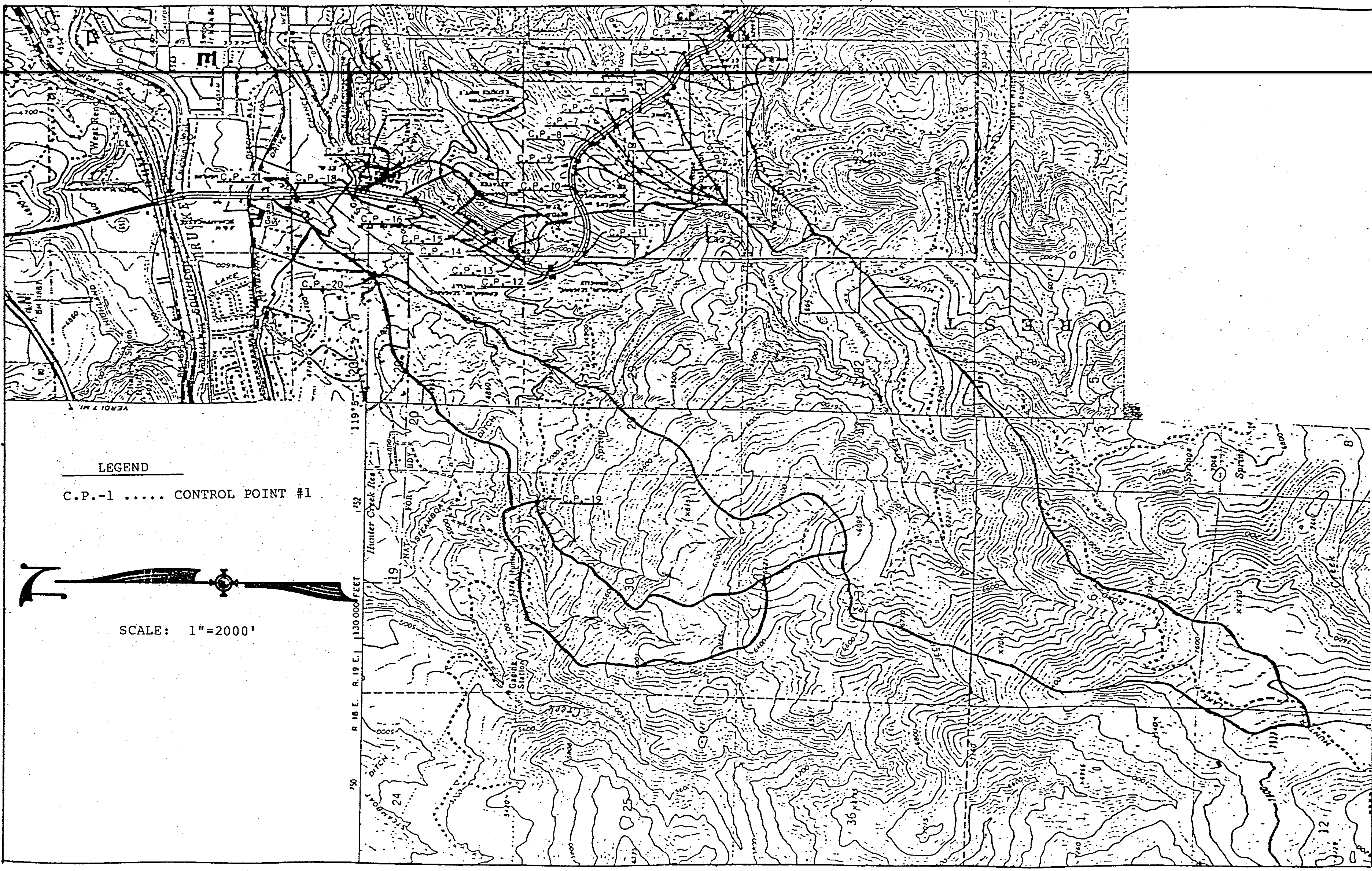
through the index of five-day antecedent rainfall, dependent upon the time of year. AMC is classified as I, II, or III. AMC II is taken as the reference status and NC's are adjusted up or down in accordance with categories and the design conditions. The origin of the CN/AMC relationship is not known, nor is its derivation documented. As a matter of practical usage, most calculations for peak flow are done with AMC II.

All considerations must be considered together when making the selection for CN. CN may vary from values of 0 (a completely pervious watershed with no possible runoff) to 100 (a completely impervious watershed with runoff equaling rainfall). The Soil Survey of Washoe County, South Part, Nevada, was used to determine the soil types of the watershed.

The existing condition curve numbers shown in Table 1 were based on field inspections and an estimated average total percentage of standing vegetative cover of 80 percent.

The subarea lag time was calculated using the velocity method. The velocity method splits up the hydraulic length of the subarea into segments of slopes and land uses. Each segment has a velocity determined for its condition which is divided into the segment's length to find the time of concentrations. All the times of concentration are added and divided by 5/3 to get the subarea lag time. The subarea lag time used to estimate the delay in time from initial precipitation to actual runoff at some reference point in the watershed. It is important that the input lag variable correctly describes the field conditions. Field conditions which affect channel efficiency are soil materials in banks and bottoms, the stability or lack of for the channel, vegetation, debris, and sinuosity. These characteristics need to be evaluated and appropriate adjustments need to be made to the calculated lag variable. The lag time components are shown in Table 1.

The calculated stormwater peak discharges are shown in Table 2 along with their corresponding subareas and control point numbers, as reflected on Figure 3. Use these stormwater peak discharges with the particular inlet condition required by the construction of McCarran Boulevard to determine the size of the stormwater facility needed. Reference Appendix "A" for the hydrographs and the computer data.



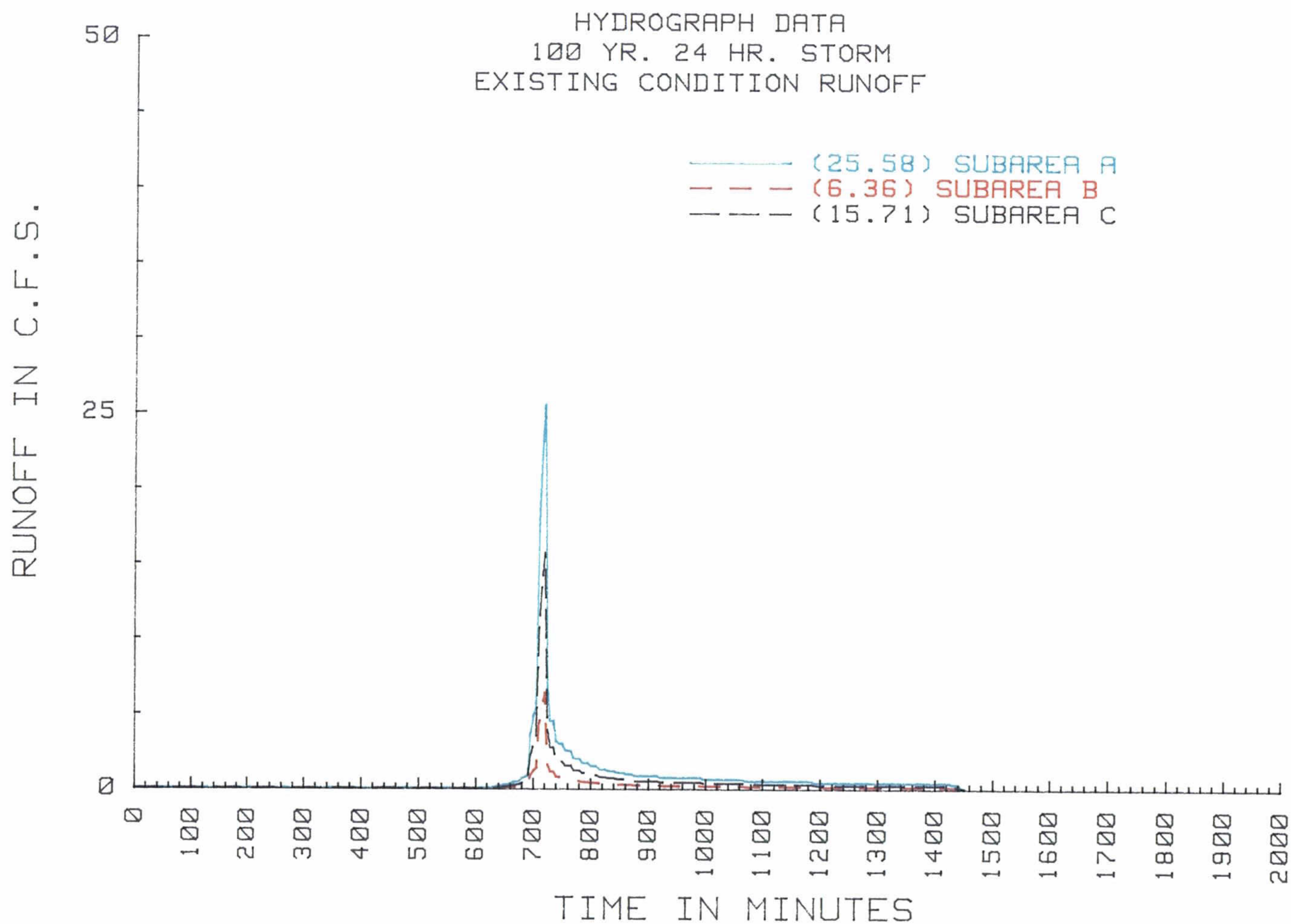
CONTROL POINT NUMBER LOCATIONS FIGURE - 3

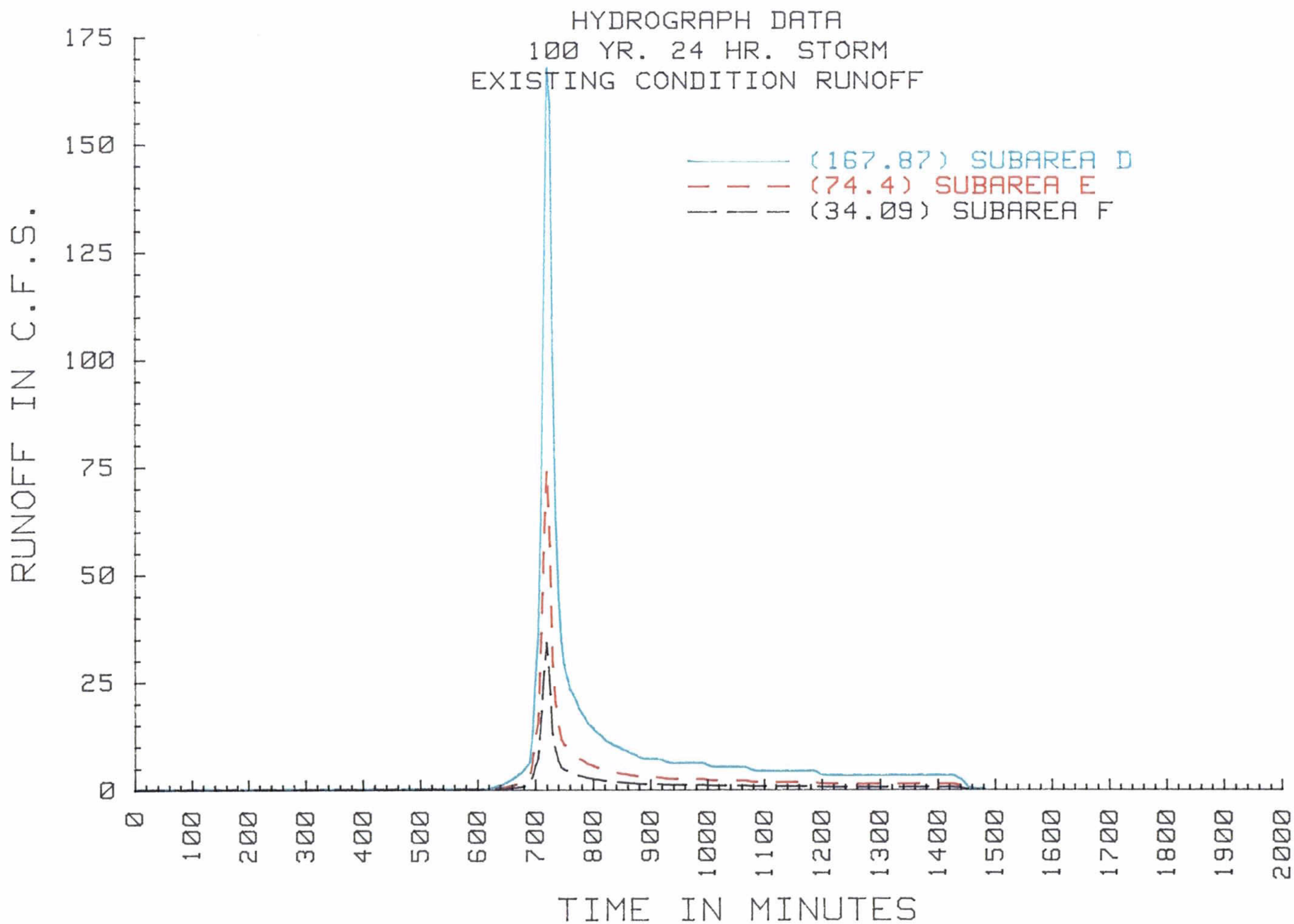
TABLE 2

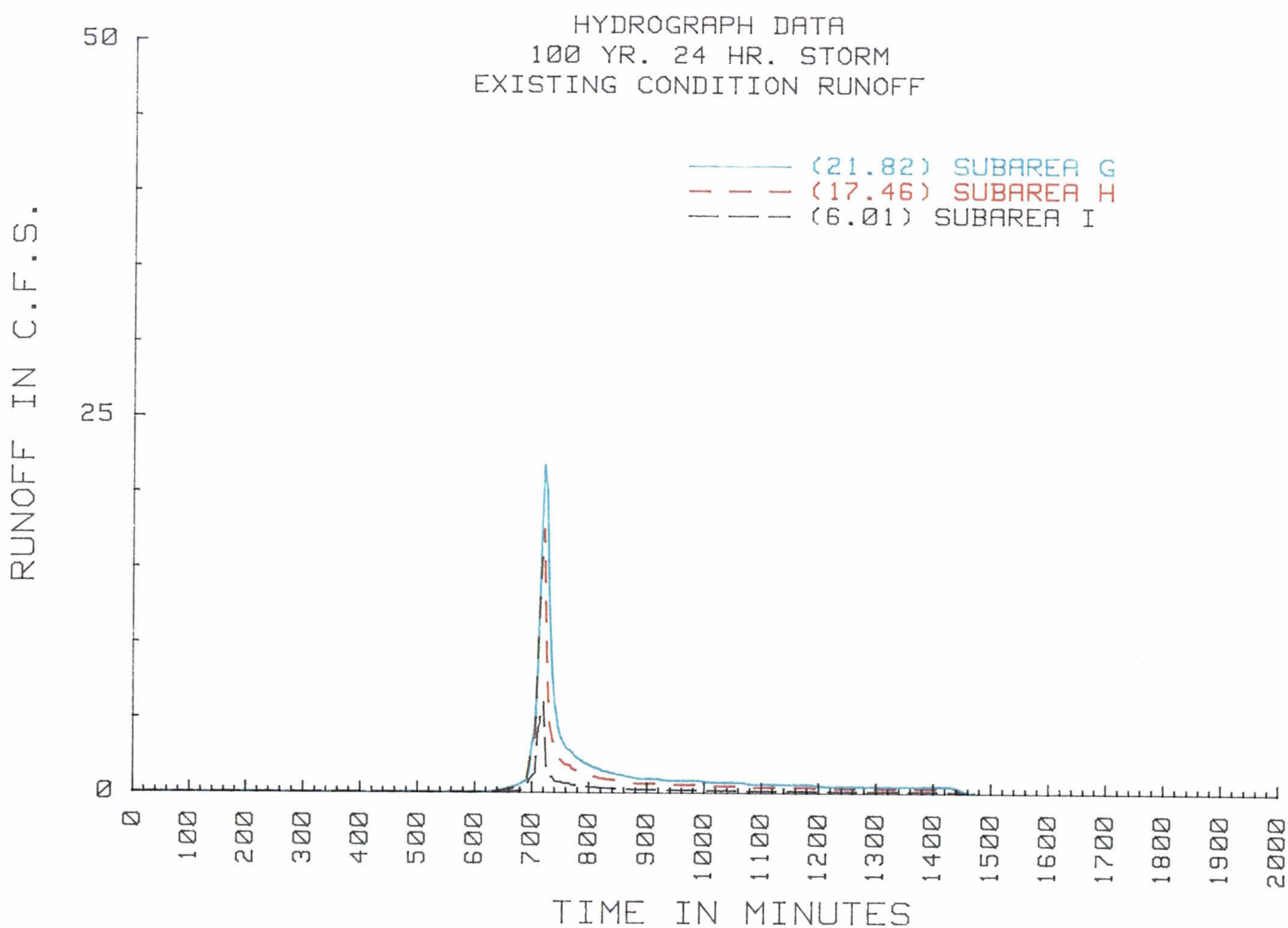
CALCULATED STORMWATER PEAK DISCHARGES

Subarea	Control Point Number	100-Yr, 24-Hr Storm Runoff (cfs)
A	1	25.58
B	2	6.36
C	3	15.71
D	4	167.97
E	5	74.4
F	6	34.09
G	7	21.82
h	8	17.46
I	9	6.01
J	10	55.57
K	11	87.63
L	12	120.14
M	13	7.11
N	14	25.57
O	15	29.54
P	16	32.74
Q	17	29.40
R	18	132.08
S	21	193.05
T	20	298.13
U	19	678.27

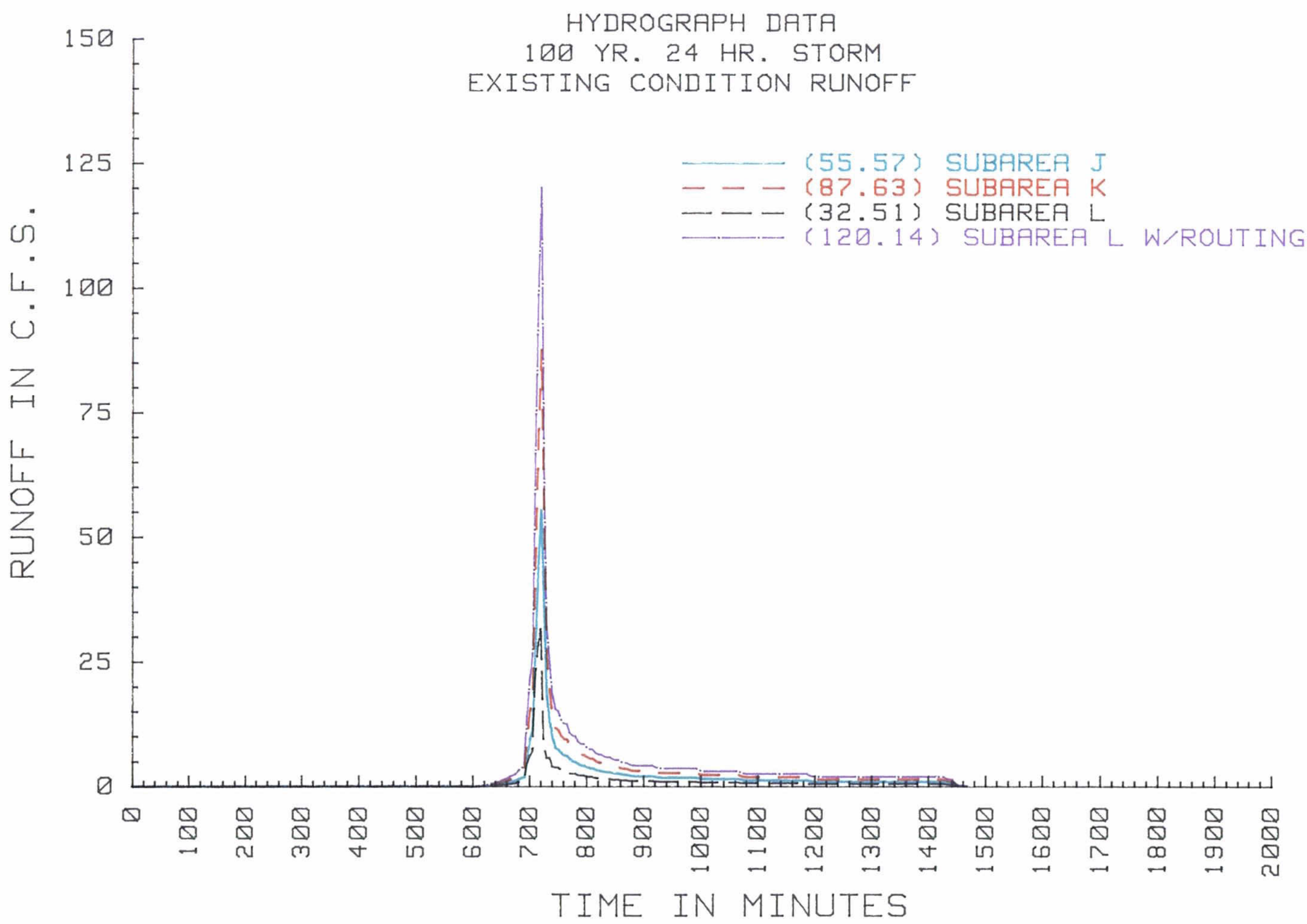
APPENDIX "A"

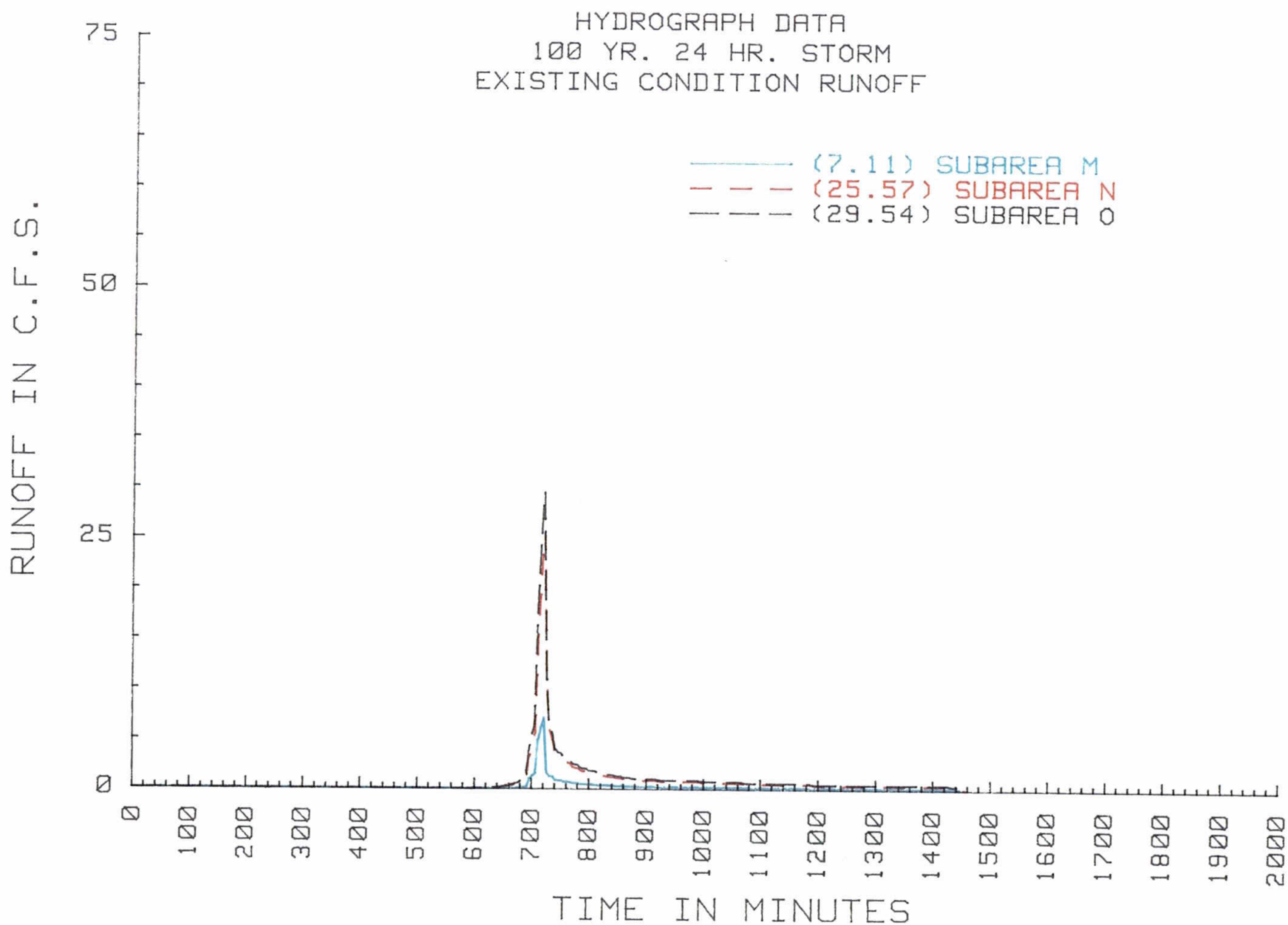

HYDROGRAPH DATA
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF
(25.58) SUBAREA A
(6.36) SUBAREA B
(15.71) SUBAREA C
RUNOFF IN C.F.S.
50
25
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
TIME IN MINUTES

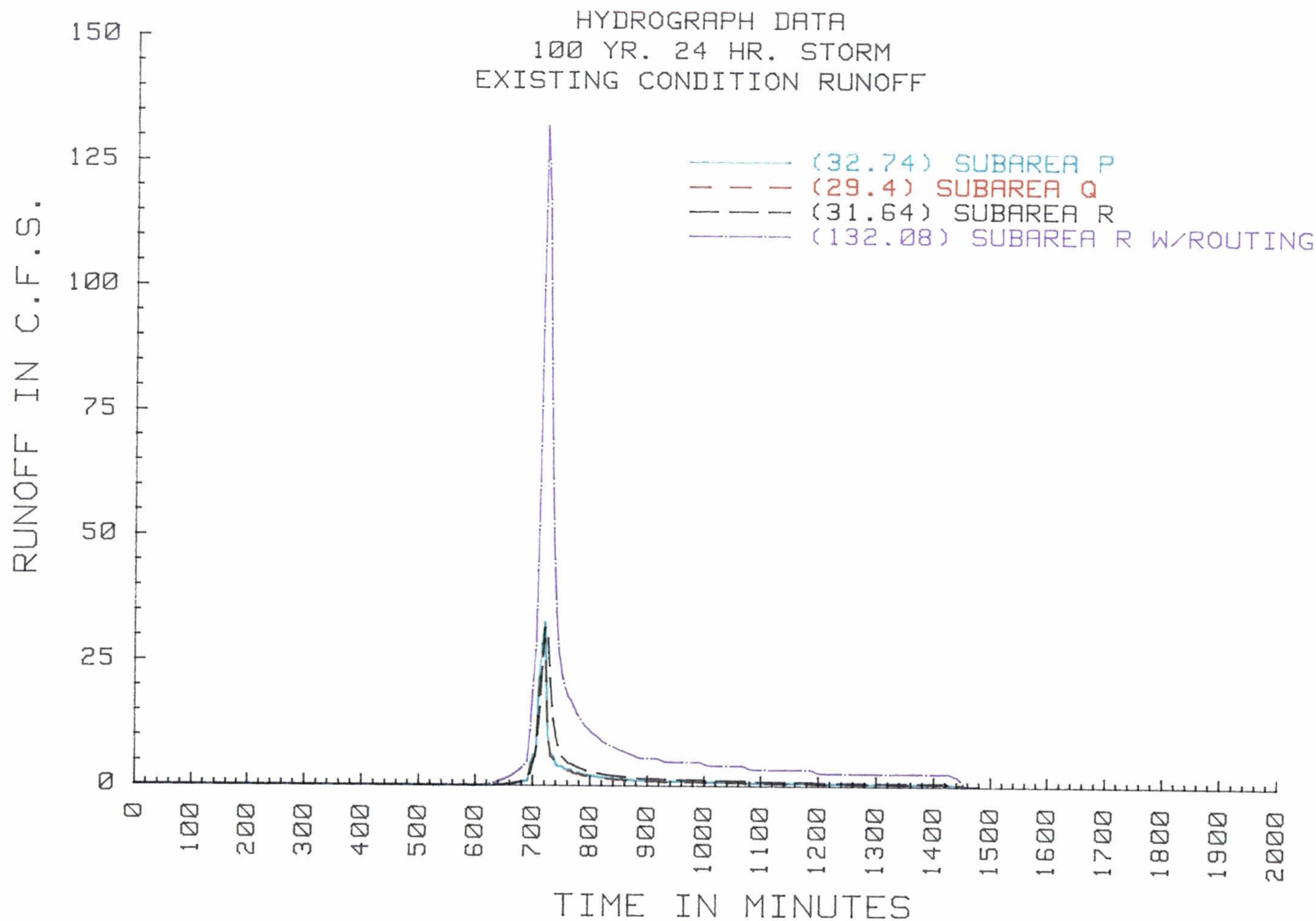

HYDROGRAPH DATA
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF
(167.87) SUBAREA D
(74.4) SUBAREA E
(34.09) SUBAREA F
RUNOFF IN C.F.S.
0
25
50
75
100
125
150
175
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
TIME IN MINUTES

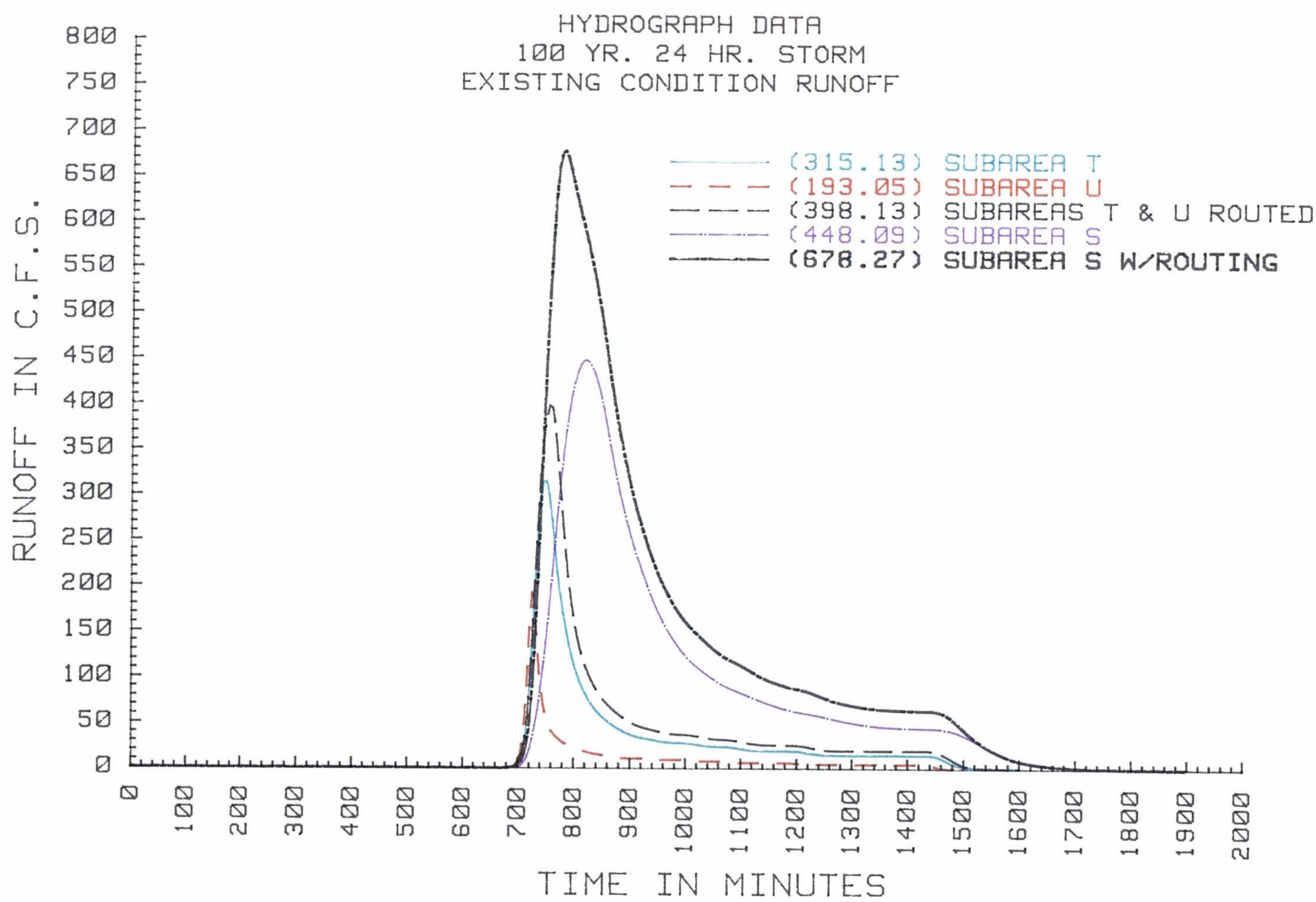


HYDROGRAPH DATA
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF
(21.82) SUBAREA G
(17.46) SUBAREA H
(6.01) SUBAREA I
RUNOFF IN C.F.S.
50
25
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
TIME IN MINUTES


HYDROGRAPH DATA
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF
(55.57) SUBAREA J
(87.63) SUBAREA K
(32.51) SUBAREA L
(120.14) SUBAREA L W/ROUTING
RUNOFF IN C.F.S.
150
125
100
75
50
25
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
TIME IN MINUTES


HYDROGRAPH DATA
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF
(7.11) SUBAREA M
(25.57) SUBAREA N
(29.54) SUBAREA O
RUNOFF IN C.F.S.
75
50
25
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
TIME IN MINUTES


HYDROGRAPH DATA
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF
(32.74) SUBAREA P
(29.4) SUBAREA Q
(31.64) SUBAREA R
(132.08) SUBAREA R W/ROUTING
RUNOFF IN C.F.S.
0
25
50
75
100
125
150
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
TIME IN MINUTES


HYDROGRAPH DATA
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF
(315.13) SUBAREA T
(193.05) SUBAREA U
(398.13) SUBAREAS T & U ROUTED
(448.09) SUBAREA S
(678.27) SUBAREA S W/ROUTING
RUNOFF IN C.F.S.
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
TIME IN MINUTES
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000

****

McCARRAN BLVD. EXTENTION - HYDROLOGY
20 Feb 1987   10:00:42

****

TIME INCREMENT, MIN, =   5.00

DISCHARGE DIMENSION =   500.00

COMPUTE RAINFALL 100 YR
STORM DURATION 24 HOURS WITH 2.79 " RAINFALL - TYPE II DISTRIBUTION

STATION	WEIGHT
1	1.00

AVERAGE RAINFALL, IN =   2.79

STATION	WEIGHT
1	1.00

READ SCALING
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF

********** SUBAREA A **********

CATCHMENT AREA 1 , SQ. MI. = .0253

SCS CURVE NUMBER =   80.00

SCS LAG, HRS =   .02 = 1.2 min = 1 min 16 sec

COMPUTE RUNOFF @ 1

MAXIMUM FLOW =   25.58 CFS
TIME @ MAX FLOW =   720.00 MINUTES ?

VOLUME IN AC. FT. @ CP # 1 = 1.39029924151 = 60,560 CF

PLOTTED TOTAL FOR CP NO. 1

********** SUBAREA B **********

CATCHMENT AREA 2 , SQ. MI. = .0067

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .02

COMPUTE RUNOFF @ 2

MAXIMUM FLOW = 6.36 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 2 = .344823509962

PLOTTED TOTAL FOR CP NO. 2

********** SUBAREA C **********

CATCHMENT AREA 3 , SQ. MI. = .0163

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .02

COMPUTE RUNOFF @ 3

MAXIMUM FLOW = 15.71 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 3 = .851234468664

PLOTTED TOTAL FOR CP NO. 3

NEW GRAPH

COMPUTE RAINFALL 100 YR
STORM DURATION 24 HOURS WITH 2.79 " RAINFALL - TYPE II DISTRIBUTION

READ SCALING
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF

********** SUBAREA D **********

CATCHMENT AREA 4 , SQ. MI. = .2061

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .12

COMPUTE RUNOFF @ 4

MAXIMUM FLOW = 167.87 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 4 = 11.9401374809

PLOTTED TOTAL FOR CP NO. 4

********** SUBAREA E **********

CATCHMENT AREA 5 , SQ. MI. = .08

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .09

COMPUTE RUNOFF @ 5

MAXIMUM FLOW = 74.40 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 5 = 4.70482076009

PLOTTED TOTAL FOR CP NO. 5

********** SUBAREA F **********

CATCHMENT AREA 6 , SQ. MI. = .0363

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .08

COMPUTE RUNOFF @ 6

MAXIMUM FLOW = 34.09 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 6 = 2.14162418357

PLOTTED TOTAL FOR CP NO. 6

NEW GRAPH

COMPUTE RAINFALL 100 YR
STORM DURATION 24 HOURS WITH 2.79 " RAINFALL - TYPE II DISTRIBUTION

READ SCALING
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF

********** SUBAREA G **********

CATCHMENT AREA 7 , SQ. MI. = .0261

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .11

COMPUTE RUNOFF @ 7

MAXIMUM FLOW = 21.82 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 7 = 1.51565720806

PLOTTED TOTAL FOR CP NO. 7

********** SUBAREA H **********

CATCHMENT AREA 8 , SQ. MI. = .0171

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .05

COMPUTE RUNOFF @ 8

MAXIMUM FLOW = 17.46 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 8 = 1.00211182427

PLOTTED TOTAL FOR CP NO. 8

********** SUBAREA I **********

CATCHMENT AREA 9 , SQ. MI. = .0059

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .02

COMPUTE RUNOFF @ 9

MAXIMUM FLOW = 6.01 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 9 = .326784427337

PLOTTED TOTAL FOR CP NO. 9

NEW GRAPH

COMPUTE RAINFALL 100 YR
STORM DURATION 24 HOURS WITH 2.79 " RAINFALL - TYPE II DISTRIBUTION

READ SCALING
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF

********** SUBAREA J **********

CATCHMENT AREA 10 , SQ. MI. = .0562

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .07

COMPUTE RUNOFF @ 10

MAXIMUM FLOW = 55.57 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 10 = 3.35535874598

PLOTTED TOTAL FOR CP NO. 10

********** SUBAREA K **********

CATCHMENT AREA 11 , SQ. MI. = .0875

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .06

COMPUTE RUNOFF @ 11

MAXIMUM FLOW = 87.63 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 11 = 5.19304271427

PLOTTED PARTIAL SUBAREA K

********** SUBAREA L **********

CATCHMENT AREA 12 , SQ. MI. = .0319

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .02

COMPUTE RUNOFF @ 12

MAXIMUM FLOW = 32.51 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 12 = 1.76801574097

PLOTTED PARTIAL SUBAREA L

MUSKINGUM K, HRS. = .04

MUSKINGUM X = .20

MUSKINGUM ROUTE FROM 11 TO 12

MAXIMUM CONTRIBUTION = 87.63
MAXIMUM FLOW = 120.14
TIME @ MAX FLOW = 720.00 MINUTES

PLOTTED TOTAL FOR CP NO. 12

NEW GRAPH

COMPUTE RAINFALL 100 YR
STORM DURATION 24 HOURS WITH 2.79 " RAINFALL - TYPE II DISTRIBUTION

READ SCALING
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF

********** SUBAREA M **********

CATCHMENT AREA 13 , SQ. MI. = .0096

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .01

COMPUTE RUNOFF @ 13

MAXIMUM FLOW = 7.11 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 13 = .383983751407

PLOTTED PARTIAL SUBAREA M

********** SUBAREA N **********

CATCHMENT AREA 14 , SQ. MI. = .0245

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .04

COMPUTE RUNOFF @ 14

MAXIMUM FLOW = 25.57 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 14 = 1.44148675274

PLOTTED PARTIAL SUBAREA N

********** SUBAREA O **********

CATCHMENT AREA 15 , SQ. MI. = .0282

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .04

COMPUTE RUNOFF @ 15

MAXIMUM FLOW = 29.54 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 15 = 1.6611229099

PLOTTED PARTIAL SUBAREA O

NEW GRAPH

COMPUTE RAINFALL 100 YR
STORM DURATION 24 HOURS WITH 2.79 " RAINFALL - TYPE II DISTRIBUTION

READ SCALING
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF

********** SUBAREA P **********

CATCHMENT AREA 16 , SQ. MI. = .0311

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .03

COMPUTE RUNOFF @ 16

MAXIMUM FLOW = 32.74 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 16 = 1.79473710986

PLOTTED PARTIAL SUBAREA P

********** SUBAREA Q **********

CATCHMENT AREA 17 , SQ. MI. = .0274

SCS CURVE NUMBER = 80.00

SCS LAG, HRS = .03

COMPUTE RUNOFF @ 17

MAXIMUM FLOW = 29.40 CFS
TIME @ MAX FLOW = 720.00 MINUTES

VOLUME IN AC. FT. @ CP # 17 = 1.6214677449

PLOTTED PARTIAL SUBAREA Q

********** SUBAREA R **********

CATCHMENT AREA 18 , SQ. MI. = .04

SCS CURVE NUMBER = 80.00

SCS LAG, HRS =   .12

COMPUTE RUNOFF @ 18

MAXIMUM FLOW =   31.64 CFS
TIME @ MAX FLOW =   720.00 MINUTES

VOLUME IN AC. FT. @ CP # 18 = 2.319481407

PLOTTED PARTIAL SUBAREA R

MUSKINGUM K, HRS. =   .21

MUSKINGUM X =   .20

MUSKINGUM ROUTE FROM 13 TO 18

MAXIMUM CONTRIBUTION =   5.57
MAXIMUM FLOW   =   36.83
TIME @ MAX FLOW =   725.00 MINUTES

MUSKINGUM K, HRS. =   .15

MUSKINGUM X =   .20

MUSKINGUM ROUTE FROM 14 TO 18

MAXIMUM CONTRIBUTION =   19.59
MAXIMUM FLOW   =   56.42
TIME @ MAX FLOW =   725.00 MINUTES

MUSKINGUM K, HRS. =   .12

MUSKINGUM X =   .20

MUSKINGUM ROUTE FROM 15 TO 18

MAXIMUM CONTRIBUTION =   24.26
MAXIMUM FLOW   =   80.68
TIME @ MAX FLOW =   725.00 MINUTES

MUSKINGUM K, HRS. = .05

MUSKINGUM X = .20

MUSKINGUM ROUTE FROM 16 TO 18

MAXIMUM CONTRIBUTION = 27.39
MAXIMUM FLOW = 106.90
TIME @ MAX FLOW = 725.00 MINUTES

MUSKINGUM K, HRS. = 0.00

MUSKINGUM X = .20

MUSKINGUM ROUTE FROM 17 TO 18

MAXIMUM CONTRIBUTION = 29.40
MAXIMUM FLOW = 132.08
TIME @ MAX FLOW = 720.00 MINUTES

PLOTTED TOTAL FOR CP NO. 18

NORMAL TERMINATION

****

McCARRAN BLVD. EXTENTION - HYDROLOGY
20 Feb 1987   09:48:15

****

TIME INCREMENT, MIN. =   5.00

DISCHARGE DIMENSION =   500.00

COMPUTE RAINFALL 100 YR
STORM DURATION 24 HOURS WITH 2.8 " RAINFALL - TYPE II DISTRIBUTION

STATION	WEIGHT
1	1.00

AVERAGE RAINFALL, IN =   2.80

STATION	WEIGHT
1	1.00

READ SCALING
100 YR. 24 HR. STORM
EXISTING CONDITION RUNOFF

STATION	WEIGHT
1	1.00

AVERAGE RAINFALL, IN =   2.80

STATION	WEIGHT
1	1.00

********** SUBAREA T **********

CATCHMENT AREA 20, SQ. MI. = 1.0374

SCS CURVE NUMBER =   76.00

SCS LAG, HRS =   .53

COMPUTE RUNOFF @ 20

MAXIMUM FLOW = 315.13 CFS
TIME @ MAX FLOW = 750.00 MINUTES

VOLUME IN AC. FT. @ CP # 20 = 48.9061797843

PLOTTED PARTIAL SUBAREA T

********** SUBAREA U **********

CATCHMENT AREA 19 , SQ. MI. = .3884

SCS CURVE NUMBER = 74.00

SCS LAG, HRS = .18

COMPUTE RUNOFF @ 19

MAXIMUM FLOW = 193.05 CFS
TIME @ MAX FLOW = 725.00 MINUTES

VOLUME IN AC. FT. @ CP # 19 = 16.2709101112

PLOTTED PARTIAL SUBAREA U

MUSKINGUM K, HRS. = .63

MUSKINGUM X = .20

MUSKINGUM ROUTE FROM 19 TO 20

MAXIMUM CONTRIBUTION = 129.90
MAXIMUM FLOW = 398.13
TIME @ MAX FLOW = 755.00 MINUTES

PLOTTED TOTAL FOR CP NO. 20

********** SUBAREA S **********

CATCHMENT AREA 21 , SQ. MI. = 3.1115

SCS CURVE NUMBER = 76.00

SCS LAG, HRS = 1.54

COMPUTE RUNOFF @ 21

MAXIMUM FLOW = 448.09 CFS
TIME @ MAX FLOW = 820.00 MINUTES

VOLUME IN AC. FT. @ CP # 21 = 146.78496037

PLOTTED PARTIAL SUBAREA S

MUSKINGUM K, HRS. = .20

MUSKINGUM X = .20

MUSKINGUM ROUTE FROM 20 TO 21

MAXIMUM CONTRIBUTION = 388.95
MAXIMUM FLOW = 678.27
TIME @ MAX FLOW = 780.00 MINUTES

PLOTTED TOTAL FOR CP NO. 21

NORMAL TERMINATION

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REVIEWED BY ______ DATE ______
BY GF DATE 6-20-89

(t_c) CONCENTRATION TIME $\leq$ 10 MIN
10 yr. INTENSITY - $i_{10} = 1.9$ (in/hr)
100 yr. INTENSITY - $i_{100} = 3.8$ (in/hr)

$C_{PAVED} = 0.90$

$C_{UNPAVED\ SLOPE} = 0.60$

$Q = C \times i \times AREA$ (ACRES)

CATCH BASIN #1

$A_{PAVED} = 0.1877$ ACRES

$A_{UNPAVED} = 0.0224$ ACRES

$Q_{10} = (0.90)(0.1877)(1.9) + (.0224)(.60)(1.9)$

$Q_{10} = 0.35$ CFS

$Q_{100} = (0.90)(.1877)(3.8) + (0.60)(.0224)(3.8)$

$Q_{100} = 0.69$ CFS

CATCH BASIN #2

$A_{PAVED} = 0.3445$ ACRES

$A_{UNPAVED} = 0.5150$ ACRES

$Q_{10} = (0.90)(0.3445)(1.9) + (0.60)(0.5150)(1.9)$

$Q_{10} = 1.18$ CFS

$Q_{100} = (0.90)(0.3445)(3.8) + (0.60)(0.5150)(3.8)$

$Q_{100} = 2.35$ CFS

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SHEET 2 OF 12
PROJECT SOUTHWEST MCCARRAN BOULEV
PROJECT NO. 2781
SUBJECT CATCH BASIN CALCULATIONS
REVIEWED BY ______ DATE ______
BY ______ DATE 6·20·89

CATCH BASIN #3

$A_{PAVED} = 0.5012$ ACRES

$A_{UNPAVED} = 0.4136$ ACRES

$Q_{10} = (0.90)(0.5012)(1.9) + (0.60)(0.4136)(1.9)$

$Q_{10} = 1.33$ CFS

$Q_{100} = (0.90)(0.5012)(3.8) + (0.60)(0.4136)(3.8)$

$Q_{100} = 2.65$ CFS

CATCH BASIN #4

$A_{PAVED} = 0.4284$ ACRES

$A_{UNPAVED} = 0.4992$ ACRES

$Q_{10} = (0.90)(0.4284)(1.9) + (0.60)(0.4992)(1.9)$

$Q_{10} = 1.30$ CFS

$Q_{100} = (0.90)(0.4284)(3.8) + (0.60)(0.4992)(3.8)$

$Q_{100} = 2.61$ CFS

CATCH BASIN #5

$Q = A \frac{1.49}{N} R^{2/3} S^{1/2}$ (MANNING'S)

$R = \frac{AREA}{WETTED\ PERIMETER}$

$Q = (.0938)\frac{(1.49)}{(0.014)}(.0574)^{2/3}(0.0675)^{1/2}$

$Q = 0.38$ CFS FOR 10 yr. AND 100 yr.

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CATCH BASIN # 6

$A_{PAVED} = .6601$ ACRES

$A_{UNPAVED} = 1.5236$ ACRES

$Q_{10} = (0.90)(.6601)(1.9) + (0.60)(1.5236)(1.9)$

$Q_{10} = 2.86$ CFS

$Q_{100} = (0.90)(.6601)(3.8) + (0.60)(1.5236)(3.8)$

$Q_{100} = 5.73$ CFS

CATCH BASIN #7

$A_{PAVED} = 0.7089$ ACRES

$A_{UNPAVED} = 1.1658$ ACRES

$Q_{10} = (0.90)(0.7089)(1.9) + (0.60)(1.1658)(1.9)$

$Q_{10} = 2.54$ CFS

$Q_{100} = (0.90)(0.7089)(3.8) + (0.60)(1.1658)(3.8)$

$Q_{100} = 5.07$ CFS

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REVIEWED BY ______ DATE ______
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CATCH BASIN # 8

$$Q = A \frac{1.49}{N} R^{2/3} S^{1/2} \quad \text{(MANNING'S)}$$

$$R = \frac{\text{AREA}}{\text{WETTED PERIMETER}}$$

$$Q = (0.0938)\frac{(1.49)}{(0.014)}(.0574)^{2/3}(0.060)^{1/2}$$

Q = 0.36 CFS FOR 10 yr. AND 100 yr.

CATCH BASIN # 9

A_{PAVED} = 0.5796 ACRES

$A_{UNPAVED}$ = 1.0556 ACRES

$Q_{10} = (0.90)(0.5796)(1.9) + (0.60)(1.0556)(1.9)$

Q_{10} = 2.20 CFS

$Q_{100} = (0.90)(0.5796)(3.8) + (0.60)(1.0556)(3.8)$

Q_{100} = 4.39 CFS

CATCH BASIN # 10

A_{PAVED} = 0.5785

$A_{UNPAVED}$ = 1.1059

$Q_{10} = (0.90)(0.5785)(1.9) + (0.60)(1.1059)(1.9)$

Q_{10} = 2.25 CFS

$Q_{100} = (0.90)(0.5785)(3.8) + (0.60)(1.1059)(3.8)$

Q_{100} = 4.51 CFS

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CATCH BASIN # 11

$A_{PAVED} = 0.6773$ ACRES

$A_{UNPAVED} = 0.9785$ ACRES

$Q_{10} = (0.90)(0.6773)(1.9) + (0.60)(0.9785)(1.9)$

$\boxed{Q_{10} = 2.28 \text{ CFS}}$

$Q_{100} = (0.90)(0.6773)(3.8) + (0.60)(0.9785)(3.8)$

$\boxed{Q_{100} = 4.55 \text{ CFS}}$

CATCH BASIN # 12

$A_{PAVED} = 0.5616$ ACRES

$A_{UNPAVED} = 1.1368$ ACRES

$Q_{10} = (0.90)(0.5616)(1.9) + (0.60)(1.1368)(1.9)$

$\boxed{Q_{10} = 2.26 \text{ CFS}}$

$Q_{100} = (0.90)(0.5616)(3.8) + (0.60)(1.1368)(3.8)$

$\boxed{Q_{100} = 4.51 \text{ CFS}}$

CATCH BASIN #13

$$Q = A \frac{1.49}{N} R^{2/3} S^{1/2}$$

$$R = \frac{\text{AREA}}{\text{WETTED PERIMETER}}$$

$$Q = (0.0938) \frac{(1.49)}{0.014} (.0574)^{2/3} (0.060)^{1/2}$$

$\boxed{Q = 0.36 \text{ CFS}}$ FOR 10 YR. AND 100 YR.

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BY ____ DATE 6-20-89

CATCH BASIN #14

$A_{PAVED} = 0.7859$ ACRES

$A_{UNPAVED} = 0.4703$ ACRES

$Q_{10} = (0.90)(0.7859)(1.9) + (0.60)(0.4703)(1.9)$

$Q_{10} = 1.88$ CFS

$Q_{100} = (0.90)(0.7859)(3.8) + (0.60)(0.4703)(3.8)$

$Q_{100} = 3.75$ CFS

CATCH BASIN #15

$A_{PAVED} = 1.1635$ ACRES

$A_{UNPAVED} = 0.7898$

$Q_{10} = (0.90)(1.1635)(1.9) + (0.60)(0.7898)(1.9)$

$Q_{10} = 2.89$ CFS

$Q_{100} = (0.90)(1.1635)(3.8) + (0.60)(0.7898)(3.8)$

$Q_{100} = 5.78$

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REVIEWED BY ______ DATE ______
BY ______ DATE 6-20-89

CATCH BASIN # 16

A PAVED = 0.5510 ACRES

AUNPAVED = 0.0735 ACRES

$Q_{10} = (0.5510)(0.90)(1.9) + (0.60)(0.0735)(1.9)$

$Q_{10} = 1.02$ CFS

$Q_{100} = (0.5510)(0.90)(3.8) + (0.60)(0.0735)(3.8)$

$Q_{100} = 2.05$ CFS

CATCH BASIN # 17

A PAVED = 0.4702 ACRES

AUNPAVED = 0.0676 ACRES

$Q_{10} = (0.90)(0.4702)(1.9) + (0.60)(0.0676)(1.9)$

$Q_{10} = 0.88$ CFS

$Q_{100} = (0.90)(0.4702)(3.8) + (0.60)(0.0676)(3.8)$

$Q_{100} = 1.75$ CFS

CATCH BASIN # 18

$Q = A \frac{1.49}{N} R^{2/3} S^{1/2}$ (MANNING'S)

$R = \frac{\text{AREA}}{\text{WETTED PERIMETER}}$

$Q = (0.0938)\left(\frac{1.49}{0.014}\right)(.0574)^{2/3}(0.060)^{1/2}$

$Q = 0.36$ CFS FOR 10 YR. AND 100 YR.

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CATCH BASIN #19

$A_{PAVED} = 0.8103$ ACRES

$A_{UNPAVED} = 0.1179$ ACRES

$Q_{10} = (0.90)(0.8103)(1.9) + (0.60)(0.1179)(1.9)$

$Q_{10} = 1.52$ CFS

$Q_{100} = (0.90)(0.8103)(3.8) + (0.60)(0.1179)(3.8)$

$Q_{100} = 3.04$ CFS

CATCH BASIN #20

$A_{PAVED} = 0.8239$ ACRES

$A_{UNPAVED} = 0.1150$ ACRES

$Q_{10} = (0.90)(0.8239)(1.9) + (0.60)(0.1150)(1.9)$

$Q_{10} = 1.54$ CFS

$Q_{100} = (0.90)(0.8239)(3.8) + (0.60)(0.1150)(3.8)$

$Q_{100} = 3.08$ CFS

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BY ______ DATE 6-20-89

CATCH BASIN #21

$A_{PAVED} = 0.8283$

$A_{UNPAVED} = 0.4506$ ACRES

$Q_{10} = (0.90)(0.8283)(1.9) + (0.60)(0.4506)(1.9)$

$Q_{10} = 1.93$ CFS

$Q_{100} = (0.90)(0.8283)(3.8) + (0.60)(0.4506)(3.8)$

$Q_{100} = 3.86$ CFS

CATCH BASIN #22

$A_{PAVED} = 0.8430$

$A_{UNPAVED} = 0.1127$

$Q_{10} = (0.90)(0.8430)(1.9) + (0.60)(0.1127)(1.9)$

$Q_{10} = 1.57$ CFS

$Q_{100} = (0.90)(0.8430)(3.8) + (0.60)(0.1127)(3.8)$

$Q_{100} = 3.15$ CFS

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CATCH BASIN # 23

$A_{PAVED} = 0.5620$ ACRES

$A_{UNPAVED} = 0.0781$ ACRES

$Q_{10} = (0.90)(0.5620)(1.9) + (0.60)(0.0781)(1.9)$

$Q_{10} = 1.05$ CFS

$Q_{100} = (0.90)(0.5620)(3.8) + (0.60)(0.0781)(3.8)$

$Q_{100} = 2.10$ CFS

CATCH BASIN # 24

$A_{PAVED} = 0.5789$ ACRES

$A_{UNPAVED} = 0.1931$ ACRES

$Q_{10} = (0.90)(0.5789)(1.9) + (0.60)(0.1931)(1.9)$

$Q_{10} = 1.21$ CFS

$Q_{100} = (0.90)(0.5789)(3.8) + (0.60)(0.1931)(3.8)$

$Q_{100} = 2.43$ CFS

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PROJECT SOUTH WEST MCCARRAN BLVD.
PROJECT NO. 2281
SUBJECT CATCH BASIN CALCULATIONS
REVIEWED BY ________ DATE ________
BY ________ DATE 6-20-89

CATCH BASIN # 25

$A_{PAVED} = 0.7269$

$A_{UNPAVED} = 0.1026$

$Q_{10} = (0.90)(0.7269)(1.9) + (0.60)(0.1026)(1.9)$

$Q_{10} = 1.36$ CFS

$Q_{100} = (0.90)(0.7269)(3.8) + (0.60)(0.1026)(3.8)$

$Q_{100} = 2.72$ CFS

CATCH BASIN # 26

$A_{PAVED} = 0.7269$

$A_{UNPAVED} = 0.1026$

$Q_{10} = (0.90)(0.7269)(1.9) + (0.60)(0.1026)(1.9)$

$Q_{10} = 1.36$ CFS

$Q_{100} = (0.90)(0.7269)(3.8) + (0.60)(0.1026)(3.8)$

$Q_{100} = 2.72$ CFS

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REVIEWED BY ______ DATE ______
BY ______ DATE 6-20-89

CATCH BASIN #27 (PROPOSED)

$A_{PAVED} = 0.5848$ ACRES

$A_{UNPAVED} = 0.0635$ ACRES

$Q_{10} = (0.90)(0.5848)(1.9) + (0.60)(0.0635)(1.9)$

$Q_{10} = 1.07$ CFS

$Q_{100} = (0.90)(0.5848)(3.8) + (0.60)(0.0635)(3.8)$

$Q_{100} = 2.14$ CFS

CATCH BASIN #28 (PROPOSED)

$A_{PAVED} = 0.5297$ ACRES

$A_{UNPAVED} = 0.0563$ ACRES

$Q_{10} = (0.90)(0.5297)(1.9) + (0.60)(.0563)(1.9)$

$Q_{10} = 0.97$ CFS

$Q_{100} = (0.90)(0.5297)(3.8) + (0.60)(0.0563)(3.8)$

$Q_{100} = 1.94$ CFS

RECEIVED
SEP 11 1987

Regional Transportation Commission

2050 Villanova Drive • Mailing Address: P.O. Box 30002 • Reno, Nevada 89520 - 3002 • 702-323-2800

September 8, 1987

Steve Varela
City Engineer
City of Reno
Post Office Box 1900
Reno, Nevada 89505

SUBJECT: McCarran Boulevard - Skyline Boulevard to Mayberry Drive

Dear Steve:

Per our discussion about the subject project - in particular the division of storm runoff from the first swale north of Skyline Boulevard to the large swale south of Skyline Boulevard, the enclosed Hydrologic Analysis is provided for your review.

As I previously indicated, one of my major concerns with the McCarran Boulevard project is drainage. The drainage design for all transverse drainage crossing is based upon passing the 100 year storm. The recently approved developments adjacent to McCarran Boulevard provide an underground drainage system capable of carrying the 10 year storm. Obviously, there must be a surface system capable of accommodating the flow differential between the two design years.

As I recall, you were going to request the Public Works staff to review the potential problem and develop some alternative scenarios. Our consultant and RTC staff will provide assistance in reviewing this mater.

RTC to look at scenario in their R/W
City to look @ D.S. improvements

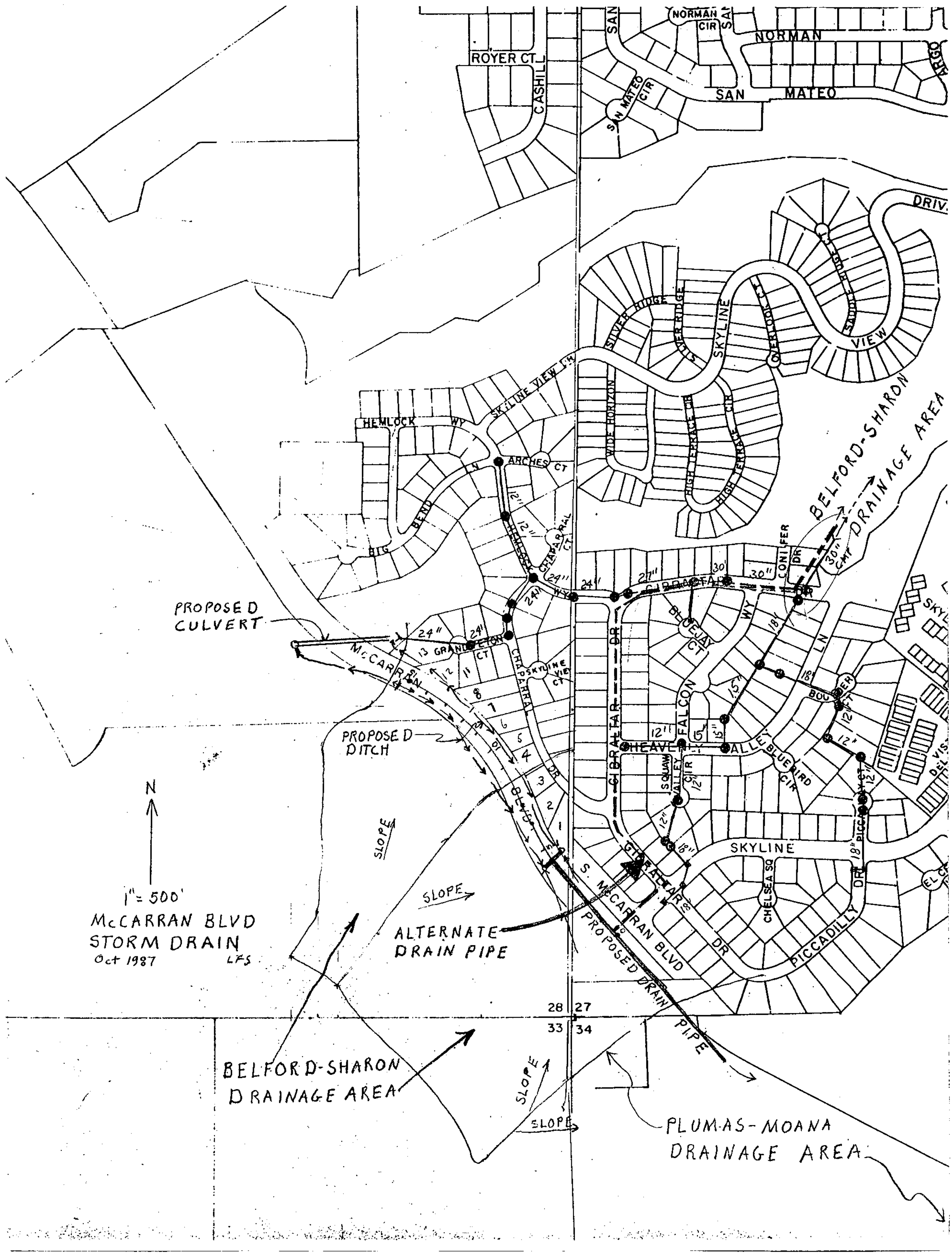
Please keep me advised of the review status and the development of alternatives so we can keep the design of our project moving forward.

Very truly yours,

Tom

THOMAS E. WILLIAMS, P.E.
Engineering Manager

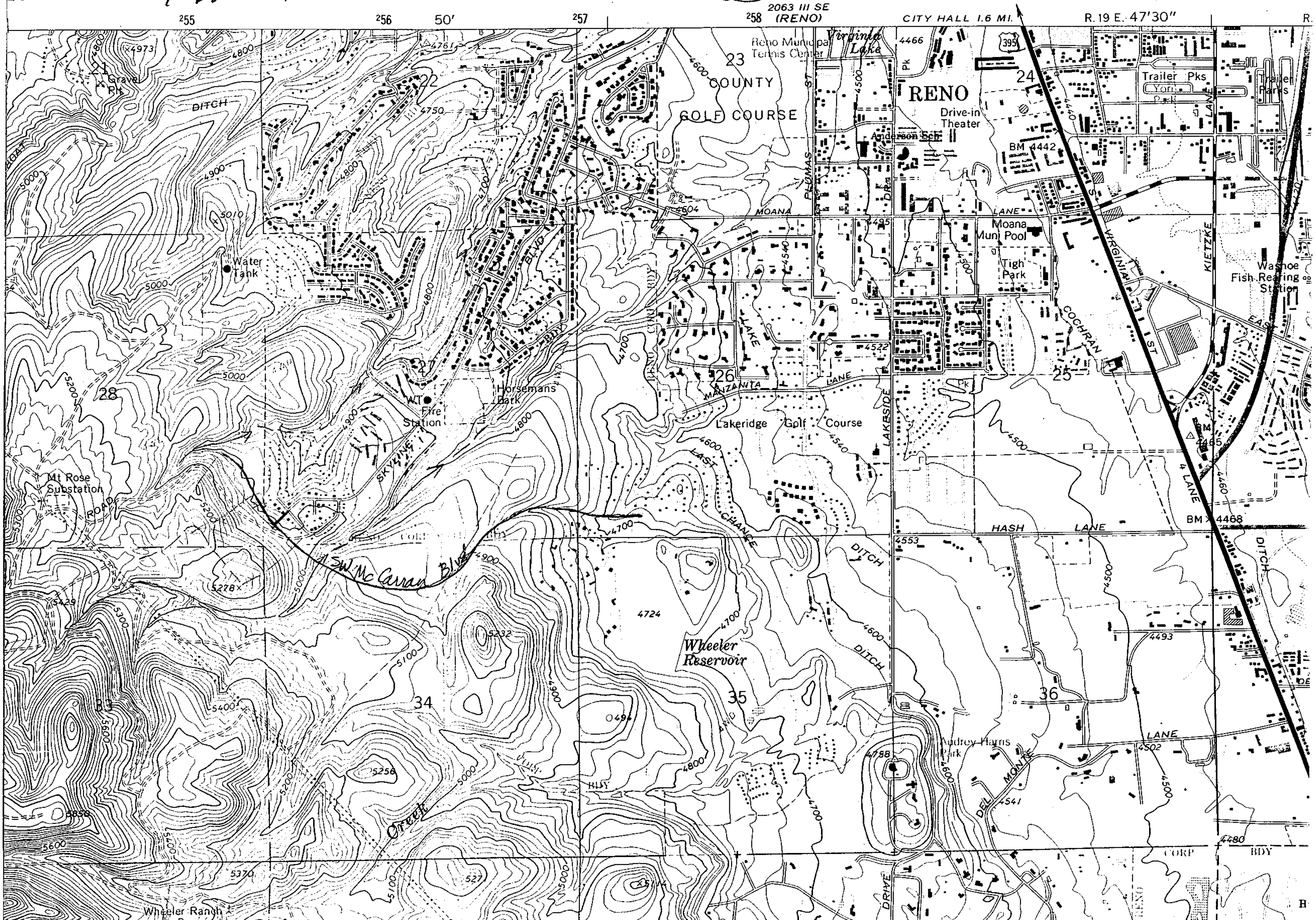
TEW/lm
enclosure
cc: Jerry Walsh, Summit Engineering



NORMAN CIR
NORMAN
SAN MATEO
SAN MATEO CIR
ROYER CT
CASHILL
ARGO
DRIVE
SILVER RIDGE
SKYLINE
OVERLOOK CT
SADDLE RIDGE
VIEW
SKYLINE VIEW LN
WIDE HORIZON
HIGH TERRACE CIR
HEMLOCK WY
ARCHES CT
BIG BEND
CHAPARRAL CT
HEMLOCK
GIBRALTAR
CONIFER DR
BELFORD-SHARON DRAINAGE AREA
30" CMP
PROPOSED CULVERT
GRAND ETON CT
CHAPARRAL DR
SKYLINE VIEW CT
McCARRAN BLVD
PROPOSED DITCH
BLUEJAY CT
FALCON
HEAVENLY VALLEY LN
BOULDER CT
BLUEBIRD CIR
SQUAW VALLEY CIR
SKYLINE
PICCADILLY CT
PICCADILLY DR
CHELSEA SQ
EL CAPITAN
GIBRALTAR DR
S. McCARRAN BLVD
PROPOSED DRAIN PIPE
ALTERNATE DRAIN PIPE
SLOPE
N
1" = 500'
McCARRAN BLVD STORM DRAIN
Oct 1987
LFS
28 27
33 34
BELFORD-SHARON DRAINAGE AREA
PLUMAS-MOANA DRAINAGE AREA

ITERIOR
EY

DRAINAGE CONCERNS WITH MCCARRAN 8/17/87



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LETTER OF TRANSMITTAL

DATE 9/4/87 JOB NO. 133-030-874

ATTENTION Brent Boyer

RE: SW McCarran Blvd - Greensboro to Skyline

RECEIVED
SEP 4 1987
Engineering Div.

TO City of Reno
Engineering Div

GENTLEMEN: WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☒ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ ______

COPIES	DATE	NO.	DESCRIPTION
2			Preliminary plans

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ______ copies for approval

☐ For your use ☐ Approved as noted ☐ Submit ______ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return ______ corrected prints

☒ For review and comment ☒ as requested by RTC

☐ FOR BIDS DUE ______ 19___ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS:
Please give one set to Steve Varela.
Plans sent to Fire Dept. for Review, 9/4/87
Recieved plans back from Fire on 9/10/87. No comments.

COPY TO Tom Williams - RTC

SIGNED: Guy A Sharp

FORM NO. 100

If enclosures are not as noted, kindly notify us at once.