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MARYVALE AREA FLOODING MITIGATION PROJECT PHASE I FCD 93-34

HYDROLOGIC MODELING

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, Arizona 85014

MARYVALE AREA
FLOODING MITIGATION PROJECT
PHASE I
FCD 93-34

HYDROLOGIC MODELING

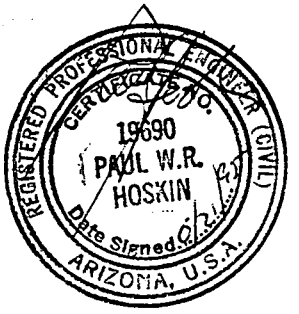
DRAFT
SUBMITTED
June 20, 1995

Prepared for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

Prepared by:

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, AZ 85014



COE & VAN LOO

Land Planning
Civil Engineering
Water Resources Engineering
Environmental Sciences
Computer Services
Landscape Architecture
Surveying

Founded in 1958 by
P.E. Coe, P.E. (1915-1977)
H.W. Van Loo, P.E.

John B. Nelson, P.E., R.L.S.
David L. Maguire, R.L.A.
Ken Knickerbocker, P.E., R.L.S.
Paul W.R. Hoskin, P.E.
Paul E. Siders, P.E., R.L.S.
David W. Dust, P.E.
Glen W. Roth, P.E.
Richard Lee Knudson, R.L.S.
E. Thompson Van Loo, P.E., R.L.S.
Gerald Rasmussen, R.L.S.
Michael J. Samer, P.E., R.L.S.
David P. Forney, R.L.S.
Duane M. Hunn, P.E.

Ronald J. Mlnarik, R.L.A.
Les F. Olson, P.E., R.L.S.
Larry E. Sullivan, R.L.S.
Newell J. Roundy, R.L.A.
Earl J. Swetland, R.L.A.
Michael R. Havill, P.E., R.L.S.
Jack K. Moody, P.E.
F. Richard Jones, Jr., P.E., R.L.S.
Brad D. O'Neill, R.L.S.
Christine Taratsas, R.L.A.
William T. Miller, P.E.
Charles E. McElwain, R.L.S.
David Lucas, R.L.S.
Russell MacDonald, R.L.A.

June 21, 1995

Ms. Felicia Terry
Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Re: Maryvale Flooding Mitigation Project
FCD 93-94
Hydrologic Model

Dear Felicia:

Please find enclosed our draft submittal for the hydrologic model for your review. Once approved, this submittal will be updated and incorporated into the project's final report.

Please feel free to contact me or Jack Moody of my staff should you have any questions.

Sincerely,

COE & VAN LOO
Consultants, Inc.

Paul W. R. Hoskin, P.E.
Vice President

PWRH:ht

Enclosure

Q:\950024\ADMIN\24-017LT.WP5

MARYVALE AREA FLOODING MITIGATION PROJECT
Phase I

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1.0 INTRODUCTION

1.1 Scope

Coe & Van Loo Consultants, Inc., (CVL) has been contracted by the Flood Control District of Maricopa County (District) for Phase 1 of the Maryvale Area Flooding Mitigation Project. Phase 1, which is the Pre-Design phase, involves the preparation of a report that will include a hydrology study, an engineering analysis, and a feasibility study for two flooding locations adjacent to the Grand Canal within the City of Phoenix (Plate 1). Details of the project's work are described in the contract agreement "Scope of Work."

1.2 Purpose

The purpose of this report is to document the results of the hydrologic modeling phase of this contract. The hydrologic modeling phase of this project is intended to identify the location and magnitude of discharges that may result from rainfall events of various return periods under existing conditions. Results will be compared with known flooding problems and assessed for their reasonableness.

1.3 Project Description

The two known flooding areas are located on the north side of the Grand Canal. One of the locations is at 64th Drive and Sunset Drive and the other is at 47th Drive and Crittenden Lane (Plate 2). The approximately eight square mile study area is bounded by 67th Avenue at the Grand Canal northerly to Grand Avenue, then southwesterly along Grand Avenue to the Grand Canal, and then westerly along the canal bank back to 67th Avenue.

The hydrologic modeling phase of this project has included a review of detailed topographic mapping which was compiled for this project, field reconnaissance, evaluation of watershed flow paths, directions and sub-basin boundaries, and development of watershed runoff parameters, and precipitation data for various frequency storm events, using guidelines presented in the *Drainage Design Manual for Maricopa County, Arizona*. All hydrologic parameters were compiled into a hydrologic rainfall-runoff model using the U.S. Army Corps of Engineers computer program HEC-1, Version 4.0 (1990).

2.0 HYDROLOGIC MODEL

2.1 General

The U.S. Army Corps of Engineers' HEC-1 computer program was used to model the Maryvale Watershed, for the 10-year, 6-hour; 50-year, 6-hour; 100-year, 6-hour; and 100-year, 24-hour storms. The September 1990, version of HEC-1 (as implemented by Dodson and Associates, Inc. in their 1991 version of ProHEC-1) was used in this study. The Clark Unit Hydrograph, the Green-Ampt Loss Rate, and the Normal Depth/Modified Puls Channel Routing options were used in the HEC-1 model for the Maryvale Watershed. The assumptions, procedures, and methodologies used to develop the HEC-1 data input sets are discussed in the following sections.

2.2 Drainage Area Boundaries

The study watershed encompasses approximately 8 square miles. The study area is located north of the Grand Canal, southwest of Grand Avenue and east of 67th Avenue (See Plate 1, Appendix III). The sub-basin boundaries were initially delineated using aerial maps from Kenney Aerial Mapping. The initial delineations were then verified or modified based on the field investigations. The sub-basin boundaries used are on Plate 3.

The sub-basins were delineated such that concentration points were provided at general locations due to the broad flow patterns. The sub-basin areas were limited to a maximum of 1.0 square mile; however, most of the sub-basins have areas much less than that.

2.3 Rainfall Parameters

2.3.1 Rainfall Distributions

The rainfall distributions that were used for the 6-hour storms were based on distributions documented in the District's *Hydrologic Design Manual* as implemented by the Maricopa County Unit Hydrograph Procedure 1 (MCUHP1). The SCS Type II distribution was used for the 24-hour storm. The aerial reduction is built in the MCUHP1 and SCS Type II distribution programs.

2.3.2 Precipitation Data

The point precipitation values used in this study were obtained from isopluvial maps for Maricopa County published in the District's *Hydrologic Design Manual*. The point precipitation values are given in Table 1 in the Appendix I. These values were calculated using the PREFRE program provided by the District.

2.3.3 Computational Time Step Interval

The computational time step interval was chosen to be long enough such that the total storm would be covered by the 300 time increments, and short enough that it was not longer than the shortest time of concentration (Tc). A time step interval of 5 minutes was chosen. With 300 time increments, the computations would cover 25 hours. This was sufficient for the 6-hour and 24-hour storms.

2.4 Physical Parameters

2.4.1 Unit Hydrograph Procedure

The majority of the watershed is urbanized with relatively flat slopes. Therefore, the site was modeled based on the Clark Unit Hydrograph as implemented in the MCUHP1 program.

2.4.2 Loss Rate Estimation

Precipitation loss rates were computed using the Green-Ampt Infiltration Equation option in HEC-1. The Green-Ampt parameters XKSAT (hydraulic conductivity at natural saturation), PSIF (wetting front capillary suction), and DTHETA (volumetric soil moisture deficit at the start of rainfall) were determined for each sub-basin. The area of each soil unit within each sub-basin was computed using soil maps provided by the District and checked by maps from the Soil Conservation Service's *Soil Survey of Maricopa County, Arizona Central Part* (1977), then a log area-weighted set of Green-Ampt parameters for each sub-basin was calculated.

Given the Green-Ampt parameters based strictly on soil characteristics, the XKSAT and DTHETA parameters were then adjusted to account for vegetative cover and/or land use. To account for the impact of vegetative cover, the XKSAT parameters for each sub-basin were adjusted based on guidelines given in the District's *Hydrologic Design Manual* (1991), aerial photographs, and field observations. The DTHETA parameter was influenced by land use. DTHETA (normal) was used for the residential, industrial, commercial, and park areas, since there is intermittent moisture due to watering landscaping. The DTHETA (dry) was used for open space land areas. The DTHETA parameter was calculated as an area-weighted average based on the land use.

The "percent impervious" parameter (RTIMP) specifies the percentage of a sub-basin that is impervious. The "percent impervious" was computed for each sub-basin, as a function of zoning and land use. A land use map is included in the appendix (Plate 6).

The surface retention loss parameter (IA) is a function of land use and/or surface vegetative cover. IA values for each sub-basin were calculated using guidelines given in the District's *Hydrologic Design Manual.*

2.4.3 Time of Concentration (Tc)

Times of concentration have been determined using the MCUHP1 program from the District. Tc were calculated for each sub-basin per District guidelines.

2.5 Routing Parameters

2.5.1 Channel Routing

In this study, the Normal Depth Channel-Modified Puls method was used for all flow routings. Channel geometries, slopes, and Manning's roughness coefficients were estimated from available mapping, aerial photography, and from observations made during the field investigations. The channel geometries were determined based on the general flow path and the average number of streets the flow path traversed, see Table 2 in the Appendix II and Plate 3, Appendix III.

Transmission losses were evaluated for the major channel routes. The infiltration rates were based on the adjacent soils' XKSAT values per the SCS map unit along the channel reach.

2.5.2 Reservoir Storage Routing

Reservoir storage routing was modeled in several locations, mainly along the Grand Canal and on the Maryvale Golf Course. Storage volumes were calculated based on street and canal elevations and the upstream ponding which results. Outflow from each affected sub-basin was computed based upon a combination of storm drain flows and weir computations for overtapping of the adjacent road and/or canal.

2.5.3 Flow Diversions

The flow diversions were based on weir flow over the street and canal. Storage volume computation tables with storage volumes, weir flow, and storm drain capacities are located in Appendix II.

Where storm drains exist, the capacity was computed based upon the average street slope using Manning's Equation assuming pipe full conditions. Where the storm drain originates within the study area, the full capacity of the storm drain was assumed as in flow diversion out of the study area. Where the storm drain originates outside of the study area, the increase in storm drain capacity within the study area was computed and diverted, thereby assuming that any storm drains entering the study area are flowing full.

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
* RUN DATE  06/20/1995  TIME  14:04:20 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        MARYVALE FLOOD MITIGATION STUDY
  2           ID        COE & VAN LOO CONSULTING, INC.
  3           ID        100-YEAR, 6-HOUR STORM
  4           ID        FILE: H1MV1006          DATE: 6/20/95
  5           ID        JOB #: 95-0024-01
  6           ID
              *DIAGRAM
  7           IT       5                    300
  8           IO       5       0
  9           IN      15
 10           JD    3.05    0.01
 11           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 12           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 13           PC    .962    .972    .983    .991   1.000
 14           JD    3.03    0.50
 15           JD    2.99    2.80
 16           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
 17           PC    .087    .100    .120    .163    .252    .451    .694    .837    .900    .938
 18           PC    .950    .963    .975    .988   1.000
 19           JD    2.81    16.0
 20           PC    .000    .015    .020    .030    .048    .063    .076    .090    .105    .119
 21           PC    .135    .152    .175    .222    .304    .472    .670    .796    .868    .912
 22           PC    .946    .960    .973    .987   1.000
 23           JD    2.47    90.0
 24           PC    .000    .021    .035    .051    .071    .087    .105    .125    .143    .160
 25           PC    .179    .201    .232    .281    .364    .500    .658    .773    .841    .888
 26           PC    .927    .945    .964    .982   1.000
 27           JD    1.74   500.0
 28           PC    .000    .024    .043    .059    .078    .098    .119    .141    .162    .186
 29           PC    .212    .239    .271    .321    .408    .515    .627    .735    .814    .864
 30           PC    .907    .930    .954    .977   1.000

 31           KK       A
 32           KM   SUB-BASIN A
 33           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 34           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .999
 35           KM     L =  .47  Kb = .029  Adj. Slope =   14.8
 36           BA    .095
 37           LG    .150    .250   4.300    .620  55.000
 38           UC    .308    .211
 39           UA       0       5      16      30      65      77      84      90      94      97
 40           UA     100

 41           KK       B
 42           KM   SUB-BASIN B
 43           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 44           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .996
 45           KM     L = 1.03  Kb = .026  Adj. Slope =   16.5
 46           BA    .294
 47           LG    .150    .250   5.670    .279  55.000
 48           UC    .446    .311
 49           UA       0       5      16      30      65      77      84      90      94      97
 50           UA     100
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  51          KK     D39        FLOW DIVERSION AT 39TH AVE
  52          DT    D39S
  53          DI       0      50     200     510
  54          DQ       0     167     167     167

  55          KK       C
  56          KM   SUB-BASIN C
  57          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
  58          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .997
  59          KM     L =  .93  Kb = .027  Adj. Slope =   22.8
  60          BA    .209
  61          LG    .145    .250   3.500    .392  57.630
  62          UC    .371    .282
  63          UA       0       5      16      30      65      77      84      90      94      97
  64          UA     100

  65          KK     R39
  66          KM        ROUTING SUBBASIN C ALONG 39TH AVE. TO CP 40
  67          RS      16    ELEV       0
  68          RC   0.025   0.016   0.025    1600  0.0042
  69          RX    69.7    69.8    69.9      70     130   130.1   130.2   130.3
  70          RY       5       2       1       0       0       1       2       5

  71          KK     C40        CONCENTRATION POINT 40 - COMBINGING B AND C
  72          HC       2

  73          KK     R40        ROUTE 40 TO C43
  74          RS      27    ELEV       0
  75          RC   0.050   0.035   0.050    2700   .0015
  76          RX     450     458     462     482     484     562     566     570
  77          RY       5       2       1       0       0       1       2       5

  78          KK       D
  79          KM   SUB-BASIN D
  80          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
  81          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .998
  82          KM     L =  .97  Kb = .027  Adj. Slope =   21.6
  83          BA    .168
  84          LG    .146    .250   3.500    .391  57.230
  85          UC    .392    .353
  86          UA       0       5      16      30      65      77      84      90      94      97
  87          UA     100

  88          KK     R43        ROUTE 43 - CARRYS SUBBASIN D TO C43
  89          RS      22    ELEV       0
  90          RC   0.020   0.016   0.020    2150  0.0037
  91          RX   439.7   439.8   439.9     440     560   560.1   560.2   560.3
  92          RY       5       2       1       0       0       1       2       5
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 93           KK       E
 94           KM   SUB-BASIN E
 95           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 96           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .997
 97           KM     L =  .78  Kb = .027  Adj. Slope =   11.4
 98           BA    .197
 99           LG    .132    .250   5.980    .274  64.010
100           UC    .438    .307
101           UA       0       5      16      30      65      77      84      90      94      97
102           UA     100

103           KK     C43        CONCENTRATION POINT 43
104           HC       3

105           KK     S43        STORAGE ROUTING
106           RS       1    FLOW      -1
107           SV       0      .1    .645    4.77    6.79   29.76
108           SE    1104    1105    1106  1106.8    1107    1108
109           SQ      25      25      25      25      52    1813

110           KK     D43        FLOW DIVERSION AT 43RD AVE
111           DT    D43S
112           DI      25      25      25      25      52    1813
113           DQ      25      25      25      25      25      25

114           KK     R44        ROUTE 44
115           RS      13    ELEV      -1
116           RC   0.025   0.016   0.025    1300  0.0027
117           RX   469.7   469.8   469.9     470     530   530.1   530.2   530.3
118           RY       5       2       1       0       0       1       2       5

119           KK       F
120           KM   SUB-BASIN F
121           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
122           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .993
123           KM     L = 1.18  Kb = .041  Adj. Slope =   20.7
124           BA    .500
125           LG    .111    .345   4.740    .234  11.550
126           UC    .654    .392
127           UA       0       5      16      30      65      77      84      90      94      97
128           UA     100

129           KK     R45        ROUTE 45
130           RS      22    ELEV       0
131           RC   0.020   0.016   0.020    2200  0.0039
132           RX    69.7    69.8    69.9      70     135   135.1   135.2   135.3
133           RY       5       2       1       0       0       1       2       5

134           KK     C45
135           HC       2
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 136          KK       G
 137          KM   SUB-BASIN G
 138          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 139          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .998
 140          KM     L =  .80  Kb = .028  Adj. Slope =    3.0
 141          BA    .121
 142          LG    .150    .250   3.550    .403  55.000
 143          UC    .829    .837
 144          UA       0       5      16      30      65      77      84      90      94      97
 145          UA     100

 146          KK     R47        ROUTE 47
 147          RS      74    ELEV       0
 148          RC   0.025   0.016   0.025    7350  0.0043
 149          RX    54.7    54.8    54.9      55     145   145.1   145.2   145.3
 150          RY       5       2       1       0       0       1       2       5

 151          KK       H
 152          KM   SUB-BASIN H
 153          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 154          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .997
 155          KM     L = 1.03  Kb = .027  Adj. Slope =    8.2
 156          BA    .217
 157          LG    .233    .250   4.740    .309  37.470
 158          UC   1.567   1.496
 159          UA       0       5      16      30      65      77      84      90      94      97
 160          UA     100

 161          KK     C47
 162          HC       3

 163          KK     S47        STORAGE ROUTING AT 47TH AVE
 164          RS       1    FLOW      -1
 165          SV       0    4.04    6.31   28.74
 166          SE    1104  1104.8    1105    1106
 167          SQ      70      80     147    1953

 168          KK     D47        DIVERSION AT 47TH AVE
 169          DT    D47S
 170          DI      70      80     147    1953
 171          DQ       0       0      22     825

 172          KK     R48        ROUTE 48
 173          RS      27    ELEV       0
 174          RC   0.030   0.016   0.030    2650   .0020
 175          RX    64.7    64.8    64.9      65     135   135.1   135.2   135.3
 176          RY       5       2       1       0       0       1       2       5

 177          KK       I
 178          KM   SUB-BASIN I
 179          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 180          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .994
 181          KM     L = 1.46  Kb = .025  Adj. Slope =   15.0
 182          BA    .445
```

SURROUNDING grade
1106.1

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 183          LG    .241    .254   3.810    .343  29.760
 184          UC    .600    .451
 185          UA       0       5      16      30      65      77      84      90      94      97
 186          UA     100

 187          KK     C49        CONCENTRATION POINT 49
 188          HC       2

 189          KK       J
 190          KM   SUB-BASIN J
 191          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 192          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .995
 193          KM     L = 1.60  Kb = .026  Adj. Slope =   12.3
 194          BA    .388
 195          LG    .200    .252   3.500    .378  44.870
 196          UC    .700    .622
 197          UA       0       5      16      30      65      77      84      90      94      97
 198          UA     100

 199          KK     C51
 200          HC       2

 201          KK     S51        STORAGE ROUTING
 202          RS       1    FLOW      -1
 203          SV       0    4.81   23.30   57.73
 204          SE    1103    1104    1105    1106
 205          SQ     697     701    1601    4467

 206          KK     D51        FLOW DIVERSION
 207          DT    D51S
 208          DI       0     697     701    1601    4467
 209          DQ       0     697     697    1264    2597

 210          KK   RTN47
 211          DR    D47S

 212          KK     C52
 213          HC       2

 214          KK       K
 215          KM   SUB-BASIN K
 216          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 217          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .997
 218          KM     L =  .75  Kb = .035  Adj. Slope =   12.3
 219          BA    .217
 220          LG    .153    .290   4.430    .304  41.200
 221          UC    .508    .331
 222          UA       0       5      16      30      65      77      84      90      94      97
 223          UA     100
```

51 - TOR
1104.2

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 224          KK     R55
 225          RS      26    ELEV       0
 226          RC   0.030   0.016   0.030    2600   .0028
 227          RX    49.7    49.8    49.9      50     150   150.1   150.2   150.3
 228          RY       3       2       1       0       0       1       2       3

 229          KK     S55        STORAGE ROUTING
 230          RS       1    FLOW      -1
 231          SV       0     .04     .08    5.56   12.08   20.80
 232          SE    1100  1100.7    1101    1102  1102.5    1103
 233          SQ      52      55      91    1153    2454    4425

 234          KK     D55        FLOW DIVERSION
 235          DT    D55S
 236          DI      52      55      91    1153    2454    4425
 237          DQ       0       0       0       0     134     505

 238          KK       L
 239          KM   SUB-BASIN L
 240          KM   6-HOUR RAINFALL, PATTERN NO. 1.05 WAS USED TO FIND TC & R FOR THIS BASIN
 241          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .993
 242          KM     L = 1.98  Kb = .024  Adj. Slope =   14.0
 243          BA    .541
 244          LG    .217    .250   5.360    .285  45.930
 245          UC    .729    .640
 246          UA       0       5      16      30      65      77      84      90      94      97
 247          UA     100

 248          KK     R59
 249          RS      26    ELEV       0
 250          RC   0.025   0.016   0.025    2600   .0021
 251          RX    89.7    89.8    89.9      90     310   310.1   310.2   310.3
 252          RY       5       2       1       0       0       1       2       5

 253          KK       M
 254          KM   SUB-BASIN M
 255          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 256          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .998
 257          KM     L =  .64  Kb = .027  Adj. Slope =   15.2
 258          BA    .172
 259          LG    .235    .150   8.050    .117  34.940
 260          UC    .342    .215
 261          UA       0       5      16      30      65      77      84      90      94      97
 262          UA     100

 263          KK     C59        CONCENTRATION POINT 59
 264          HC       3

 265          KK     S59        STORAGE ROUTING
 266          RS       1    FLOW      -1
 267          SV       0    2.31    9.93   15.88   46.45
 268          SE    1099    1100  1100.8    1101    1102
 269          SQ     645     645     692     803    3114
```

TOR 1094'

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 270          KK     D59        FLOW DIVERSION
 271          DT    D59S
 272          DI       0     645     645     692     803    3114
 273          DQ       0     697     697     697     697    1507

 274          KK       N
 275          KM   SUB-BASIN N
 276          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 277          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .995
 278          KM     L = 1.12  Kb = .025  Adj. Slope =   12.2
 279          BA    .383
 280          LG    .150    .250   4.430    .341  55.000
 281          UC    .521    .340
 282          UA       0       5      16      30      65      77      84      90      94      97
 283          UA     100

 284          KK     RCM        ROUTING N ALONG CAMELBACK ROAD
 285          RS      26    ELEV       0
 286          RC   0.025   0.016   0.025    2600  0.0025
 287          RX    44.7    44.8    44.9      45     155   155.1   155.2   155.3
 288          RY       5       2       1       0       0       1       2       5

 289          KK       O
 290          KM   SUB-BASIN O
 291          KM   6-HOUR RAINFALL, PATTERN NO. 1.16 WAS USED TO FIND TC & R FOR THIS BASIN
 292          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .991
 293          KM     L = 1.29  Kb = .030  Adj. Slope =   15.7
 294          BA    .658
 295          LG    .202    .225   4.740    .329  49.420
 296          UC    .613    .335
 297          UA       0       5      16      30      65      77      84      90      94      97
 298          UA     100

 299          KK     CCM
 300          HC       2

 301          KK     RCP        ROUTING ALONG CAMPBELL
 302          RS      52    ELEV       0
 303          RC   0.025   0.016   0.025    5200  0.0026
 304          RX   159.7   159.8   159.9     160     340   340.1   340.2   340.3
 305          RY       5       2       1       0       0       1       2       5

 306          KK       P
 307          KM   SUB-BASIN P
 308          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 309          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .995
 310          KM     L = 1.37  Kb = .025  Adj. Slope =   17.9
 311          BA    .397
 312          LG    .250    .250   5.050    .288  30.000
 313          UC    .529    .398
 314          UA       0       5      16      30      65      77      84      90      94      97
 315          UA     100
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 316          KK     CCP
 317          HC       2

 318          KK     RGC        ROUTE THROUGH GOLF COURSE
 319          RS      46    ELEV       0
 320          RC   0.035   0.035   0.035    4600  0.0027
 321          RX    39.7    39.8    39.9      40     160   160.1   160.2   160.3
 322          RY       5       2       1       0       0       1       2       5

 323          KK       Q
 324          KM   SUB-BASIN Q
 325          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 326          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .994
 327          KM     L = 1.38  Kb = .050  Adj. Slope =   15.3
 328          BA    .475
 329          LG    .230    .250   6.290    .259  17.750
 330          UC   1.004    .733
 331          UA       0       5      16      30      65      77      84      90      94      97
 332          UA     100

 333          KK     C63        CONCENTRATION POINT AT GOLF COURSE
 334          HC       2

 335          KK     SGC        STORAGE ROUTING IN GOLF COURSE
 336          RS       1    FLOW      -1
 337          SV       0    1.93    5.25    9.27   14.63   20.86   28.00      32
 338          SE    1100    1101    1102    1103    1104    1105    1106  1106.5
 339          SQ       0       0       0       0       0     477    2326    3000

 340          KK     R63
 341          RS      15    ELEV       0
 342          RC   0.025   0.016   0.025    1450  0.0020
 343          RX    44.7    44.8    44.9      45     155   155.1   155.2   155.3
 344          RY       5       2       1       0       0       1       2       5

 345          KK       R
 346          KM   SUB-BASIN R
 347          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 348          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .998
 349          KM     L =  .74  Kb = .027  Adj. Slope =   11.4
 350          BA    .179
 351          LG    .250    .150   7.780    .130  30.000
 352          UC    .425    .301
 353          UA       0       5      16      30      65      77      84      90      94      97
 354          UA     100

 355          KK     C64
 356          HC       3
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 357          KK     S64        STORAGE ROUTING AT 64TH AVE
 358          RS       1    FLOW      -1
 359          SV       0    1.27    3.89   10.16   34.71
 360          SE      97    97.2    97.5      98     999
 361          SQ    1324    1678    2282    3778    8709

 362          KK     D64        FLOW DIVERSION
 363          DT    D64S
 364          DI       0    1324    1678    2282    3778    8709
 365          DQ       0    1220    1573    2154    3248    5846

 366          KK       S
 367          KM   SUB-BASIN S
 368          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 369          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .996
 370          KM     L =  .70  Kb = .026  Adj. Slope =   20.6
 371          BA    .300
 372          LG    .150    .250   4.430    .341  55.000
 373          UC    .317    .155
 374          UA       0       5      16      30      65      77      84      90      94      97
 375          UA     100

 376          KK     R57        ROUTE NEAR 57TH AVE
 377          RS      52    ELEV       0
 378          RC   0.025   0.016   0.025    5200  0.0028
 379          RX   114.7   114.8   114.9     115     285   285.1   285.2   285.3
 380          RY       5       2       1       0       0       1       2       5

 381          KK       T
 382          KM   SUB-BASIN T
 383          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 384          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .995
 385          KM     L =  .97  Kb = .025  Adj. Slope =   15.3
 386          BA    .361
 387          LG    .157    .250   4.430    .342  56.390
 388          UC    .429    .252
 389          UA       0       5      16      30      65      77      84      90      94      97
 390          UA     100

 391          KK     C58
 392          HC       2

 393          KK     RMO        ROUTE NEAR MISSOURI
 394          RS      52    ELEV       0
 395          RC   0.020   0.016   0.020    5200  0.0028
 396          RX    49.7    49.8    49.9      50     350   350.1   350.2   350.3
 397          RY       5       2       1       0       0       1       2       5

 398          KK       U
 399          KM   SUB-BASIN U
 400          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 401          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .998
 402          KM     L =  .96  Kb = .028  Adj. Slope =   15.2
 403          BA    .130
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CI = ~~1089~~ 109.

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 404          LG    .198    .250   4.430    .332  51.460
 405          UC    .463    .485
 406          UA       0       5      16      30      65      77      84      90      94      97
 407          UA     100

 408          KK     RBH        ROUTE ALONG BETHANY HOME
 409          RS      13    ELEV       0
 410          RC   0.020   0.016   0.020    1330  0.0035
 411          RX    59.7    59.8    59.9      60     140   140.1   140.2   140.3
 412          RY       5       2       1       0       0       1       2       5

 413          KK       V
 414          KM   SUB-BASIN V
 415          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 416          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .998
 417          KM     L =  .71  Kb = .027  Adj. Slope =   12.9
 418          BA    .172
 419          LG    .208    .150   7.500    .152  48.050
 420          UC    .392    .272
 421          UA       0       5      16      30      65      77      84      90      94      97
 422          UA     100

 423          KK     CBH
 424          HC       2

 425          KK     R61        ROUTE NEAR 61ST AVE
 426          RS      42    ELEV       0
 427          RC   0.025   0.016   0.025    4200  0.0045
 428          RX    34.7    34.8    34.9      35     360   360.1   360.2   360.3
 429          RY       5       2       1       0       0       1       2       5

 430          KK       W
 431          KM   SUB-BASIN W
 432          KM   6-HOUR RAINFALL, PATTERN NO. 1.16 WAS USED TO FIND TC & R FOR THIS BASIN
 433          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .991
 434          KM     L = 1.47  Kb = .024  Adj. Slope =   16.1
 435          BA    .656
 436          LG    .241    .150   8.280    .102  36.060
 437          UC    .546    .328
 438          UA       0       5      16      30      65      77      84      90      94      97
 439          UA     100

 440          KK     CCK
 441          HC       3

 442          KK     RCK        ROUTE NEAR CAMELBACK ROAD
 443          RS      63    ELEV       0
 444          RC   0.025   0.016   0.025    6300  0.0023
 445          RX    49.7    49.8    49.9      50     350   350.1   350.2   350.3
 446          RY       5       2       1       0       0       1       2       5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 447          KK       X
 448          KM   SUB-BASIN X
 449          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 450          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .994
 451          KM     L = 1.17  Kb = .025  Adj. Slope =   12.7
 452          BA    .469
 453          LG    .246    .150   7.780    .130  34.310
 454          UC    .521    .314
 455          UA       0       5      16      30      65      77      84      90      94      97
 456          UA     100

 457          KK     C67
 458          HC       2
 459          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

 31          A
             .
             .
 41          .          B
             .          .
             .          .
 52          .          .------->    D39S
 51          .        D39
             .          .
             .          .
 55          .          .           C
             .          .           V
             .          .           V
 65          .          .         R39
             .          .           .
             .          .           .
 71          .        C40............
             .          V
             .          V
 73          .        R40
             .          .
             .          .
 78          .          .           D
             .          .           V
             .          .           V
 88          .          .         R43
             .          .           .
             .          .           .
 93          .          .           .           E
             .          .           .           .
             .          .           .           .
103          .        C43........................
             .          V
             .          V
105          .        S43
             .          .
             .          .
111          .          .------->    D43S
110          .        D43
             .          V
             .          V
114          .        R44
             .          .
             .          .
119          .          .           F
             .          .           V
             .          .           V
129          .          .         R45
             .          .           .
             .          .           .
134          .        C45............
             .          .
             .          .
136          .          .           G
             .          .           V
             .          .           V
146          .          .         R47
             .          .           .
             .          .           .
151          .          .           .           H
             .          .           .           .
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.          .          .          .
161        .        C47.......................
           .          V
           .          V
163        .        S47
           .          .
           .          .
169        .          .-------->    D47S
168        .        D47
           .          V
           .          V
172        .        R48
           .          .
           .          .
177        .          .          I
           .          .          .
           .          .          .
187        .        C49............
           .          .
           .          .
189        .          .          J
           .          .          .
           .          .          .
199        .        C51............
           .          V
           .          V
201        .        S51
           .          .
           .          .
207        .          .-------->    D51S
206        .        D51
           .          .
           .          .
211        .          .          .<-------    D47S
210        .          .      RTN47
           .          .          .
           .          .          .
212        .        C52............
           .          .
           .          .
214        .          .          K
           .          .          V
           .          .          V
224        .          .        R55
           .          .          V
           .          .          V
229        .          .        S55
           .          .          .
           .          .          .
235        .          .          .-------->    D55S
234        .          .        D55
           .          .          .
           .          .          .
238        .          .          .          L
           .          .          .          V
           .          .          .          V
248        .          .          .        R59
           .          .          .          .
           .          .          .          .
253        .          .          .          .          M
           .          .          .          .          .
           .          .          .          .          .
263        .          .        C59........................
           .          .          V
           .          .          V
265        .          .        S59
           .          .          .
           .          .          .
271        .          .          .-------->    D59S
```

```
270          .          .          D59
             .          .           .
             .          .           .
274          .          .           .          N
             .          .           .          V
             .          .           .          V
284          .          .           .         RCM
             .          .           .           .
             .          .           .           .
289          .          .           .           .          O
             .          .           .           .          .
             .          .           .           .          .
299          .          .           .         CCM............
             .          .           .          V
             .          .           .          V
301          .          .           .         RCP
             .          .           .           .
             .          .           .           .
306          .          .           .           .          P
             .          .           .           .          .
             .          .           .           .          .
316          .          .           .         CCP............
             .          .           .          V
             .          .           .          V
318          .          .           .         RGC
             .          .           .           .
             .          .           .           .
323          .          .           .           .          Q
             .          .           .           .          .
             .          .           .           .          .
333          .          .           .         C63............
             .          .           .          V
             .          .           .          V
335          .          .           .         SGC
             .          .           .          V
             .          .           .          V
340          .          .           .         R63
             .          .           .           .
             .          .           .           .
345          .          .           .           .          R
             .          .           .           .          .
             .          .           .           .          .
355          .          .          C64.........................
             .          .           V
             .          .           V
357          .          .          S64
             .          .           .
             .          .           .
363          .          .           .-------->    D64S
362          .          .          D64
             .          .           .
             .          .           .
366          .          .           .          S
             .          .           .          V
             .          .           .          V
376          .          .           .         R57
             .          .           .           .
             .          .           .           .
381          .          .           .           .          T
             .          .           .           .          .
             .          .           .           .          .
391          .          .           .         C58............
             .          .           .          V
             .          .           .          V
393          .          .           .         RMO
             .          .           .           .
             .          .           .           .
398          .          .           .           .          U
             .          .           .           .          V
```

```
                .         .         .         .         V
408             .         .         .         .       RBH
                .         .         .         .         .
                .         .         .         .         .
413             .         .         .         .         .         V
                .         .         .         .         .         .
                .         .         .         .         .         .
423             .         .         .         .       CBH...........
                .         .         .         .         V
                .         .         .         .         V
425             .         .         .         .       R61
                .         .         .         .         .
                .         .         .         .         .
430             .         .         .         .         .         W
                .         .         .         .         .         .
                .         .         .         .         .         .
440             .         .         .       CCK.......................
                .         .         .         V
                .         .         .         V
442             .         .         .       RCK
                .         .         .         .
                .         .         .         .
447             .         .         .         .         X
                .         .         .         .         .
                .         .         .         .         .
457             .         .         .       C67...........
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
                                        *
   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*            SEPTEMBER 1990              *
*             VERSION 4.0                *
                                        *
  RUN DATE  06/20/1995  TIME  14:04:20  *
*                                       *
*****************************************
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****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
                    MARYVALE FLOOD MITIGATION STUDY
                    COE & VAN LOO CONSULTING, INC.
                    100-YEAR, 6-HOUR STORM
                    FILE: H1MV1006          DATE: 6/20/95
                    JOB #: 95-0024-01


  8 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2   0  ENDING DATE
                   NDTIME       0055  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT

 10 JD        INDEX STORM NO. 1
                    STRM       3.05  PRECIPITATION DEPTH
                    TRDA        .01  TRANSPOSITION DRAINAGE AREA

 11 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                  .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                  .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00

 14 JD        INDEX STORM NO. 2
                    STRM       3.03  PRECIPITATION DEPTH
                    TRDA        .50  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```

```
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00

15 JD         INDEX STORM NO. 3
                STRM        2.99  PRECIPITATION DEPTH
                TRDA        2.80  TRANSPOSITION DRAINAGE AREA

16 PI           PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00

19 JD         INDEX STORM NO. 4
                STRM        2.81  PRECIPITATION DEPTH
                TRDA       16.00  TRANSPOSITION DRAINAGE AREA

20 PI           PRECIPITATION PATTERN
                .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00

23 JD         INDEX STORM NO. 5
                STRM        2.47  PRECIPITATION DEPTH
                TRDA       90.00  TRANSPOSITION DRAINAGE AREA

24 PI           PRECIPITATION PATTERN
                .01       .01       .01       .00       .00       .00       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                .03       .03       .05       .05       .05       .05       .05       .05       .04       .04
                .04       .02       .02       .02       .02       .02       .02       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01

27 JD         INDEX STORM NO. 6
                STRM        1.74  PRECIPITATION DEPTH
                TRDA      500.00  TRANSPOSITION DRAINAGE AREA

28 PI           PRECIPITATION PATTERN
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                .03       .03       .04       .04       .04       .04       .04       .04       .04       .04
                .04       .03       .03       .03       .02       .02       .02       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	A	198.	4.08	22.	6.	5.	.09		
HYDROGRAPH AT	B	520.	4.17	74.	19.	18.	.29		
DIVERSION TO	D39S	167.	3.92	47.	12.	11.	.29		
HYDROGRAPH AT	D39	353.	4.17	27.	7.	6.	.29		
HYDROGRAPH AT	C	396.	4.17	53.	13.	13.	.21		
ROUTED TO	R39	402.	4.17	53.	13.	13.	.21		
2 COMBINED AT	C40	753.	4.17	79.	20.	19.	.50		
ROUTED TO	R40	795.	4.33	79.	20.	19.	.50		
HYDROGRAPH AT	D	287.	4.17	42.	11.	10.	.17		
ROUTED TO	R43	298.	4.25	42.	11.	10.	.17		
HYDROGRAPH AT	E	360.	4.17	52.	13.	13.	.20		
3 COMBINED AT	C43	1194.	4.33	167.	42.	41.	.87		
ROUTED TO	S43	972.	4.50	158.	58.	57.	.87		
DIVERSION TO	D43S	25.	.08	25.	25.	25.	.87		
HYDROGRAPH AT	D43	947.	4.50	133.	33.	32.	.87		
ROUTED TO	R44	948.	4.50	133.	33.	32.	.87		
HYDROGRAPH AT	F	650.	4.25	93.	23.	22.	.50		
ROUTED TO	R45	646.	4.33	93.	23.	22.	.50		
2 COMBINED AT	C45	1341.	4.50	214.	54.	52.	1.37		
HYDROGRAPH AT	G	111.	4.42	29.	8.	7.	.12		
ROUTED TO	R47	130.	4.83	29.	8.	7.	.12		
HYDROGRAPH AT	H	110.	4.83	45.	12.	12.	.22		
3 COMBINED AT	C47	1381.	4.50	278.	71.	68.	1.71		
ROUTED TO	S47	1269.	4.67	290.	125.	123.	1.71		
DIVERSION TO	D47S	521.	4.67	91.	23.	22.	1.71		
HYDROGRAPH AT	D47	748.	4.67	199.	102.	101.	1.71		
ROUTED TO ?	R48	756.	4.75	199.	102.	100.	1.71		
HYDROGRAPH AT	I	569.	4.25	92.	23.	22.	.44		
2 COMBINED AT	C49	1003.	4.67	278.	123.	120.	2.15		
HYDROGRAPH AT	J	421.	4.33	89.	23.	22.	.39		

2 COMBINED AT	C51	1264.	4.67	357.	143.	139.	2.54
ROUTED TO	S51	1094.	4.92	740.	708.	706.	2.54
DIVERSION TO	D51S	944.	4.92	723.	704.	702.	2.54
HYDROGRAPH AT	D51	149.	4.92	16.	4.	4.	2.54
HYDROGRAPH AT	RTN47	521.	4.67	91.	23.	22.	1.71
2 COMBINED AT	C52	612.	4.83	104.	26.	25.	2.54
HYDROGRAPH AT	K	346.	4.17	49.	12.	12.	.22
ROUTED TO	R55	348.	4.33	49.	12.	12.	.22
ROUTED TO	S55	334.	4.42	81.	59.	59.	.22
DIVERSION TO	D55S	0.	.08	0.	0.	0.	.22
HYDROGRAPH AT	D55	334.	4.42	81.	59.	59.	.22
HYDROGRAPH AT	L	571.	4.33	125.	32.	31.	.54
ROUTED TO	R59	570.	4.42	125.	32.	31.	.54
HYDROGRAPH AT	M	379.	4.08	42.	11.	10.	.17
3 COMBINED AT	C59	995.	4.42	241.	100.	98.	.93
ROUTED TO	S59	695.	4.75	649.	646.	645.	.93
DIVERSION TO	D59S	681.	4.75	649.	646.	645.	.93
HYDROGRAPH AT	D59	14.	4.75	0.	0.	0.	.93
HYDROGRAPH AT	N	622.	4.17	95.	24.	23.	.38
ROUTED TO	RCM	630.	4.33	95.	24.	23.	.38
HYDROGRAPH AT	O	988.	4.25	156.	39.	38.	.66
2 COMBINED AT	CCM	1443.	4.25	245.	62.	60.	1.04
ROUTED TO	RCP	1453.	4.42	245.	62.	60.	1.04
HYDROGRAPH AT	P	554.	4.25	83.	21.	20.	.40
2 COMBINED AT	CCP	1758.	4.42	319.	80.	77.	1.44
ROUTED TO	RGC	1743.	4.58	318.	80.	77.	1.44
HYDROGRAPH AT	Q	381.	4.42	88.	22.	22.	.47
2 COMBINED AT	C63	1950.	4.58	392.	99.	96.	1.91
ROUTED TO	SGC	1930.	4.67	392.	99.	96.	1.91
ROUTED TO	R63	1924.	4.75	392.	99.	96.	1.91
HYDROGRAPH AT	R	328.	4.17	42.	11.	10.	.18
3 COMBINED AT	C64	1924.	4.75	425.	108.	104.	3.02
ROUTED TO	S64	1844.	4.75	1353.	1331.	1329.	3.02
DIVERSION TO	D64S	1732.	4.75	1249.	1227.	1225.	3.02
HYDROGRAPH AT	D64	112.	4.75	104.	104.	104.	3.02

HYDROGRAPH AT	S	736.	4.08	75.	19.	18.	.30
ROUTED TO	R57	711.	4.25	75.	19.	18.	.30
HYDROGRAPH AT	T	699.	4.17	91.	23.	22.	.36
2 COMBINED AT	C58	1257.	4.25	163.	41.	40.	.66
ROUTED TO	RMO	1274.	4.50	163.	41.	40.	.66
HYDROGRAPH AT	U	177.	4.25	32.	8.	8.	.13
ROUTED TO	RBH	185.	4.25	32.	8.	8.	.13
HYDROGRAPH AT	V	339.	4.17	44.	11.	11.	.17
2 COMBINED AT	CBH	497.	4.17	75.	19.	18.	.30
ROUTED TO	R61	540.	4.33	75.	19.	18.	.30
HYDROGRAPH AT	W	1071.	4.25	161.	40.	39.	.66
3 COMBINED AT	CCK	2169.	4.42	386.	98.	94.	1.62
ROUTED TO	RCK	2226.	4.67	386.	98.	94.	1.62
HYDROGRAPH AT	X	809.	4.17	113.	28.	27.	.47
2 COMBINED AT	C67	2472.	4.67	488.	124.	119.	2.09

* NORMAL END OF HEC-1 ***

TABLE 1

*** O U T P U T D A T A ***

REVISED JUNE 1988 TO UPDATE COMPUTATION OF SHORT-DURATION VALUES

PRECIPITATION FREQUENCY VALUES FOR MARYVALE MITIGATION
PRIMARY ZONE NUMBER= 7
SHORT-DURATION ZONE NUMBER= 8

OPTION NUMBER 2 --- INPUT OF 12 PRECIP VALUES
LATITUDE 33.50N LONGITUDE 112.20W

POINT VALUES

RETURN PERIOD

DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	
5-MIN	.33	.42	.49	.58	.65	.72	.89	5-MIN
10-MIN	.49	.64	.74	.88	1.00	1.11	1.36	10-MIN
15-MIN	.60	.80	.93	1.12	1.27	1.42	1.76	15-MIN
30-MIN	.79	1.07	1.26	1.52	1.72	1.92	2.39	30-MIN
1-HR	.97	1.32	1.56	1.89	2.15	2.40	3.00	1-HR
2-HR	1.03	1.43	1.69	2.06	2.34	2.62	3.28	2-HR
3-HR	1.08	1.50	1.78	2.17	2.47	2.77	3.46	3-HR
6-HR	1.17	1.64	1.95	2.38	2.72	3.05	3.82	6-HR
12-HR	1.24	1.77	2.13	2.61	2.99	3.36	4.22	12-HR
24-HR	1.32	1.91	2.30	2.84	3.26	3.67	4.63	24-HR

* IF YOUR SITE IS IN ARIZONA OR NEW MEXICO, PLEASE CONSULT THE FOLLOWING PAPER FOR REVISED DEPTH-AREA VALUES:
DEPTH-AREA RATIOS IN THE SEMI-ARID SOUTHWEST UNITED STATES
NOAA TECHNICAL MEMORANDUM NWS HYDRO-40
ZEHR AND MYERS
AUGUST 1984

INPUT DATA

ROJECT NAME=MARYVALE MITIGATION
ONE= 7 SHORT-DURATION ZONE= 8
LATITUDE= 33.50 LONGITUDE= 112.20 ELEVATION= 0
12-VALUE PRECIPITATION OPTION
PRECIPITATION VALUE:

1.15	1.65
1.95	2.37
2.78	3.00
1.35	1.92
2.29	2.79
3.19	3.77

* * * * E N D O F R U N * * * *

TABLE 2
CHANNEL ROUTING DATA

ROUTE NUMBER	MANNINGS n	NUMBER OF STREETS	FLOW WIDTH (FT)	TOP ELEV.	BOTTOM ELEV.	LENGTH (FT)	SLOPE (%)
39	0.020	1	60	14.0	7.2	1600	0.43
40	0.050	N/A	20	7.2	6.8	2700	0.015
43	0.020	1	120	15.0	7.0	2150	0.37
44	0.025	1	60	7.0	4.5	1300	0.19
45	0.020	1	65	13.0	4.5	2200	0.39
47	0.025	1	90	36.3	4.8	7350	0.43
48	0.030	1	70	4.8	4.0	2650	0.030
55	0.030	2	100	2.0	0.5	2600	0.058
59	0.025	3	220	6.0	0.5	2600	0.21
CM	0.025	1	110	33.0	26.5	2600	0.25
CP	0.025	4	280	26.6	12.9	5200	0.26
GC	0.035	N/A	120	12.9	0.4	4600	0.27
63	0.025	2	110	100.4	97.5	1450	0.20
57	0.025	3	170	43.2	28.4	5200	0.28
MO	0.020	5	300	28.4	13.8	5200	0.28
BH	0.020	1	80	37.5	32.8	1330	0.35
61	0.025	6	325	32.8	13.8	4200	0.45
CK	0.025	5	300	113.8	99.0	6300	0.23

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: 39th Ave

Prepared by: PH
Date: 6/19/95

Contour Elev. (ft) SE	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft) SV	Storm Drain			Road Weir	Canal Weir	Total	Diversion South
					Size (")	Storm Slope	Outflow (cfs)	Outflow (cfs)	Outflow (cfs)	Outflow (cfs) SQ, DI	Outflow (cfs) DQ
110'	.23				78	0.02%	167				167
											167
1109	14.75										

Remarks:

72" crosses Grand Ave. - Slope = 0.020 FT/FT, Q = 697 cfs

78" capacity = 864 cfs Excess capacity = 167 cfs

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: 43rd Ave

Prepared by: PH
Date: 6/16/95

Contour Elev. (ft) SE	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft) SV	Storm Drain			Road Weir	Canal Weir	Total	Diversion South
					Size (")	Storm Slope	Outflow (cfs)	Outflow (cfs)	Outflow (cfs)	Outflow (cfs) SQ, DI	Outflow (cfs) DQ
1104	0				63	.002%	25	0	0	25	25
1105	.05	.025	.025	0				0	0	25	25
1106	1.19	.62	.62	.645				0	0	25	25
1106.8	9.11*	5.15	4.12	4.77				0	0	25	25
1107	11.09	10.10	2.02	6.79				27	0	52	25
1107.2								149	0	174	25
1107.4								394	0	419	25
1108	34.84	22.97	22.97	29.76				1788	0	1813	25

Remarks:

* By linear interpolation.

60" crosses Grand Ave. - Slope = 0.002 FT/FT , Q = 125 cfs

63" capacity = 150 cfs Excess capacity = 25 cfs

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: 47TH Ave.

Prepared by: PH
Date: 6/19/95

Contour Elev. (ft) SE	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft) SV	Storm Drain			Road Weir	Canal Weir	Total	Diversion South
					Size (")	Storm Slope	Outflow (cfs)	Outflow (cfs)	Outflow (cfs)	Outflow (cfs) SQ, DI	Outflow (cfs) DQ
1104	0	0	0	0	48	0.002%	70	0	0	70	0
1104.8	10.10*	5.05	4.04	4.04	48	0.002%	70	10	0	80	0
1105	12.62	11.36	2.27	6.31	48	0.002%	70	55	22	147	22
1106	32.24	22.43	22.43	28.74	48	0.002%	70	1058	825	1953	825

Remarks:

* Linear interpolation

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: 51ST Ave.

Prepared by: PH
Date: 6/19/95

(Potential)

Contour Elev. (ft) SE	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft) SV	Storm Drain			Road Weir	Canal Weir	Total	Diversion South
					Size (")	Storm Slope	Outflow (cfs)	Outflow (cfs)	Outflow (cfs)	Outflow (cfs) SQ, DI	Outflow (cfs) DQ
1103	0.18				72	0.02%	697	0	0	697	697
1104	9.44	4.81	4.81	4.81	72	0.02%	697	4	0	701	697
1105	27.54	18.49	18.49	23.30	72	0.02%	697	337	567	1601	1264
1106	41.31	34.43	34.43	57.73	72	0.02%	697	1870	1900	4467	2597

Remarks:

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: 55TH Ave.

Prepared by: PH
Date: 6/19/95

Contour Elev. (ft) SE	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft) SV	Storm Drain			Road Weir	Canal Weir	Total	Diversion South
					Size (")	Storm Slope	Outflow (cfs)	Outflow (cfs)	Outflow (cfs)	Outflow (cfs) SQ, DI	Outflow (cfs) DQ
1100	0				42	0.002%	52	0	0	52	0
1100.7	0.10 *	0.05	0.04	0.04	42	0.002%	52	3	0	55	0
1101	0.14	0.12	0.04	0.08	42	0.002%	52	39	0	91	0
1102	10.82	5.48	5.48	5.56	42	0.002%	52	1101	0	1153	0
1102.5	15.23 *	13.03	6.52	12.08	42	0.002%	52	2268	134	2454	134
1103	19.64	17.44	8.72	20.80	42	0.002%	52	3868	505	4425	505

Remarks:

* Linear interpolation

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: 59TH Ave.

Prepared by: PH
Date: 6/19/95

Contour Elev. (ft) SE	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft) SV	Storm Drain			Road Weir	Canal Weir	Total	Diversion South
					Size (")	Storm Slope	Outflow (cfs)	Outflow (cfs)	Outflow (cfs)	Outflow (cfs) SQ, DI	Outflow (cfs) DQ
99	0				72	0.02%	645**	0	0	645	697
1100	4.62	2.31	2.31	2.31	72	0.02%	645	0	0	645	697
1100.8	17.14*	10.88	7.62	9.93	72	0.02%	645	47	0	692	697
1101	22.50	19.82	5.95	15.88	72	0.02%	645	158	0	803	697
1102	38.63	30.57	30.57	46.45	72	0.02%	645	1659	810	3114	1507

Remarks:

* Linear interpolation

** The flow capacity of the 72" pipe exiting at 59TH Ave. is 697 cfs. The 42" pipe from the west has a flow capacity of 52 cfs. The flow diversion is then 645 cfs.

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: Indian School & Grand Canal

Prepared by: PH
Date: 6/19/95

Contour Elev. (ft) SE	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft) SV	Storm Drain			Road Weir	Canal Weir	Total	Diversion South
					Size (")	Storm Slope	Outflow (cfs)	Outflow (cfs)	Outflow (cfs)	Outflow (cfs) SQ, DI	Outflow (cfs) DQ
97	5.38				42	0.002%	52**	0	1220	1324	1220
97.2	7.29*	6.34	1.27	1.27	42	0.002%	52**	1	1573	1678	1573
97.5	10.15*	8.72	2.62	3.89	42	0.002%	52**	24	2154	2282	2154
98	14.92	12.54	6.27	10.16	42	0.002%	52**	426	3248	3778	3248
99	34.17	24.55	24.55	34.71	42	0.002%	52**	2759	5846	8709	5846

Remarks:

* Linear interpolation

** There are two 42" storm drains exiting this subbasin, one to the west and the other to the east and then south. The flow capacity of each is 52 cfs.

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: Southwest Pond

Prepared by: PE
Date: 6-14-95

Contour Elev. (ft)	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft)	Storm Drain			Road Weir			Canal Weir		
					Size (")	Storm Slope	Outflow (cfs)	Length (ft)	Depth (ft)	Outflow (cfs)	Length (ft)	Depth (ft)	Outflow (cfs)
1100	1.85			0	–	–	–			0	–	–	–
1101	2.00	1.93	1.93	1.93						0			
1102	2.34	2.17	2.17	4.10						0			
1103	3.16	2.75	2.75	6.85						0			
1103.5	3.91	3.54	1.77	8.62						0			
1104	4.65	4.28	2.14	10.76						0			
1105				20.86				150	1	405			
1106				28				165	2	1260			

Remarks:

$Q = CLH^{3/2}$, $C = 2.7$

MARYVALE FLOODING MITIGATION PROJECT
STORAGE VOLUME COMPUTATION

FCD 93-34
Location: Northeast Pond

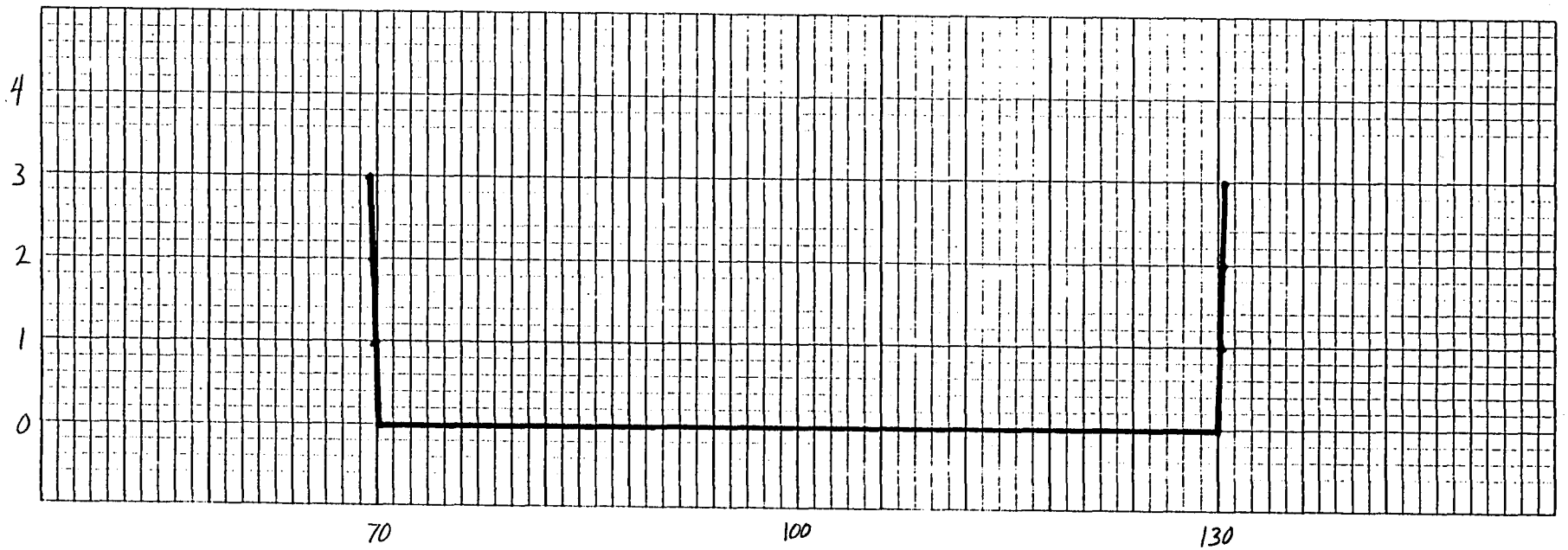
Prepared by: PE
Date: 6-14-95

Contour Elev. (ft)	Contour Area (Ac)	Average Area (Ac)	Inc. Vol (Acre-ft)	Cum Vol (Acre-ft)	Storm Drain			Road Weir			Canal Weir		
					Size (")	Storm Slope	Outflow (cfs)	Length (ft)	Depth (ft)	Outflow (cfs)	Length (ft)	Depth (ft)	Outflow (cfs)
					–	–	–				–	–	–
1101	1.09				–	–	–			0	–	–	–
1102	1.20	1.15	1.15	1.15	–	–	–			0	–	–	–
1103	1.33	1.27	1.27	2.42	–	–	–			0	–	–	–
1104	1.57	1.45	1.45	3.87	–	–	–			0	–	–	–
1104.5	1.98	1.78	.89	4.76	–	–	–			0	–	–	–
1105	2.39	2.19	1.10	5.86	–	–	–	75	0.5	72	–	–	–
1106					–	–	–	215	1.5	1066	–	–	–

Remarks:

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R39



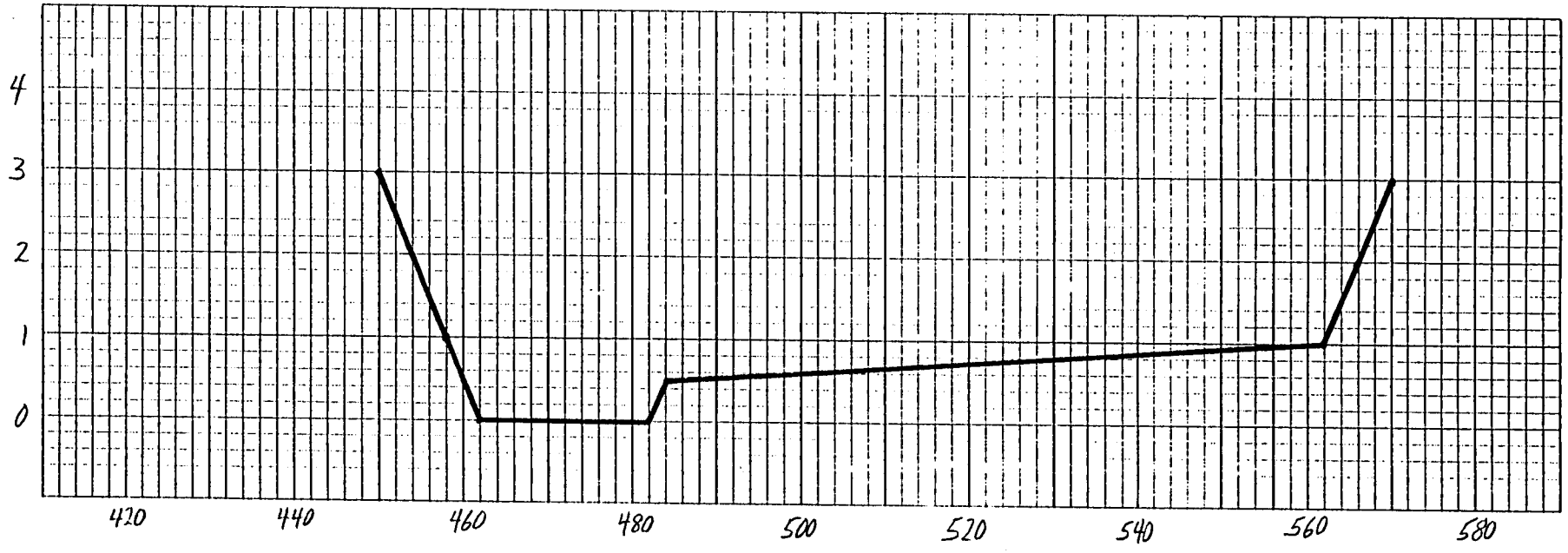
RS	16	Elev.	0					
RC	.025	0.016	.025	1600	.0042			
RX	69.7	69.8	69.9	70.0	130.0	130.1	130.2	130.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

1 street, 60' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R 40



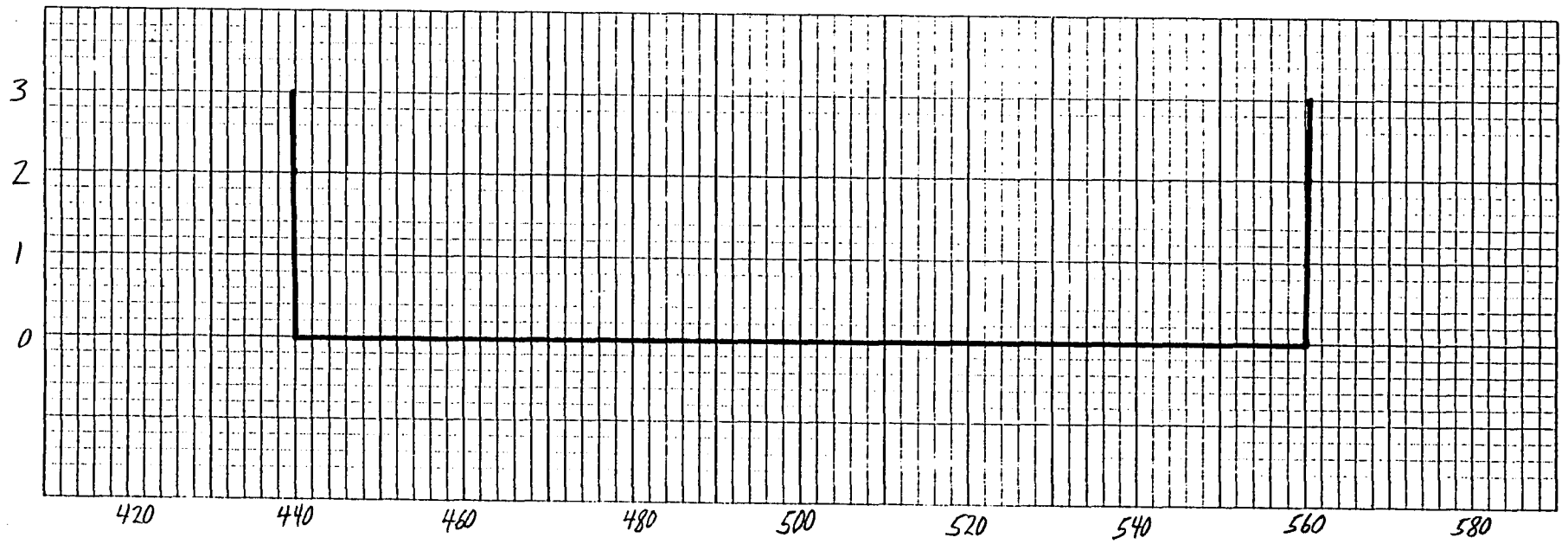
RS	27	Elev	0					
RC	0.050	0.035	0.050	2700	.0001			
RX	450	458	462	482	484	562	566	570
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

Channel adjacent to canal

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R43



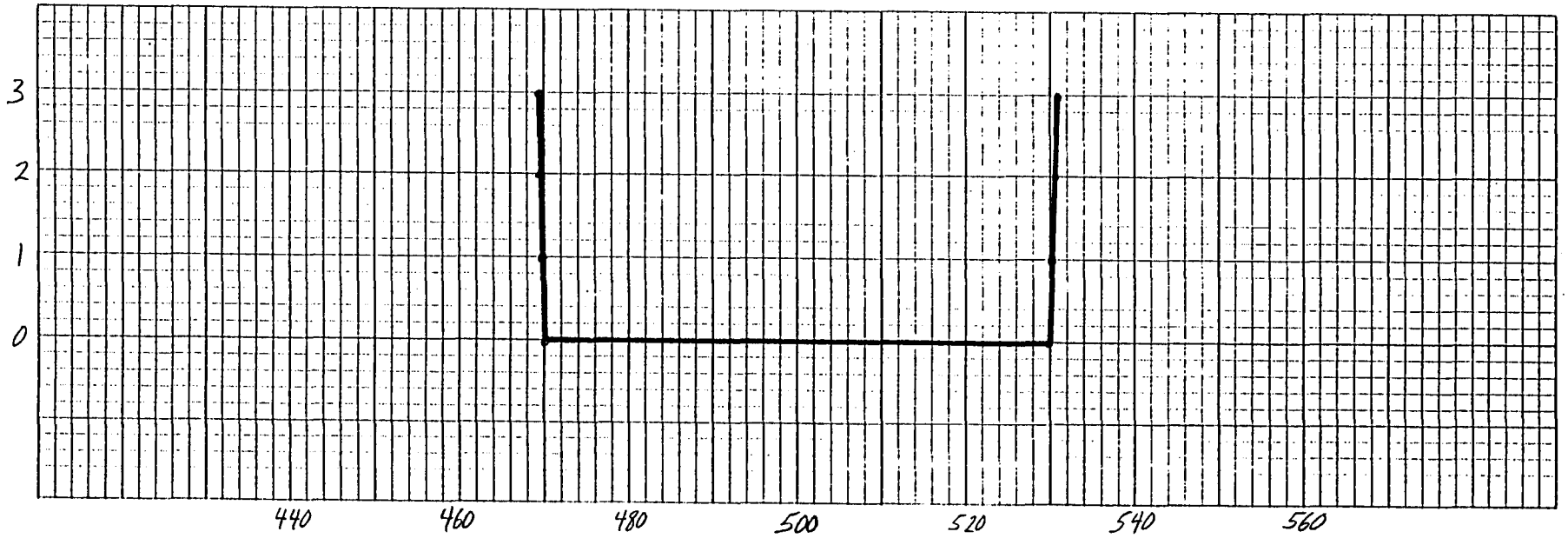
RS	22	Elev	0					
RC	0.020	0.016	0.020	2150	.0037			
RX	439.7	439.8	439.9	440	560	560.1	560.2	560.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

1 street, 120' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R44



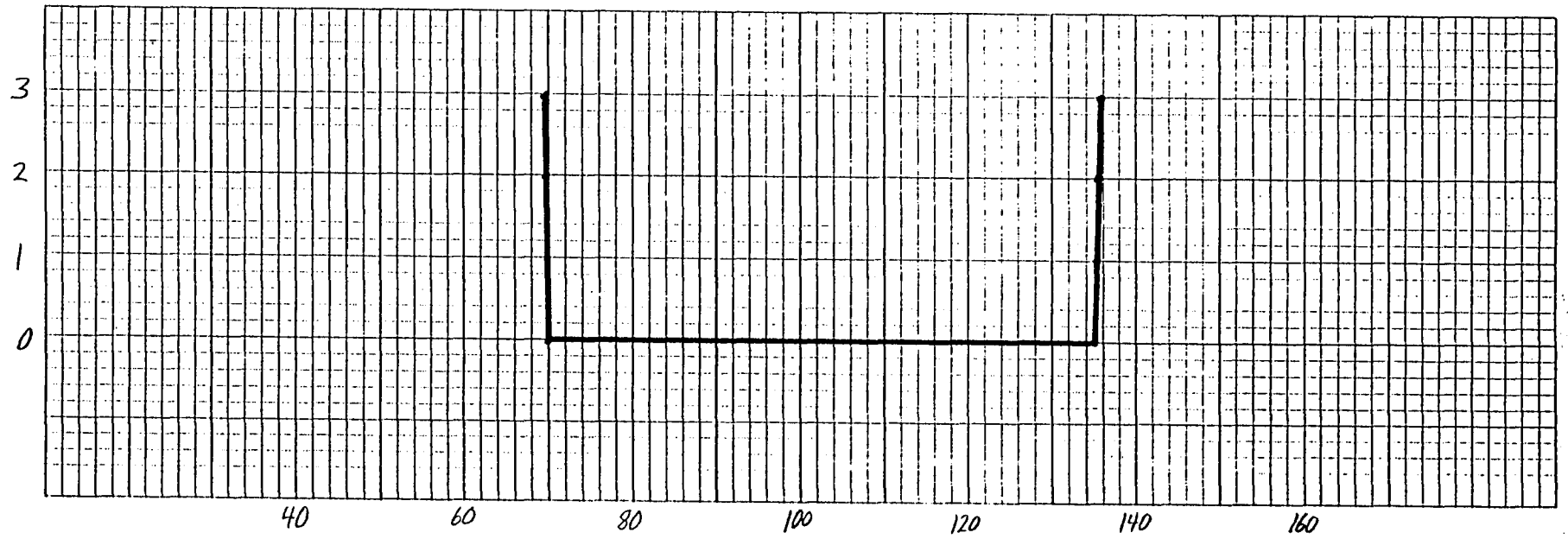
RS	13	Elev	0					
RC	0.025	0.016	0.025	1300	0.0027			
RX	469.7	469.8	469.9	470	530	530.1	530.2	530.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

1 street, 60' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R45



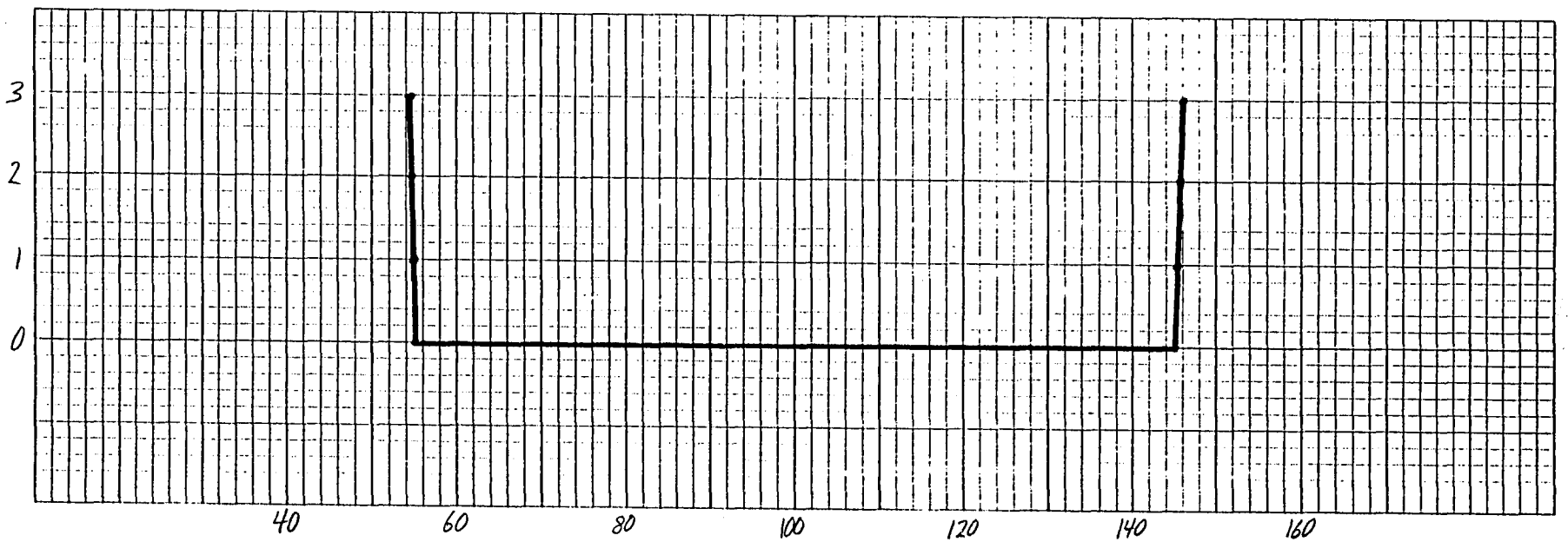
RS	22	Elev	0					
RC	0.020	0.016	0.020	2200	0.0039			
RX	69.7	69.8	69.9	70	135	135.1	135.2	135.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

1 street, 65' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R47



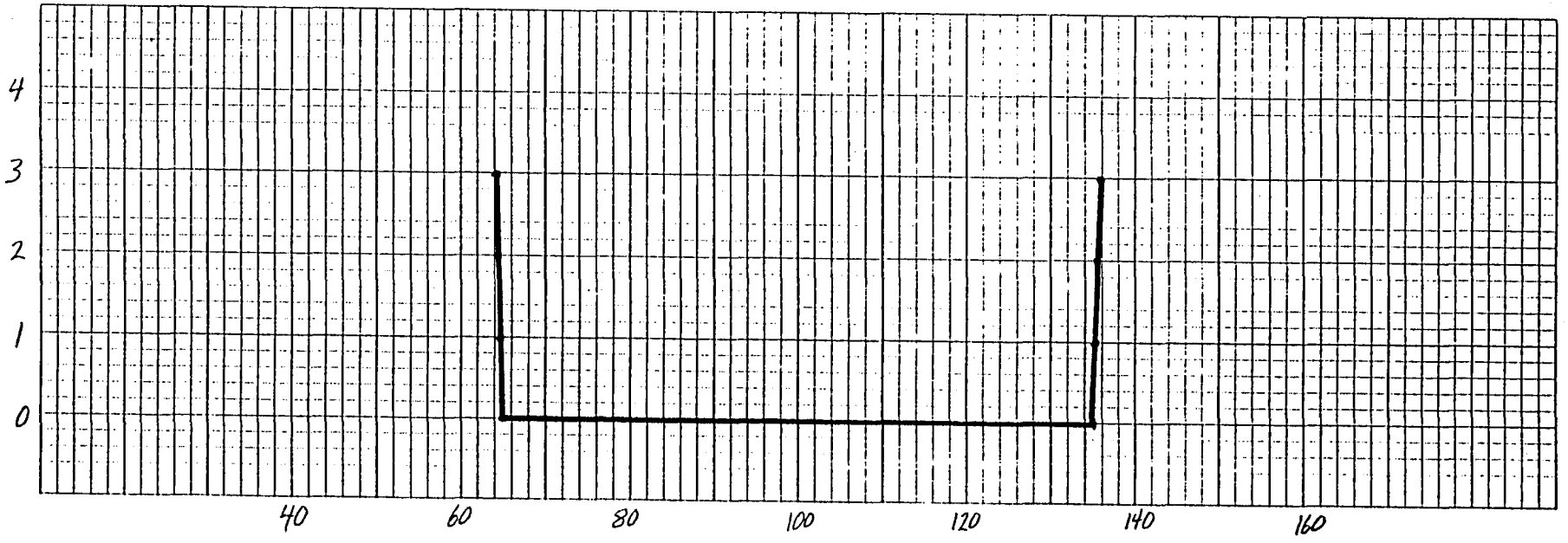
RS	74	Elev	0					
RC	0.025	0.016	0.025	7350	0.0043			
RX	54.7	54.8	54.9	55	145	145.1	145.2	145.3
RY	5	4	3	2	2	3	4	5

CALCULATED BY: PMH

1 street, 90' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R48



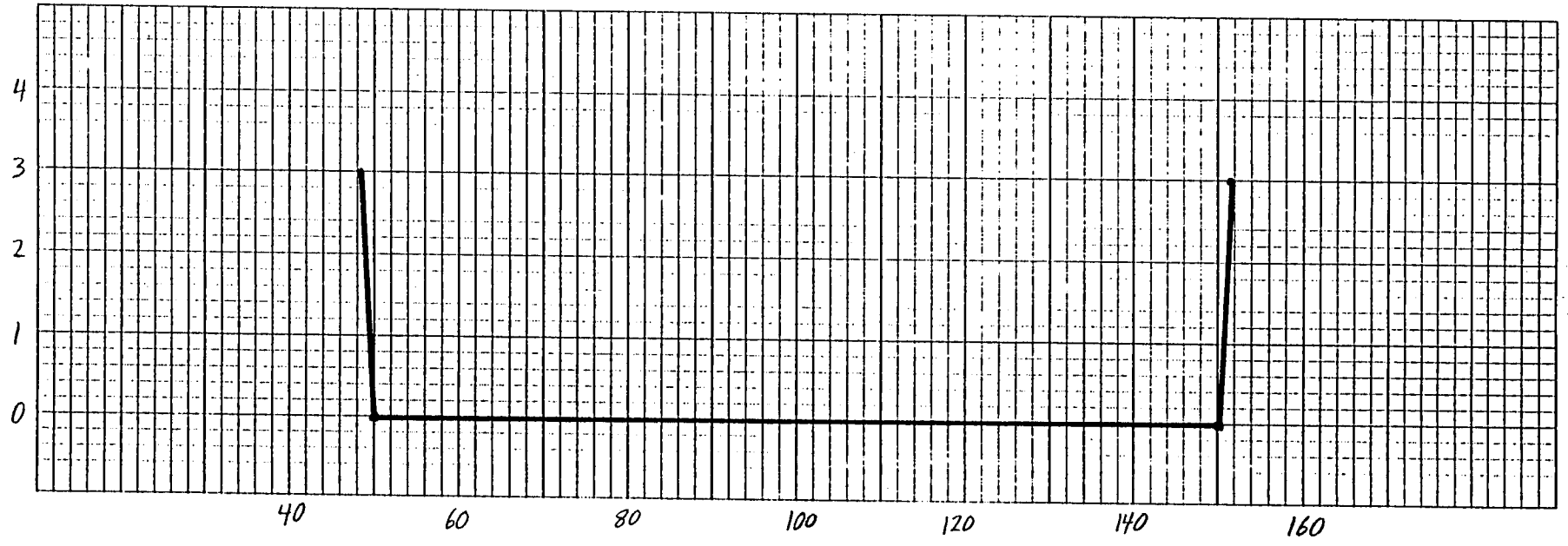
RS	27	Elev	0					
RC	0.030	0.016	0.030	2650	0.0003			
RX	64.7	64.8	64.9	65	135	135.1	135.2	135.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

1 street, 70' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R55



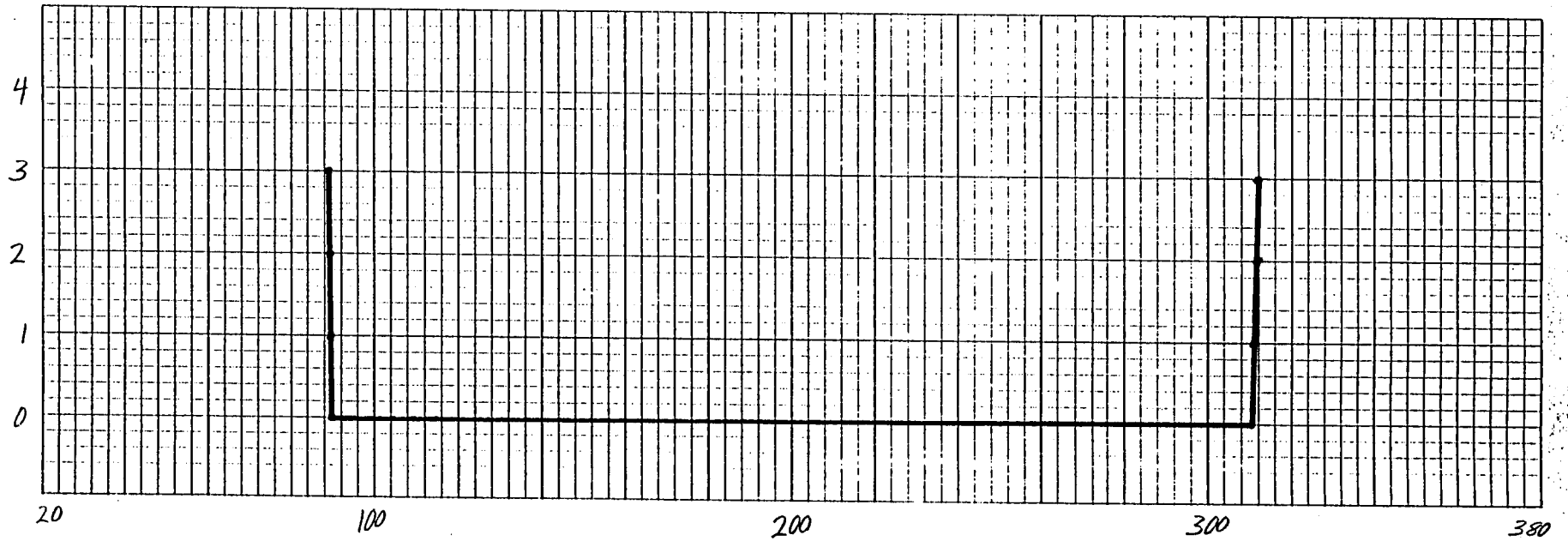
RS	26	Elev	0					
RC	0.030	0.016	0.030	2600	0.0006			
RX	49.7	49.8	49.9	50	150	150.1	150.2	150.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

2 streets, 100' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R59



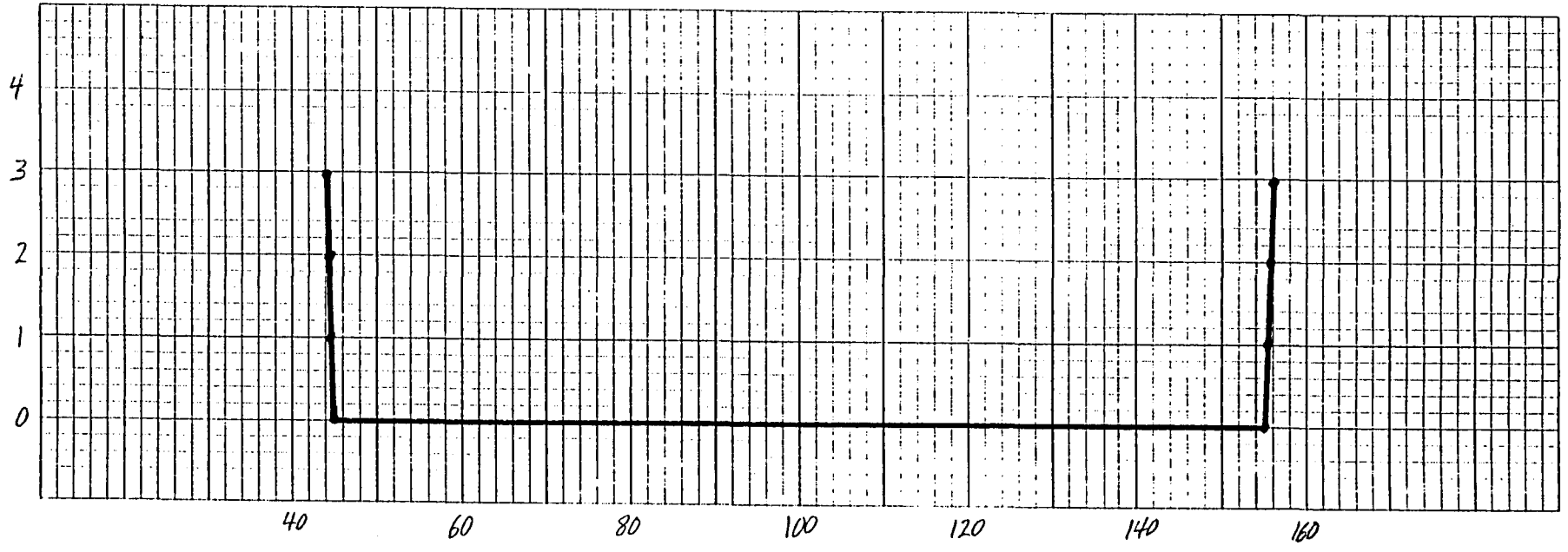
RS	26	Elev	0					
RC	0.025	0.016	0.025	2600	0.0021			
RX	89.7	89.8	89.9	90	310	310.1	310.2	310.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

3 streets, 220' flow width.

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RCM



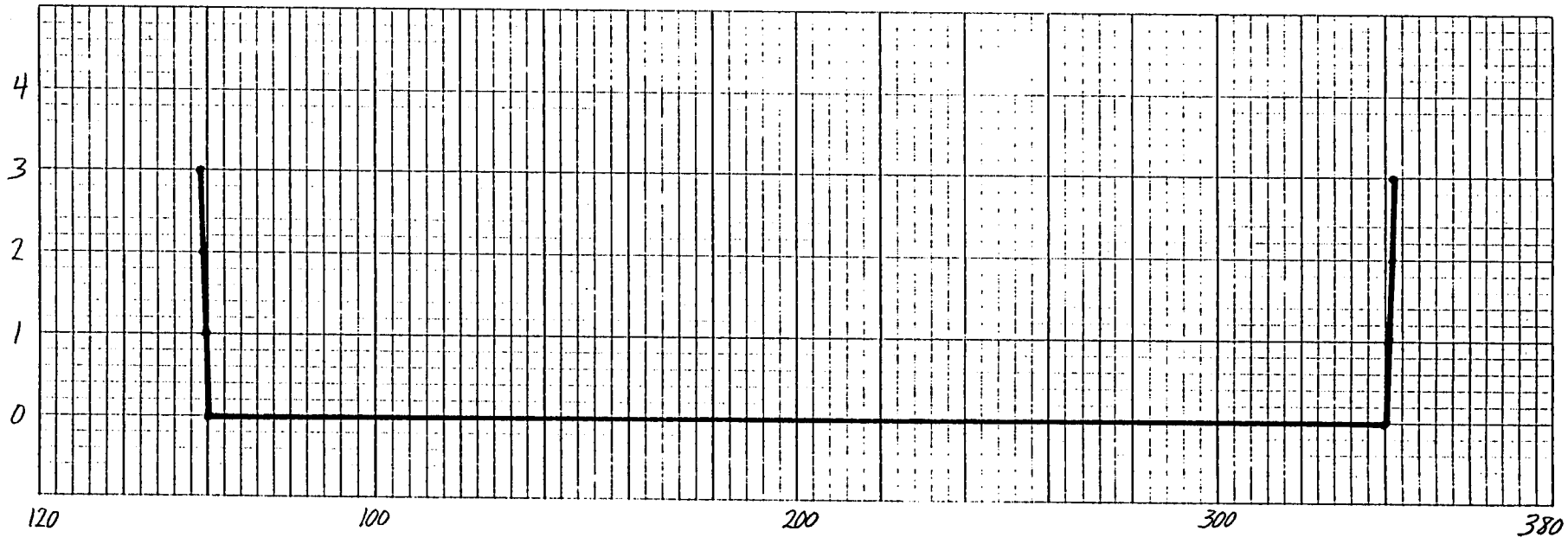
RS	26	Elev	0					
RC	0.025	0.016	0.025	2600	0.0025			
RX	44.7	44.8	44.9	45	155	155.1	155.2	155.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

1 street, 110' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RCP



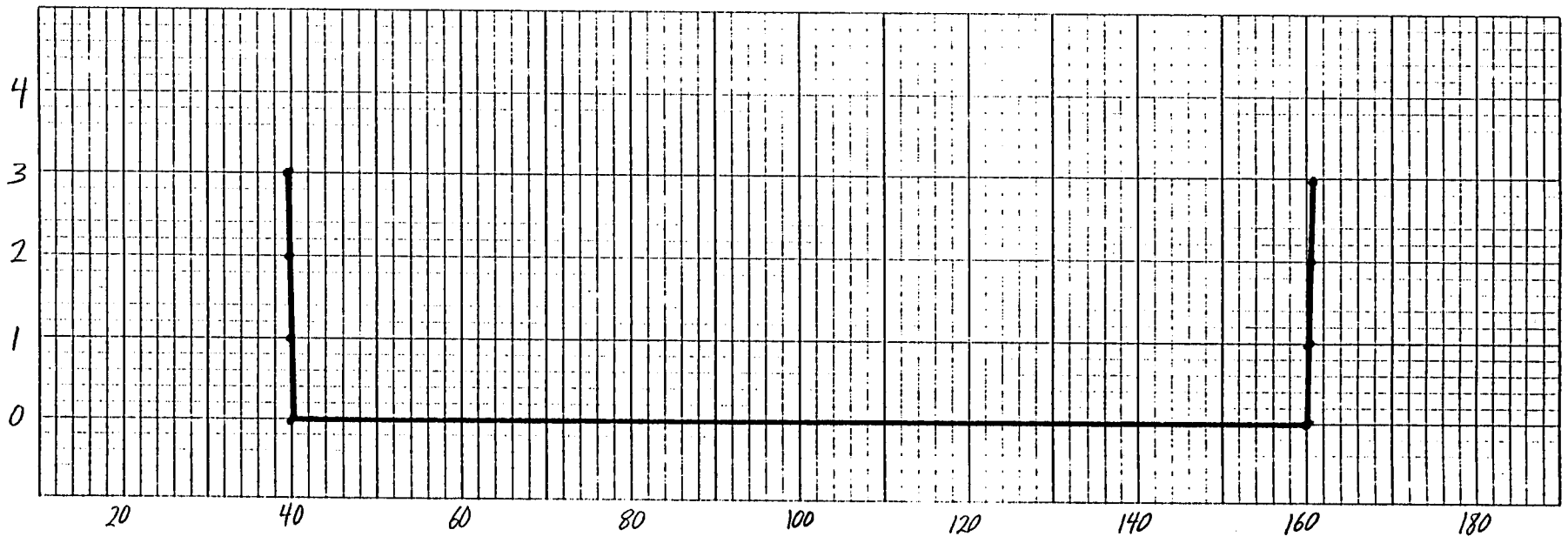
RS	52	Elev	0					
RC	0.025	0.016	0.025	5200	0.0026			
RX	159.7	159.8	159.9	160	340	340.1	340.2	340.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

4 streets, 280' flow width.

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RGC



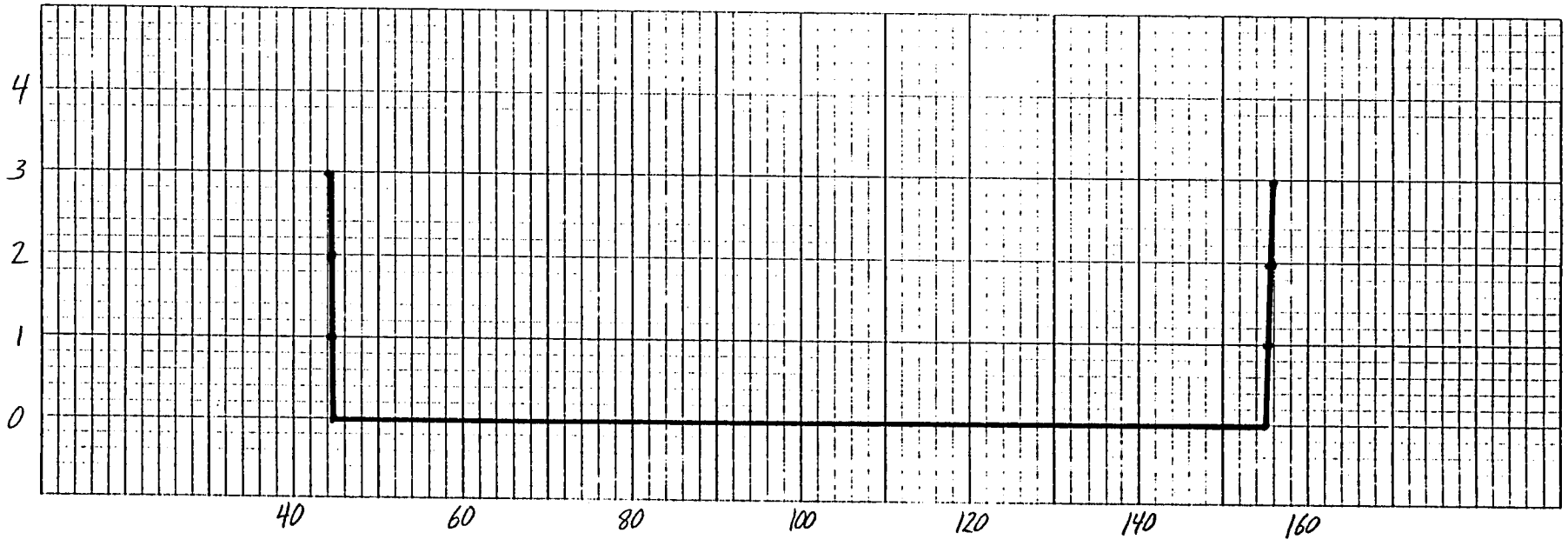
RS	46	Elev	0					
RC	0.035	0.035	0.035	4600	0.0027			
RX	39.7	39.8	39.9	40	160	160.1	160.2	160.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

Channel through golf course.

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R63



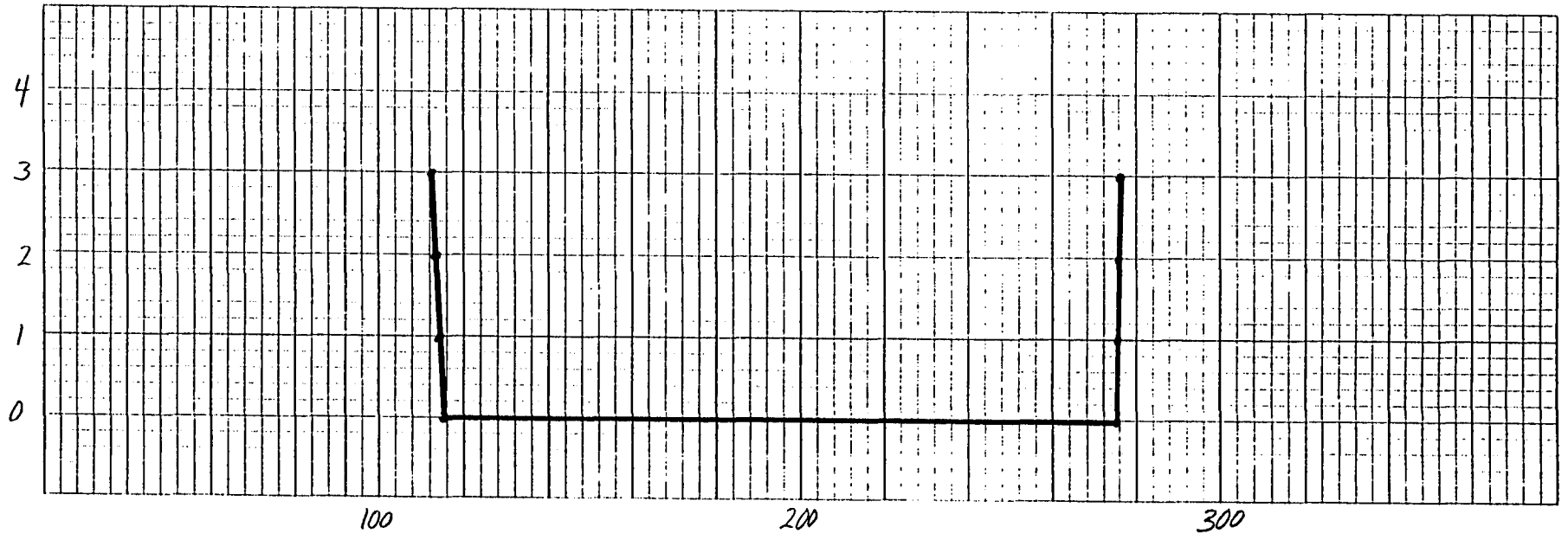
RS	15	Elev.	0					
RC	0.025	0.016	0.025	1450	0.0020			
RX	44.7	44.8	44.9	45	155	155.1	155.2	155.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

2 streets, 110' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R57



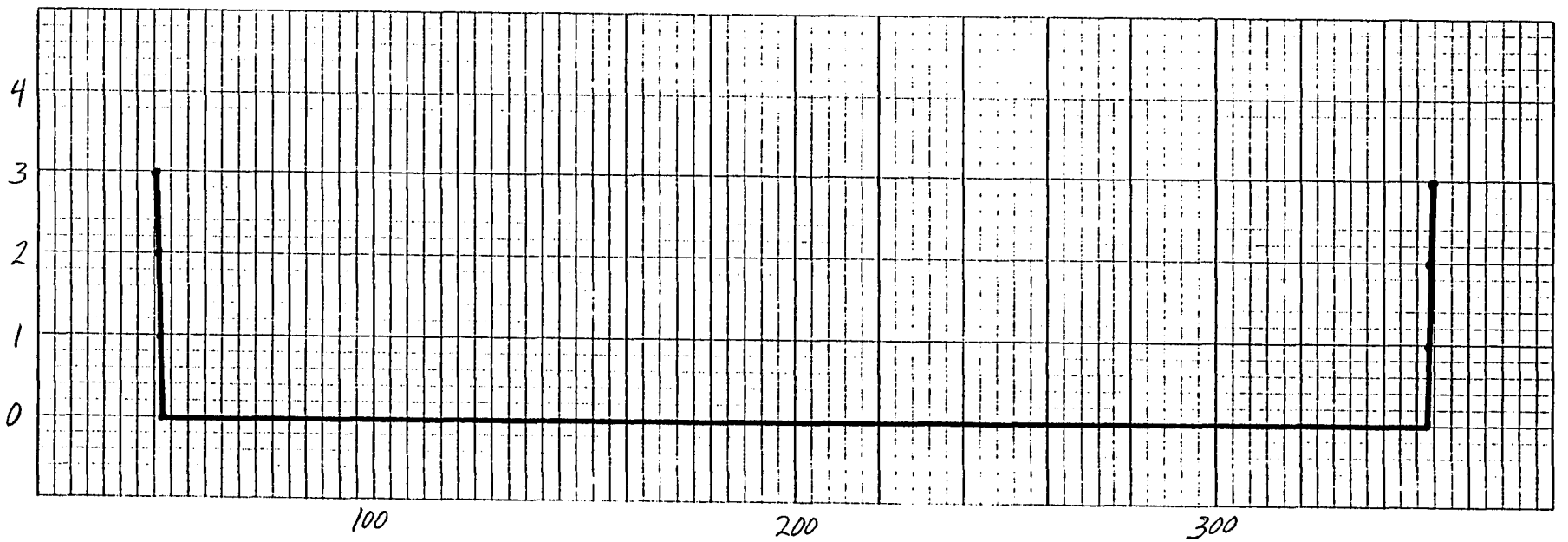
RS	52	Elev	0					
RC	0.025	0.016	0.026	5200	0.0028			
RX	114.7	114.8	114.9	115	285	285.1	285.2	285.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

3 streets, 170' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RMO



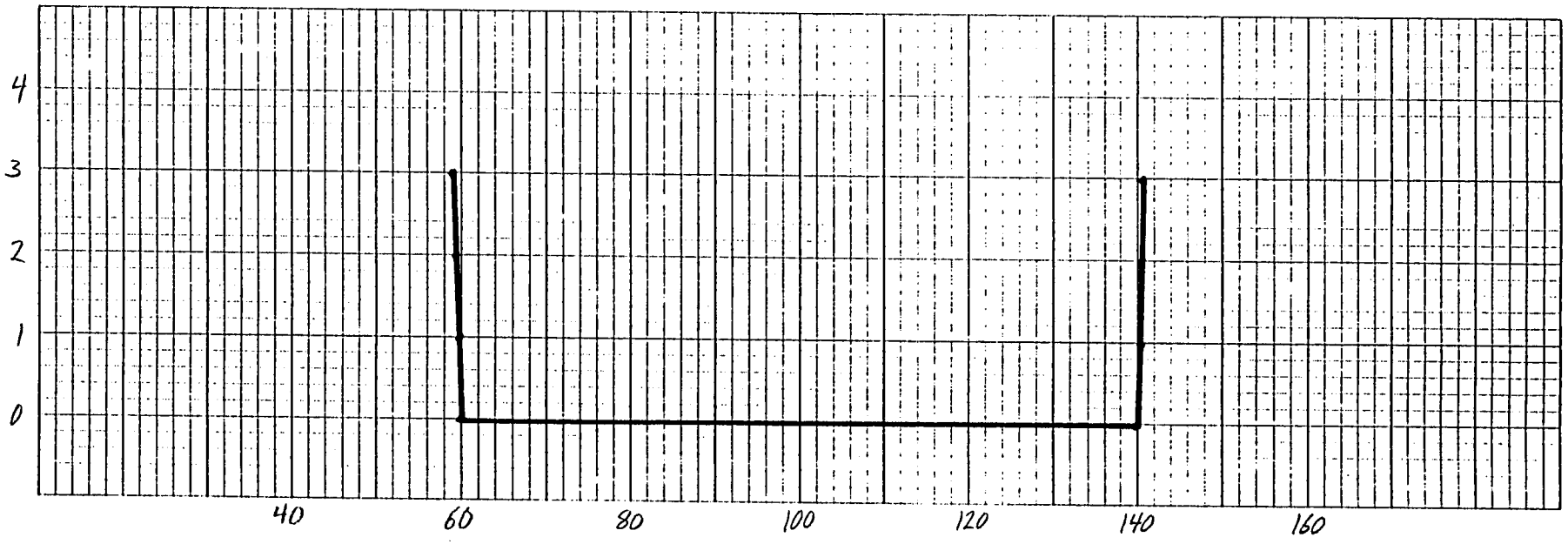
RS	52	Elev	0					
RC	0.020	0.016	0.020	5200	0.0028			
RX	49.7	49.8	49.9	50	350	350.1	350.2	350.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

5 streets, 300' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RBH



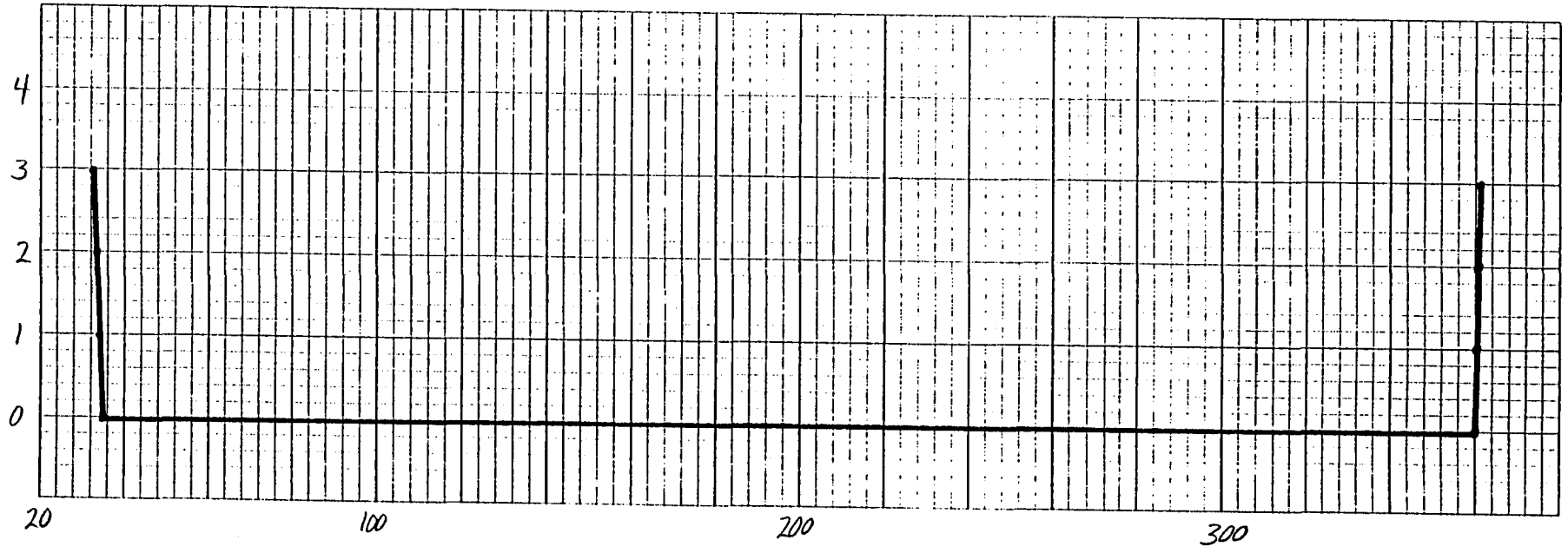
RS	13	Elev	0					
RC	0.020	0.016	0.020	1330	0.0035			
RX	59.7	59.8	59.9	60	140	140.1	140.2	140.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

1 street, 80' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER R61



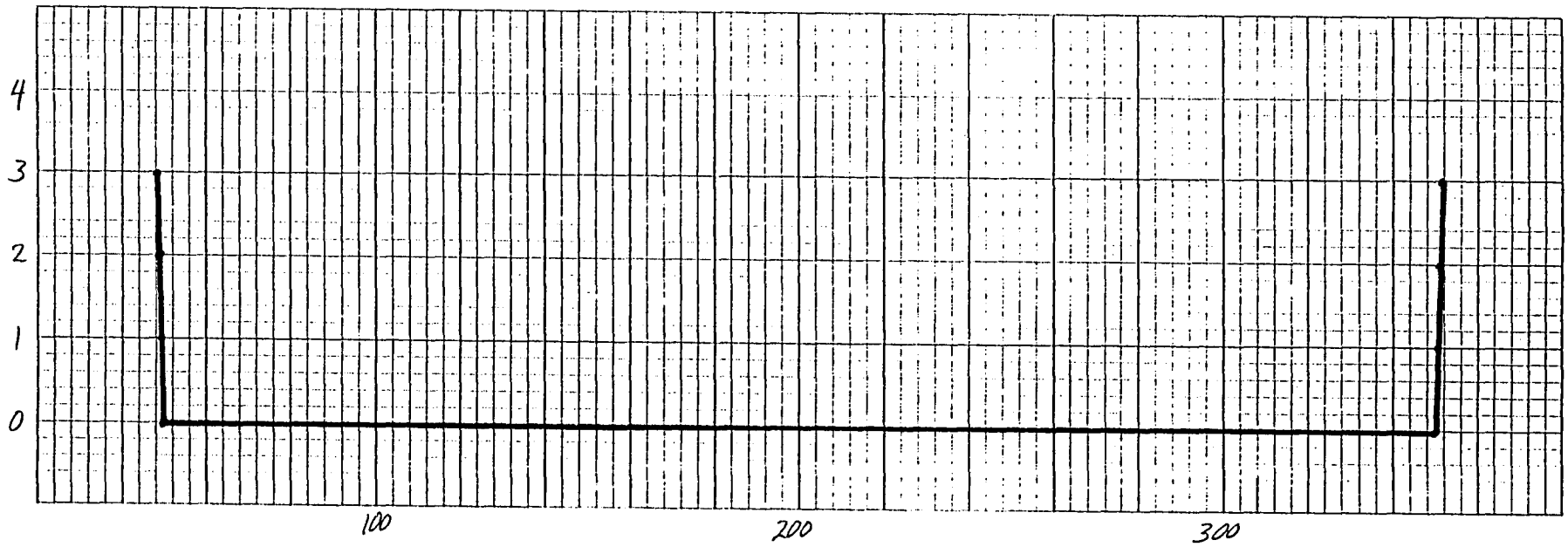
RS	42	Elev	0					
RC	0.025	0.016	0.025	4200	0.0045			
RX	34.7	34.8	34.9	35	360	360.1	360.2	360.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

6 streets, 325' flow width

NORMAL DEPTH CHANNEL ROUTE
COMPUTATION SHEET

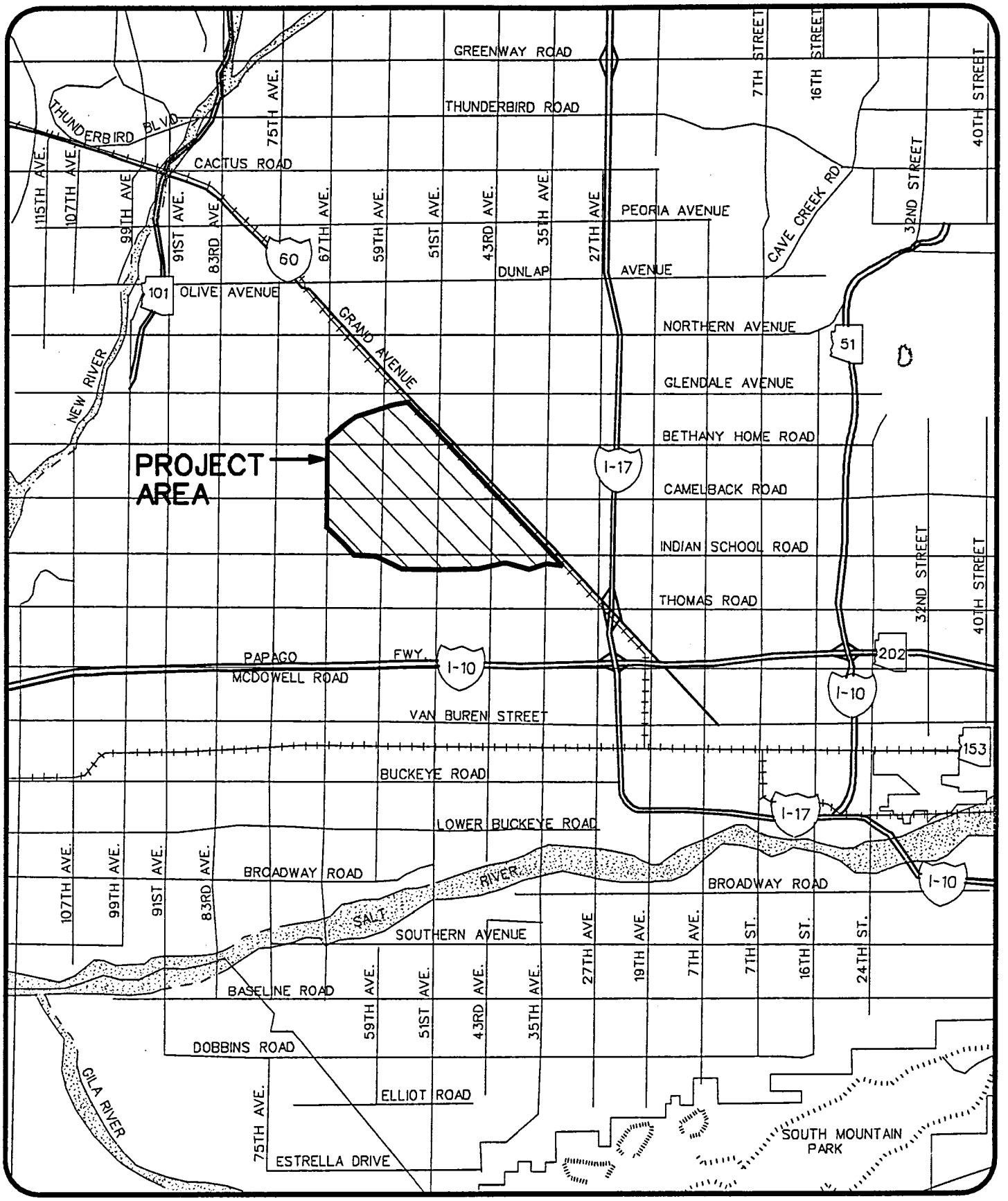
ROUTE IDENTIFICATION NUMBER RCK



RS	63	Elev	0					
RC	0.025	0.016	0.025	6300	0.0023			
RX	49.7	49.8	49.9	50	350	350.1	350.2	350.3
RY	3	2	1	0	0	1	2	3

CALCULATED BY: PMH

5 streets, 300' flow width



N.T.S.

JOB NO. 95-0024

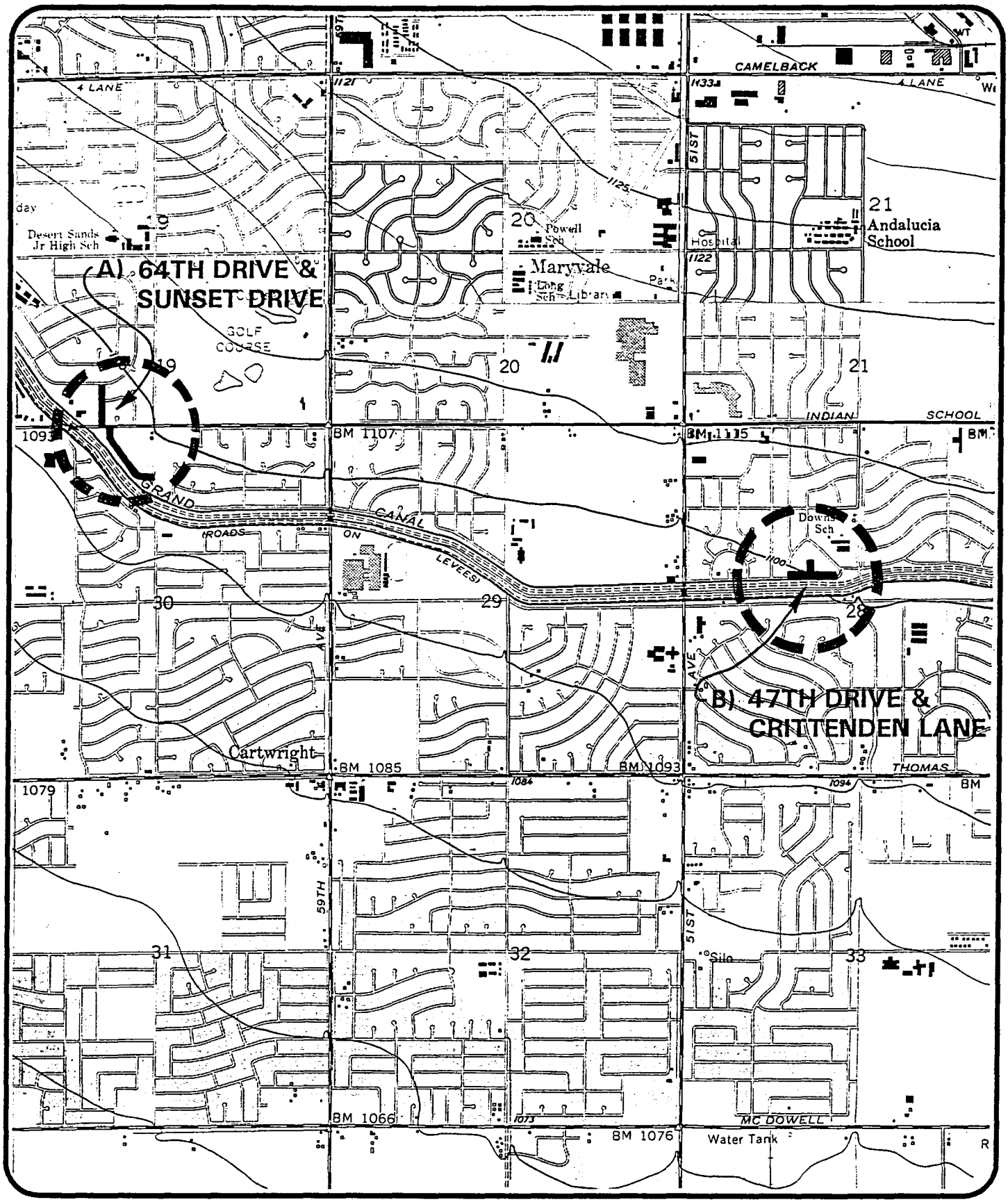
MARYVALE FLOODING MITIGATION PROJECT

LOCATION MAP

PLATE 1

CVL

FILE: LOCATE.DGN (SCALE:2.8) DATE: 6-95



N.T.S.

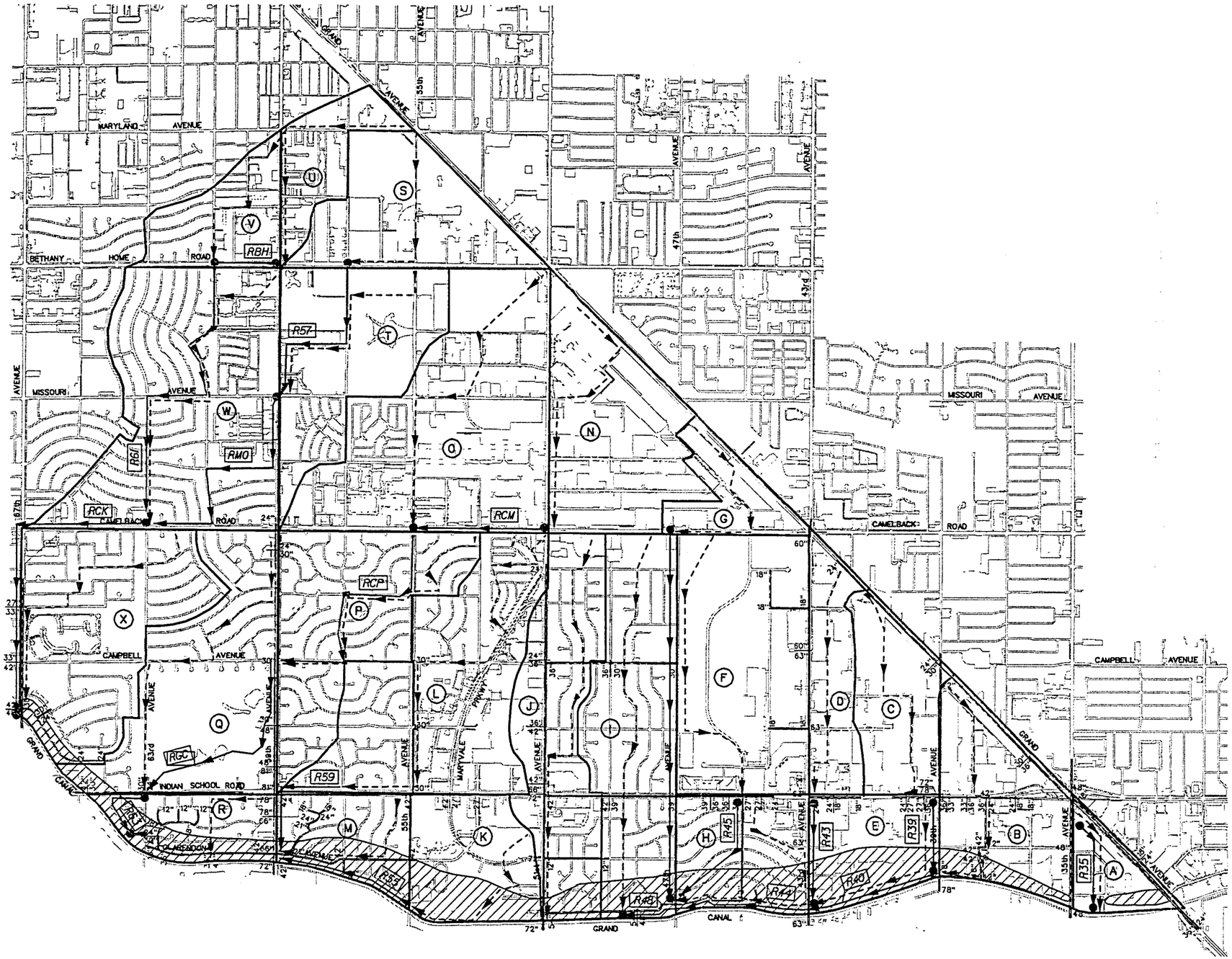
JOB NO. 95-0024

MARYVALE FLOODING MITIGATION PROJECT

FLOODING PROBLEM AREAS

PLATE 2

CVL



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF
MARYVALE
FLOODING MITIGATION PROJECT
F.C.D. CONTRACT NO. 93-94

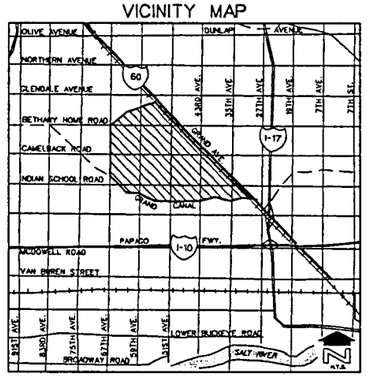
DRAINAGE AREA & FLOW ROUTING MAP

PLATE 3

LEGEND

- Drainage Basin Boundary
- (A) Drainage Basin Number
- 18" Storm Drain Location & Size
- FEMA 100-Year Flood Zone
- Lag Time Flow Path
- Route Number & Flow Path
- RCM Elevation Along Flow Path
- ● Routing Delimiter

VICINITY MAP



1000 0' 1000 2000
SCALE IN FEET
CONTOUR INTERVAL - 10' FEET

COE & VAN LOO, INC.

	BY	DATE
DESIGN	PWRH/JKM	
DESIGN CHK.	PWRH/JKM	
PLANS	PJE	
PLANS CHK.	PWRH/JKM	
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

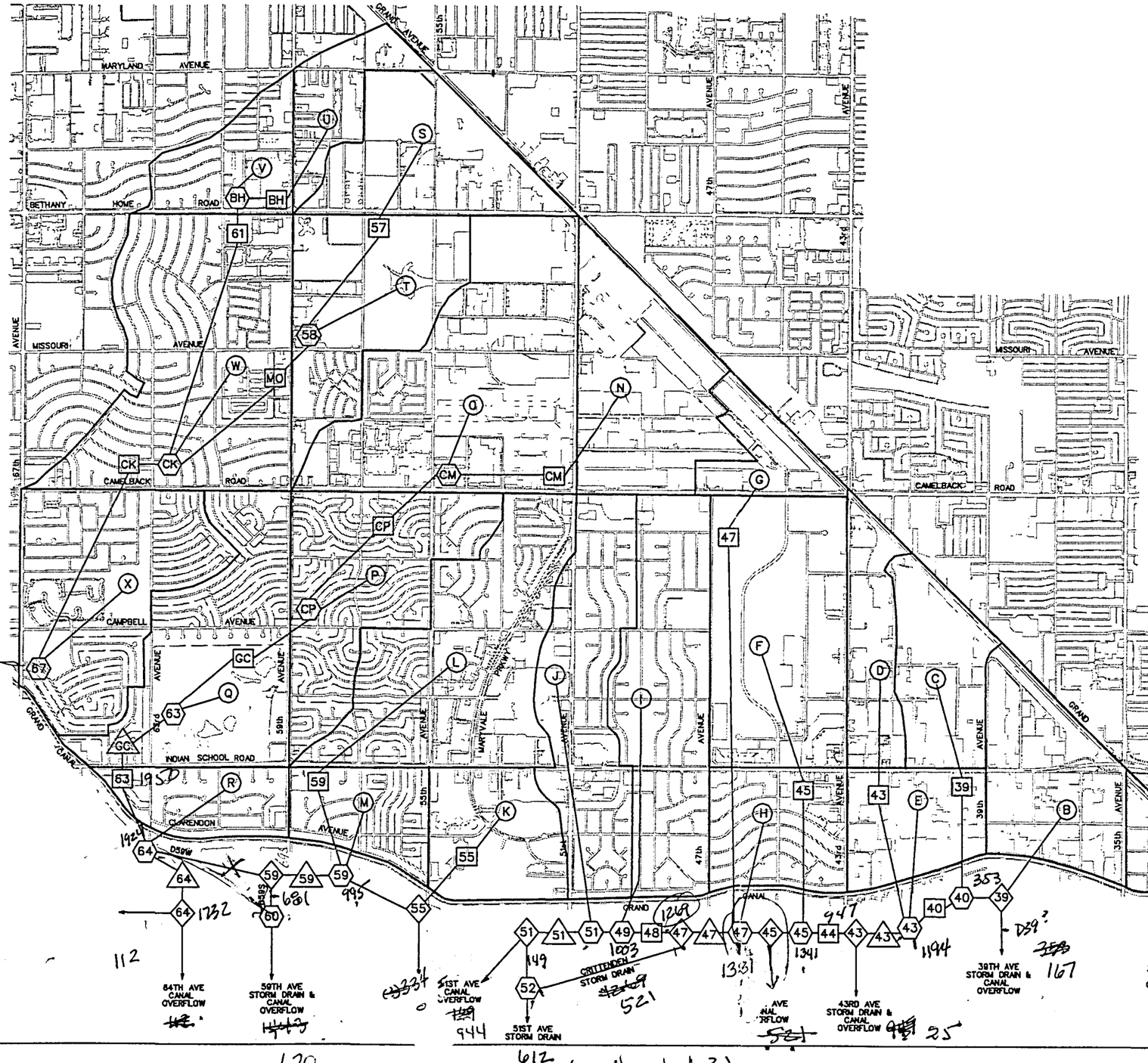
RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET OF

JOB NO. 950024



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF MARYVALE FLOODING MITIGATION PROJECT

F.C.D. CONTRACT NO. 93-94

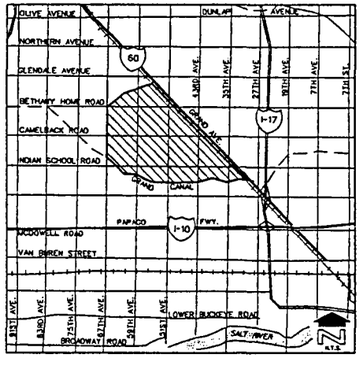
HEC-1 SCHEMATIC

PLATE 4

LEGEND

- Drainage Basin Boundary
- (T) Compute Runoff from Sub-Basin (T)
- [57] Route Hydrograph (R57)
- (S) Compute Runoff from Sub-Basin (S)
- [58] Combine Hydrographs (C58)
- [59] Divide Hydrograph (D59S)
- D59W Divert West
- [39] Route Hydrograph through Storage (S39)

VICINITY MAP



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SCALE IN FEET

CONTOUR INTERVAL = 10' FEET

COE & VAN LOO, INC.

	BY	DATE
DESIGN	PWRH/JKM	
DESIGN CHK.	PWRH/JKM	
PLANS	PJE	
PLANS CHK.	PWRH/JKM	
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

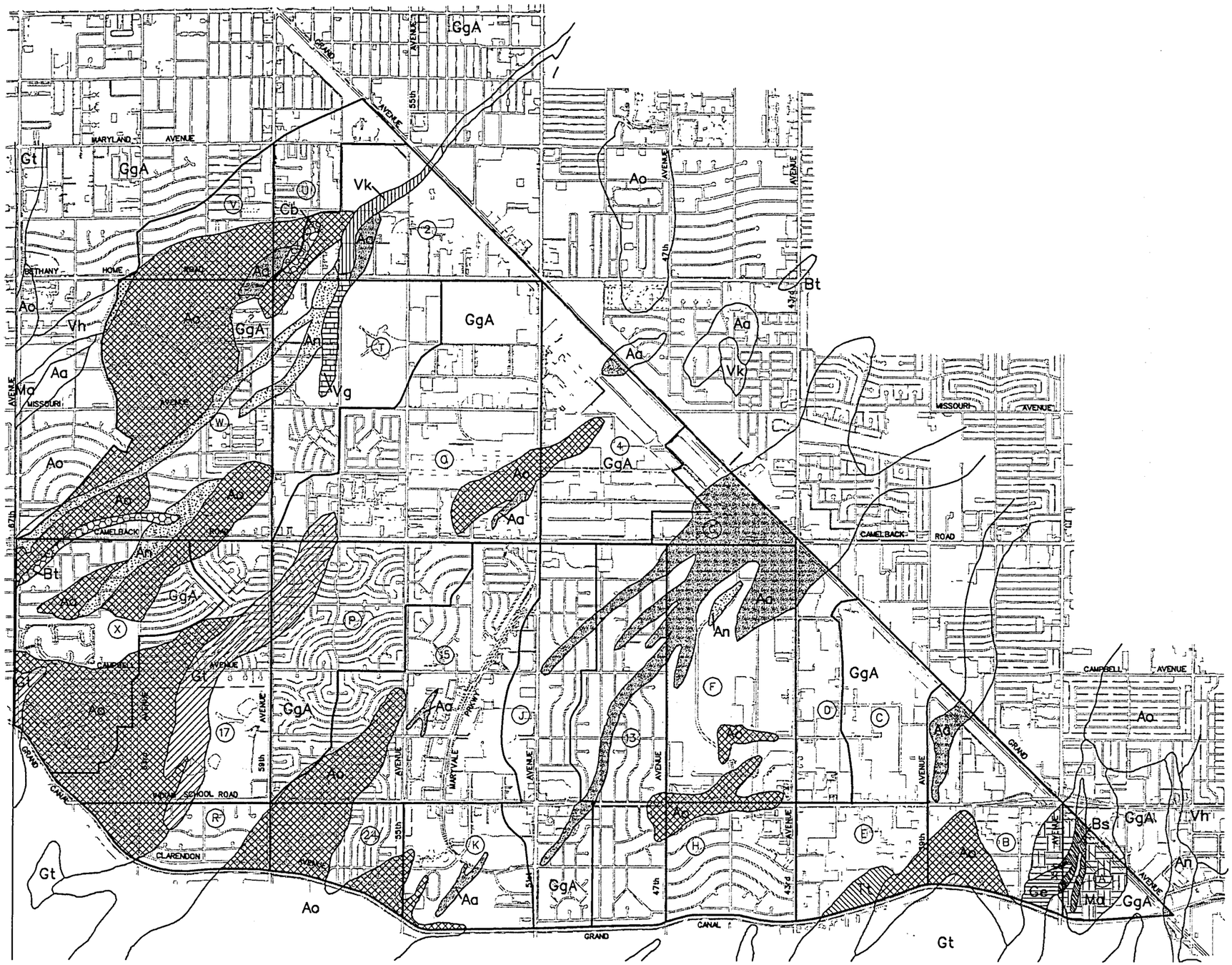
RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET OF

JOB NO. 950024



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF
MARYVALE
FLOODING MITIGATION PROJECT
F.C.D. CONTRACT NO. 93-94

SOIL CLASSIFICATION MAP

PLATE 5

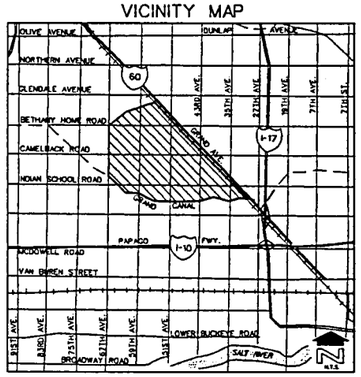
LEGEND

- Drainage Basin Boundary
- (17) Drainage Basin Number
- (Ao) Soil Unit Boundary

SOIL NAME

Ao	Agualt Loam
Aa	Avondale Clay Loam
An	Avonda Clay Loam
Bs	Brios Sandy Loam
Bt	Brios Loam
Cb	Carrizo Gravelly Sandy Loam
Ge	Gilman Loam, 0-1 Percent Slope
Gga	Gilman Fine Sandy Loam
Gt	Glenbar Clay Loam
Ma	Maripo Sandy Loam
Tt	Trix Clay Loam
Vg	Vint Loamy Fine Sand
Vh	Vint Fine Sandy Loam
Vk	Vint Loam

VICINITY MAP



N

1000 0' 1000 2000

SCALE IN FEET
CONTOUR INTERVAL = 10' FEET

COE & VAN LOO, INC.

	BY	DATE
DESIGN	PWRH/JKM	
DESIGN CHK.	PWRH/JKM	
PLANS	PJE	
PLANS CHK.	PWRH/JKM	
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET OF

JOB NO. 950024

DATE: Jan. 1, 1995
TIME: 15:51:00
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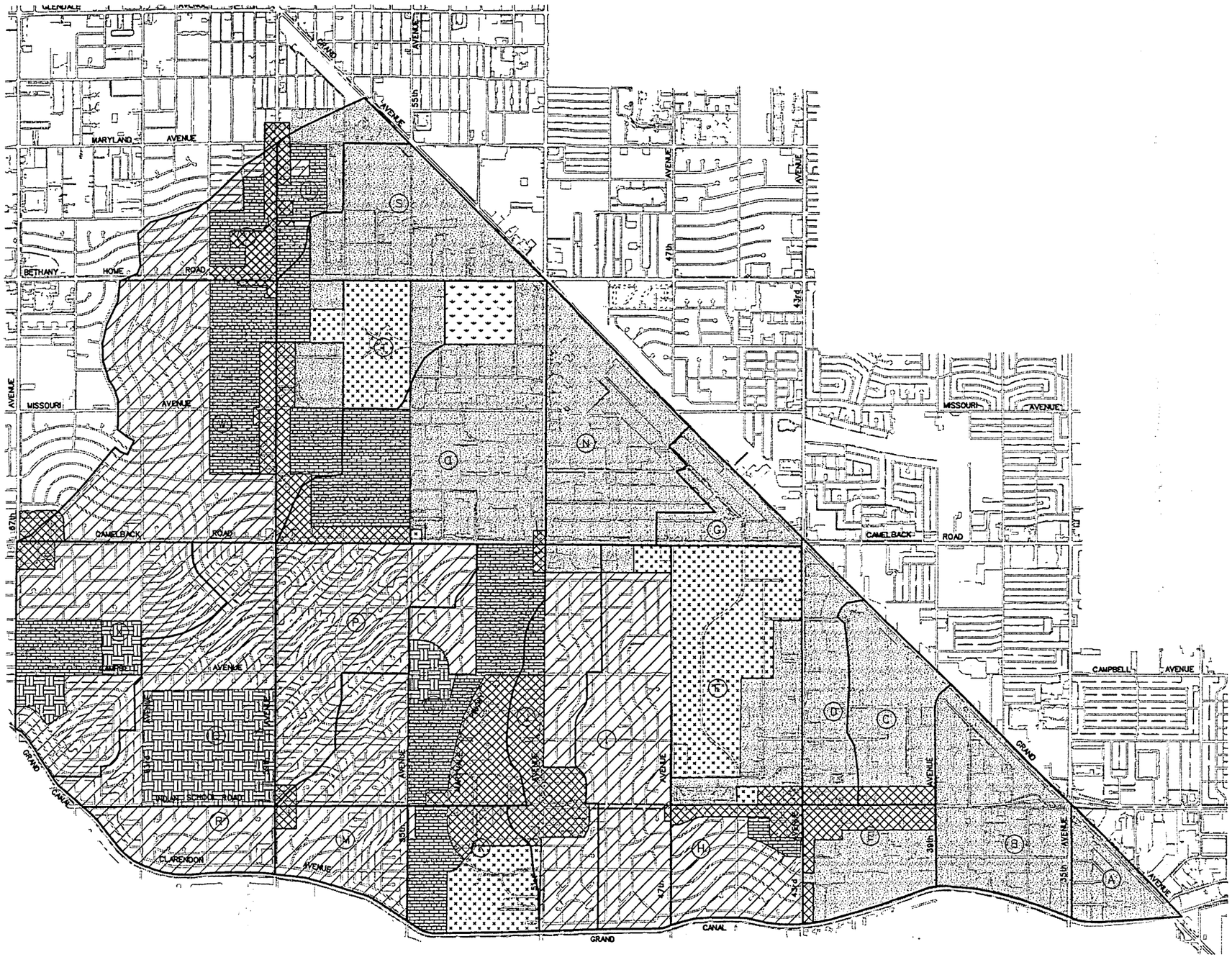


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF
MARYVALE
FLOODING MITIGATION PROJECT

F.C.D. CONTRACT NO. 93-94

LAND USE MAP

PLATE 6

LEGEND

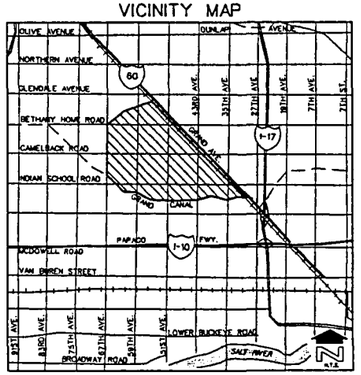
Drainage Basin Boundary

(24) Drainage Basin Number

LAND USE

- Single Family Residential
- Industrial
- Commercial
- Multi-Family Residential
- Open Space
- Park
- Row Crops

VICINITY MAP



1000 0' 1000 2000

SCALE IN FEET
CONTOUR INTERVAL - 10' FEET

COE & VAN LOO, INC.

	BY	DATE
DESIGN	PWRH/JKM	
DESIGN CHK.	PWRH/JKM	
PLANS	PJE	
PLANS CHK.	PWRH/JKM	
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET OF

JOB NO. 950024