Techniques of Water-Resources Investigations
of the United States Geological Survey

Chapter C1

FINITE-DIFFERENCE MODEL FOR AQUIFER SIMULATION IN TWO DIMENSIONS WITH RESULTS OF NUMERICAL EXPERIMENTS

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Book 7

AUTOMATED DATA PROCESSING AND COMPUTATIONS

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Attachment VII
Program Listing

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C     ******************************************************************MAN  10
C                          FINITE-DIFFERENCE MODEL                      MAN  20
C                                    FOR                                MAN  30
C                       SIMULATION OF GROUND-WATER FLOW                 MAN  40
C                              IN TWO DIMENSIONS                        MAN  50
C                                                                       MAN  60
C              BY P. C. TRESCOTT, G. F. PINDER AND S. P. LARSON         MAN  70
C                          U. S. GEOLOGICAL SURVEY                      MAN  80
C                            SEPTEMBER, 1975                            MAN  90
C     ******************************************************************MAN 100
C     MAIN PROGRAM TO DIMENSION DIGITAL MODEL AND CONTROL SEQUENCE      MAN 110
C     OF COMPUTATIONS                                                   MAN 120
C     ------------------------------------------------------------------MAN 130
C     SPECIFICATIONS:                                                   MAN 140
      REAL *4KEEP,M,HEADNG(32)                                          MAN 150
      REAL *8PHI,G,BE,TEMP,Z,YY                                         MAN 160
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,MAN 170
     1CONTR,LEAK,RECH,SIP,ADI                                           MAN 180
C                                                                       MAN 190
      DIMENSION Y(70000), L(37), IFMT1(9), IFMT2(9), IFMT3(9), NAME(99),MAN 200
     1 YY(1)                                                            MAN 210
      EQUIVALENCE (YY(1),Y(1))                                          MAN 220
C                                                                       MAN 230
      COMMON /SARRAY/ VF4(11),CHK(15)                                   MAN 240
      COMMON /ARSIZE/ IZ,JZ,IP,JP,IR,JR,IC,JC,IL,JL,IS,JS,IH,IMAX,IMX1  MAN 250
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LEMAN 260
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,MAN 270
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,MAN 280
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DIMAN 290
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 MAN 300
C                                                                       MAN 310
      DATA IFMT1/4H(1H0,4H,I5,,4H10E1,4H1.3/,4H(1H ,4H,5X,,4H10E1,4H1.3)MAN 320
     1,4H)   /                                                          MAN 330
      DATA IFMT2/4H('0',4H,I2,,4H2X,2,4H0F6.,4H1/(5,4HX,20,4HF6.1,4H))  MAN 340
     1,4H    /                                                          MAN 350
      DATA IFMT3/4H(1H0,4H,I5,,4H14F9,4H.5/(,4H1H ,,4H5X,1,4H4F9.,4H5)) MAN 360
     1,4H    /                                                          MAN 370
      DATA NAME/2*4H    ,4H STO,4HRAGE,4H COE,4HFFIC,4HIENT,4*4H    ,4H MAN 380
     1  T,4HRANS,4HMISS,4HIVIT,4HY   ,2*4H    ,4H   A,4HQUIF,4HER H,4HYDMAN 390
     2RA,4HULIC,4H CON,4HDUCT,4HIVIT,4HY   ,4H    ,4H   A,4HQUIF,4HER B,MAN 400
     34HASE ,4HELEV,4HATIO,4HN   ,3*4H    ,4H   S,4HPECI,4HFIC ,4HYIEL,4MAN 410
     4HD   ,4*4H    ,4HAQUI,4HFER ,4HTOP ,4HELEV,4HATIO,4HN   ,4H    ,4HMAN 420
     5CONF,4HININ,4HG BE,4HD HY,4HDRAU,4HLIC ,4HCOND,4HUCTI,4HVITY,3*4H MAN 430
     6   ,4H RIV,4HER H,4HEAD ,4*4H    ,4H   C,4HONFI,4HNING,4H BED,4H TMAN 440
     7HI,4HCKNE,4HSS  ,2*4H    ,4H   L,4HAND ,4HSURF,4HACE ,4HELEV,4HATIMAN 450
     80,4HN   ,3*4H    ,4H ARE,4HAL R,4HECHA,4HRGE ,4HRATE,2*4H    /    MAN 460
C                                                                       MAN 470
      DEFINE FILE 2(14,2624,U,KKK)                                      MAN 480
C     ..................................................................MAN 490
C                                                                       MAN 500
C     ---READ TITLE,PROGRAM OPTIONS AND PROGRAM SIZE---                 MAN 510
   10 READ (R,370) HEADNG                                               MAN 520
      WRITE (P,360) HEADNG                                              MAN 530
      READ (R,380) WATER,LEAK,CONVRT,EVAP,RECH,NUMS,CHCK,PNCH,IDK1,IDK2,MAN 540
     1NUM,HEAD                                                          MAN 550
      WRITE (P,390) WATER,LEAK,CONVRT,EVAP,RECH,NUMS,CHCK,PNCH,IDK1,IDK2MAN 560
     1,NUM,HEAD                                                         MAN 570
```

Program listing—Continued

```
      IF (NUMS.EQ.CHK(11).OR.NUMS.EQ.CHK(12).OR.NUMS.EQ.CHK(13)) GO TO 2MAN 580
     10                                                                 MAN 590
      WRITE (P,350)                                                     MAN 600
      STOP                                                              MAN 610
   20 READ (R,320) DIML,DIMW,NW,ITMAX                                   MAN 620
      WRITE (P,340) DIML,DIMW,NW,ITMAX                                  MAN 630
C                                                                       MAN 640
C     ---COMPUTE DIMENSIONS FOR ARRAYS---                               MAN 650
      IZ=DIML                                                           MAN 660
      JZ=DIMW                                                           MAN 670
      IH=MAX0(1,NW)                                                     MAN 680
      IMAX=MAX0(DIML,DIMW)                                              MAN 690
      ISIZ=DIML*DIMW                                                    MAN 700
      ISUM=2*ISIZ+1                                                     MAN 710
      IMX1=ITMAX+1                                                      MAN 720
      L(1)=1                                                            MAN 730
      DO 30 I=2,4                                                       MAN 740
      L(I)=ISUM                                                         MAN 750
   30 ISUM=ISUM+2*IMAX                                                  MAN 760
      DO 40 I=5,16                                                      MAN 770
      L(I)=ISUM                                                         MAN 780
   40 ISUM=ISUM+ISIZ                                                    MAN 790
      IF (WATER.NE.CHK(2)) GO TO 60                                     MAN 800
      DO 50 I=17,19                                                     MAN 810
      L(I)=ISUM                                                         MAN 820
   50 ISUM=ISUM+ISIZ                                                    MAN 830
      IP=DIML                                                           MAN 840
      JP=DIMW                                                           MAN 850
      GO TO 80                                                          MAN 860
   60 DO 70 I=17,19                                                     MAN 870
      L(I)=ISUM                                                         MAN 880
   70 ISUM=ISUM+1                                                       MAN 890
      IP=1                                                              MAN 900
      JP=1                                                              MAN 910
   80 IF (LEAK.NE.CHK(9)) GO TO 100                                     MAN 920
      DO 90 I=20,22                                                     MAN 930
      L(I)=ISUM                                                         MAN 940
   90 ISUM=ISUM+ISIZ                                                    MAN 950
      IR=DIML                                                           MAN 960
      JR=DIMW                                                           MAN 970
      GO TO 120                                                         MAN 980
  100 DO 110 I=20,22                                                    MAN 990
      L(I)=ISUM                                                         MAN1000
  110 ISUM=ISUM+1                                                       MAN1010
      IR=1                                                              MAN1020
      JR=1                                                              MAN1030
  120 IF (CONVRT.NE.CHK(7)) GO TO 130                                   MAN1040
      L(23)=ISUM                                                        MAN1050
      ISUM=ISUM+ISIZ                                                    MAN1060
      IC=DIML                                                           MAN1070
      JC=DIMW                                                           MAN1080
      GO TO 140                                                         MAN1090
  130 L(23)=ISUM                                                        MAN1100
      ISUM=ISUM+1                                                       MAN1110
      IC=1                                                              MAN1120
      JC=1                                                              MAN1130
  140 IF (EVAP.NE.CHK(6)) GO TO 150                                     MAN1140
      L(24)=ISUM                                                        MAN1150
      ISUM=ISUM+ISIZ                                                    MAN1160
      IL=DIML                                                           MAN1170
      JL=DIMW                                                           MAN1180
      GO TO 160                                                         MAN1190
```

Program listing—Continued

```
  150 L(24)=ISUM                                                        MAN1200
      ISUM=ISUM+1                                                       MAN1210
      IL=1                                                              MAN1220
      JL=1                                                              MAN1230
  160 IF (NUMS.NE.CHK(11)) GO TO 180                                    MAN1240
      DO 170 I=25,28                                                    MAN1250
      L(I)=ISUM                                                         MAN1260
  170 ISUM=ISUM+ISIZ                                                    MAN1270
      IS=DIML                                                           MAN1280
      JS=DIMW                                                           MAN1290
      GO TO 200                                                         MAN1300
  180 DO 190 I=25,28                                                    MAN1310
      L(I)=ISUM                                                         MAN1320
  190 ISUM=ISUM+1                                                       MAN1330
      IS=1                                                              MAN1340
      JS=1                                                              MAN1350
  200 DO 210 I=29,31                                                    MAN1360
      L(I)=ISUM                                                         MAN1370
  210 ISUM=ISUM+DIMW                                                    MAN1380
      DO 220 I=32,33                                                    MAN1390
      L(I)=ISUM                                                         MAN1400
  220 ISUM=ISUM+DIML                                                    MAN1410
      L(34)=ISUM                                                        MAN1420
      ISUM=ISUM+IH                                                      MAN1430
      L(35)=ISUM                                                        MAN1440
      ISUM=ISUM+2*IH                                                    MAN1450
      IF (MOD(ISUM+2).EQ.0) ISUM=ISUM+1                                 MAN1460
      CONTINUE                                                          MAN1470
  230 L(36)=ISUM                                                        MAN1480
      ISUM=ISUM+2*IMAX                                                  MAN1490
      L(37)=ISUM                                                        MAN1500
      ISUM=ISUM+IMX1                                                    MAN1510
      WRITE (P,330) ISUM                                                MAN1520
C                                                                       MAN1530
C     ---PASS INTIIAL ADDRESSES OF ARRAYS TO SUBROUTINES---             MAN1540
      CALL DATAI(Y(L(1)),Y(L(7)),Y(L(8)),Y(L(9)),Y(L(10)),Y(L(11)),Y(L(.MAN1550
     12)),Y(L(13)),Y(L(14)),Y(L(15)),Y(L(16)),Y(L(17)),Y(L(18)),Y(L(19))MAN1560
     2,Y(L(20)),Y(L(21)),Y(L(22)),Y(L(23)),Y(L(24)),Y(L(29)),Y(L(32)),Y(MAN1570
     3L(34)),Y(L(35)))                                                  MAN1580
      CALL STEP(Y(L(1)),Y(L(5)),Y(L(7)),Y(L(8)),Y(L(9)),Y(L(14)),Y(L(17)MAN1590
     1),Y(L(18)),Y(L(23)),Y(L(29)),Y(L(30)),Y(L(32)),Y(L(34)),Y(L(35)),YMAN1600
     2(L(37)))                                                          MAN1610
      IF (NUMS.EQ.CHK(11)) CALL SOLVE1(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),YMAN1620
     1(L(5)),Y(L(6)),Y(L(7)),Y(L(9)),Y(L(12)),Y(L(13)),Y(L(14)),Y(L(15))MAN1630
     2,Y(L(16)),Y(L(25)),Y(L(26)),Y(L(27)),Y(L(28)),Y(L(29)),Y(L(31)),Y(MAN1640
     3L(32)),Y(L(33)),Y(L(37)),Y(L(10)),Y(L(11)),Y(L(24)),Y(L(19)),Y(L(2MAN1650
     43)),Y(L(20)),Y(L(22)),Y(L(21)))                                   MAN1660
      IF (NUMS.EQ.CHK(12)) CALL SOLVE2(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),YMAN1670
     1(L(5)),Y(L(6)),Y(L(7)),Y(L(9)),Y(L(12)),Y(L(13)),Y(L(14)),Y(L(15))MAN1680
     2,Y(L(16)),Y(L(25)),Y(L(26)),Y(L(27)),Y(L(28)),Y(L(29)),Y(L(31)),Y(MAN1690
     3L(32)),Y(L(33)),Y(L(37)),Y(L(10)),Y(L(11)),Y(L(24)),Y(L(19)),Y(L(2MAN1700
     43)),Y(L(20)),Y(L(22)),Y(L(21)))                                   MAN1710
      IF (NUMS.EQ.CHK(13)) CALL SOLVE3(Y(L(1)),Y(L(2)),Y(L(3)),Y(L(4)),YMAN1720
     1(L(5)),Y(L(6)),Y(L(7)),Y(L(9)),Y(L(12)),Y(L(13)),Y(L(14)),Y(L(15))MAN1730
     2,Y(L(16)),Y(L(25)),Y(L(26)),Y(L(27)),Y(L(28)),Y(L(29)),Y(L(31)),Y(MAN1740
     3L(32)),Y(L(33)),Y(L(36)),Y(L(37)),Y(L(10)),Y(L(11)),Y(L(24)),Y(L(1MAN1750
     49)),Y(L(23)),Y(L(20)),Y(L(22)),Y(L(21)))                          MAN1760
      CALL COEF(Y(L(1)),Y(L(5)),Y(L(6)),Y(L(7)),Y(L(8)),Y(L(9)),Y(L(10))MAN1770
     1,Y(L(11)),Y(L(12)),Y(L(14)),Y(L(15)),Y(L(16)),Y(L(17)),Y(L(18)),Y(MAN1780
     2L(19)),Y(L(20)),Y(L(21)),Y(L(22)),Y(L(23)),Y(L(24)),Y(L(29)),Y(L(3MAN1790
     32)))                                                              MAN1800
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Program listing—Continued

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      CALL CHECKI(Y(L(1)),Y(L(5)),Y(L(6)),Y(L(7)),Y(L(9)),Y(L(10)),Y(L(1MAN1810
     11)),Y(L(12)),Y(L(13)),Y(L(14)),Y(L(15)),Y(L(17)),Y(L(18)),Y(L(19))MAN1820
     2,Y(L(20)),Y(L(21)),Y(L(22)),Y(L(23)),Y(L(24)),Y(L(29)),Y(L(32)))  MAN1830
      CALL PRNTAI(Y(L(1)),Y(L(8)),Y(L(9)),Y(L(12)),Y(L(14)),Y(L(29)),Y(LMAN1840
     1(32)))                                                           MAN1850
C     ..............................................................MAN1860
C                                                                      MAN1870
C     ---START COMPUTATIONS---                                         MAN1880
C     ************************                                         MAN1890
C     ---READ AND WRITE DATA FOR GROUPS II AND III---                  MAN1900
      CALL DATAIN                                                      MAN1910
      CALL ARRAY(Y(L(12)),IFMT3,NAME(1),2)                             MAN1920
      IF (WATER.EQ.CHK(2)) GO TO 240                                   MAN1930
      CALL ARRAY(Y(L(9)),IFMT3,NAME(10),3)                             MAN1940
      GO TO 250                                                        MAN1950
  240 CALL ARRAY(Y(L(17)),IFMT1,NAME(19),4)                            MAN1960
      CALL ARRAY(Y(L(18)),IFMT2,NAME(28),5)                            MAN1970
      CALL ARRAY(Y(L(19)),IFMT3,NAME(37),6)                            MAN1980
  250 IF (CONVRT.EQ.CHK(7)) CALL ARRAY(Y(L(23)),IFMT2,NAME(46),7)      MAN1990
      IF (LEAK.NE.CHK(9)) GO TO 260                                    MAN2000
      CALL ARRAY(Y(L(20)),IFMT1,NAME(55),8)                            MAN2010
      CALL ARRAY(Y(L(21)),IFMT2,NAME(64),9)                            MAN2020
      CALL ARRAY(Y(L(22)),IFMT2,NAME(73),10)                           MAN2030
  260 IF (EVAP.EQ.CHK(6)) CALL ARRAY(Y(L(24)),IFMT2,NAME(82),11)       MAN2040
      IF (RECH.EQ.CHK(10)) CALL ARRAY(Y(L(13)),IFMT1,NAME(91),12)      MAN2050
      CALL MDAT                                                        MAN2060
C                                                                      MAN2070
C     ---INITIALIZE TRANSMISSIVITY VALUES IN WATER TABLE PROBLEM---    MAN2080
      KT=0                                                             MAN2090
      IF (WATER.EQ.CHK(2)) CALL TRANS                                  MAN2100
C                                                                      MAN2110
C     ---COMPUTE ITERATION PARAMETERS---                               MAN2120
      IF (NUMS.EQ.CHK(11)) CALL ITER1                                  MAN2130
      IF (NUMS.EQ.CHK(12)) CALL ITER2                                  MAN2140
      IF (NUMS.EQ.CHK(13)) CALL ITER3                                  MAN2150
C                                                                      MAN2160
C     ---INITIALIZE PARAMETERS FOR ALPHAMERIC MAP---                   MAN2170
      IF (CONTR.EQ.CHK(3)) CALL MAP                                    MAN2180
C                                                                      MAN2190
C     ---COMPUTE T COEFFICIENTS FOR ARTESIAN PROBLEM---                MAN2200
      IF (WATER.NE.CHK(2)) CALL TCOF                                   MAN2210
C                                                                      MAN2220
C     ---READ TIME PARAMETERS AND PUMPING DATA FOR A NEW PUMPING PERIOD-MAN2230
  270 CALL NEWPER                                                      MAN2240
C                                                                      MAN2250
      KT=0                                                             MAN2260
      IFINAL=0                                                         MAN2270
      IERR=0                                                           MAN2280
C                                                                      MAN2290
C     ---START NEW TIME STEP COMPUTATIONS---                           MAN2300
  280 CALL NEWSTP                                                      MAN2310
C                                                                      MAN2320
C     ---COMPUTE TRANSIENT PART OF LEAKAGE TERM---                     MAN2330
      IF (LEAK.EQ.CHK(9).AND.SS.NE.0.) CALL CLAY                       MAN2340
C                                                                      MAN2350
C     ---ENTER APPROPIATE SOLUTION ROUTINE AND COMPUTE SOLUTION---     MAN2360
      IF (NUMS.EQ.CHK(11)) CALL NEWITA                                 MAN2370
      IF (NUMS.EQ.CHK(12)) CALL NEWITB                                 MAN2380
      IF (NUMS.EQ.CHK(13)) CALL NEWITC                                 MAN2390
C                                                                      MAN2400
C     ---CHECK FOR STEADY STATE AND PRINT OUTPUT AT DESIGNATED         MAN2410
```

Program listing—Continued

```
C     TIME STEPS---                                                     MAN2420
      CALL STEADY                                                       MAN2430
C                                                                       MAN2440
C     ---LAST TIME STEP IN PUMPING PERIOD ?---                          MAN2450
      IF (IFINAL.NE.1) GO TO 280                                        MAN2460
C                                                                       MAN2470
C     ---CHECK FOR NEW PUMPING PERIOD---                                MAN2480
      IF (KP.LT.NPER) GO TO 270                                         MAN2490
C                                                                       MAN2500
C     ---DISK OUTPUT IF DESIRED---                                      MAN2510
      IF (IDK2.NE.CHK(15)) GO TO 290                                    MAN2520
      CALL DISK                                                         MAN2530
C                                                                       MAN2540
C     ---PUNCHED OUTPUT IF DESIRED---                                   MAN2550
  290 IF (PNCH.NE.CHK(1)) GO TO 300                                     MAN2560
      CALL PUNCH                                                        MAN2570
C                                                                       MAN2580
C     ---CHECK FOR NEW PROBLEM---                                       MAN2590
  300 READ (R,320,END=310) NEXT                                         MAN2600
      IF (NEXT.EQ.0) GO TO 10                                           MAN2610
  310 STOP                                                              MAN2620
C     ..............................................................MAN2630
C                                                                       MAN2640
C     ---FORMATS---                                                     MAN2650
C     ---------------------------------------------------------------MAN2660
C                                                                       MAN2670
C                                                                       MAN2680
  320 FORMAT (4I10)                                                     MAN2690
  330 FORMAT ('0',54X,'WORDS OF Y VECTOR USED =',I7)                    MAN2700
  340 FORMAT ('0',62X,'NUMBER OF ROWS =',I5/60X,'NUMBER OF COLUMNS =',I5MAN2710
     1/9X,'NUMBER OF WELLS FOR WHICH DRAWDOWN IS COMPUTED AT A SPECIFIEDMAN2720
     2 RADIUS =',I5,/,39X,'MAXIMUM PERMITTED NUMBER OF ITERATIONS =',I5)MAN2730
  350 FORMAT ('-',36X,'NO EQUATION SOLVING SCHEME SPECIFIED, EXECUTION TMAN2740
     1ERMINATED'/37X,58('*'))                                           MAN2750
  360 FORMAT ('1',60X,'U. S. G. S.'//55X,'FINITE-DIFFERENCE MODEL'/65X,'MAN2760
     1FOR'/51X,'SIMULATION OF GROUND-WATER FLOW'//60X,'JANUARY, 1975'//1MAN2770
     233('*')/'0',32A4//133('*'))                                       MAN2780
  370 FORMAT (20A4)                                                     MAN2790
  380 FORMAT (16(A4,1X))                                                MAN2800
  390 FORMAT ('-SIMULATION OPTIONS:  ',13(A4,4X))                       MAN2810
      END                                                               MAN2820-

      SUBROUTINE DATAI(PHI,STRT,SURI,T,TR,TC,S,QRE,WELL,TL,SL,PERM,BOTTCDAT  10
     1M,SY,RATE,RIVER,M,TOP,GRND,DELX,DELY,WR,NWR)                      DAT  20
C     ---------------------------------------------------------------DAT  30
C     READ AND WRITE INPUT DATA                                         DAT  40
C     ---------------------------------------------------------------DAT  50
C                                                                       DAT  60
C     SPECIFICATIONS:                                                   DAT  70
      REAL *8PHI,DBLE,XLABEL,YLABEL,TITLE,XN1,MESUR                     DAT  80
      REAL *4M                                                          DAT  90
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,DAT 100
     1CONTR,LEAK,RECH,SIP,ADI                                           DAT 110
C                                                                       DAT 120
      DIMENSION PHI(IZ,JZ), STRT(IZ,JZ), SURI(IZ,JZ), T(IZ,JZ), TR(IZ,JZDAT 130
     1), TC(IZ,JZ), S(IZ,JZ), QRE(IZ,JZ), WELL(IZ,JZ), TL(IZ,JZ), SL(IZ,DAT 140
     2JZ), PERM(IP,JP), BOTTOM(IP,JP), SY(IP,JP), RATE(IR,JR), RIVER(IR,DAT 150
     3JR), M(IR,JR), TOP(IC,JC), GRND(IL,JL), DELX(JZ), DELY(IZ), WR(IH)DAT 160
     4, NWR(IH,2), A(IZ,JZ), IN(9), IFMT(9)                             DAT 170
C                                                                       DAT 180
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Program listing—Continued

```
      COMMON /SARRAY/ VF4(11),CHK(15)                                   DAT 190
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,FROR,LEDAT 200
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,DAT 210
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,DAT 220
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DIDAT 230
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 DAT 240
      COMMON /CK/ ETFLXT,STORT,QRET,CHST,CHDT,FLUXT,PUMPT,CFLUXT,FLXNT  DAT 250
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(5),XN1,MESUR,PRNT(122),BLANKDAT 260
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),DAT 270
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2                          DAT 280
      COMMON /ARSIZE/ IZ,JZ,IP,JP,IR,JR,IC,JC,IL,JL,IS,JS,IH,IMAX,IMX1  DAT 290
      RETURN                                                            DAT 300
C     ..................................................................DAT 310
C     ********************                                              DAT 320
      ENTRY DATAIN                                                      DAT 330
C     ********************                                              DAT 340
C                                                                       DAT 350
C     ---READ AND WRITE SCALAR PARAMETERS---                            DAT 360
      READ (R,500) CONTR,XSCALE,YSCALE,DINCH,FACT1,FACT2,MESUR          DAT 370
      IF (CONTR.EQ.CHK(3)) WRITE (P,610) XSCALE,YSCALE,MESUR,MESUR,DINCHDAT 380
     1,FACT1,FACT2                                                      DAT 390
      READ (R,490) NPER,KTH,ERR,EROR,SS,QET,ETDIST,LENGTH,HMAX,FACTX,FACDAT 400
     1TY                                                                DAT 410
      IF (ETDIST.LE.0.) ETDIST=1.                                       DAT 420
      WRITE (P,520) NPER,KTH,ERR,EROR,SS,QET,ETDIST,FACTX,FACTY         DAT 430
C                                                                       DAT 440
C     ---READ CUMULATIVE MASS BALANCE PARAMETERS---                     DAT 450
      READ (R,600) SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETFLDAT 460
     1XT,FLXNT                                                          DAT 470
      IF (IDK1.EQ.CHK(14)) GO TO 20                                     DAT 480
      IF (SUM.EQ.0.0) GO TO 40                                          DAT 490
      WRITE (P,480) SUM                                                 DAT 500
C     ..................................................................DAT 510
C                                                                       DAT 520
C     ---HEAD DATA TO CONTINUE PREVIOUS COMPUTATIONS READ HERE---       DAT 530
C     ------FROM CARDS:                                                 DAT 540
      DO 10 I=1,DIML                                                    DAT 550
      READ (R,540) (PHI(I,J),J=1,DIMW)                                  DAT 560
   10 WRITE (P,530) I,(PHI(I,J),J=1,DIMW)                               DAT 570
      GO TO 40                                                          DAT 580
C     ------READ AND WRITE DATA FROM UNIT 4 ON DISK RATHER THAN CARDS:  DAT 590
   20 READ (4) PHI,SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETFLDAT 600
     1XT,FLXNT                                                          DAT 610
      WRITE (P,480) SUM                                                 DAT 620
      DO 30 I=1,DIML                                                    DAT 630
   30 WRITE (P,530) I,(PHI(I,J),J=1,DIMW)                               DAT 640
      REWIND 4                                                          DAT 650
C     ............................... STRT (STARTING HEAD) ............DAT 660
   40 READ (R,490) FACT,IVAR,IPRN,IRECS,IRECD                           DAT 670
      IF (IRECS.EQ.1) READ (2'1) STRT                                   DAT 680
      IF ((IVAR.EQ.1.OR.IRECS.EQ.1).AND.IPRN.NE.1) WRITE (P,470)        DAT 690
      DO 80 I=1,DIML                                                    DAT 700
      IF (IVAR.EQ.1) READ (R,540) (STRT(I,J),J=1,DIMW)                  DAT 710
      DO 70 J=1,DIMW                                                    DAT 720
      IF (IRECS.EQ.1) GO TO 60                                          DAT 730
      IF (IVAR.NE.1) GO TO 50                                           DAT 740
      STRT(I,J)=STRT(I,J)*FACT                                          DAT 750
      GO TO 60                                                          DAT 760
   50 STRT(I,J)=FACT                                                    DAT 770
   60 SURI(I,J)=STRT(I,J)                                               DAT 780
      T(I,J)=0.                                                         DAT 785
```

Program listing—Continued

```
      TL(I,J)=0.                                                        DAT 790
      SL(I,J)=0.                                                        DAT 800
      TR(I,J)=0.                                                        DAT 810
      TC(I,J)=0.                                                        DAT 820
      WELL(I,J)=0.0                                                     DAT 830
      QRE(I,J)=0.                                                       DAT 840
   70 IF (SUM.EQ.0.0.AND.IDK1.NE.CHK(14)) PHI(I,J)=STRT(I,J)            DAT 850
      IF (IVAR.EQ.0.AND.IRECS.EQ.0.OR.IPRN.EQ.1) GO TO 80               DAT 860
      WRITE (P,530) I,(STRT(I,J),J=1,DIMW)                              DAT 870
   80 CONTINUE                                                          DAT 880
      IF (IVAR.NE.1.AND.IRECS.NE.1) WRITE (P,420) FACT                  DAT 890
      IF (IRECD.EQ.1) WRITE (2'1) STRT                                  DAT 900
      RETURN                                                            DAT 910
C                                                                       DAT 920
C     ---READ REMAINING ARRAYS FROM CARDS OR DISK (AS SPECIFIED IN THE  DAT 930
C        OPTIONS) AND WRITE THEM ON DISK IF SPECIFIED IN THE OPTIONS--- DAT 940
C     **************                                                    DAT 950
      ENTRY ARRAY(A,IFMT,IN,IRN)                                        DAT 960
C     **************                                                    DAT 970
      READ (R,490) FACT,IVAR,IPRN,IRECS,IRECD                           DAT 980
      IK=4*IRECS+2*IVAR+IPRN+1                                          DAT 990
      GO TO (90,90,110,110,140,140), IK                                 DAT1000
   90 DO 100 I=1,DIML                                                   DAT1010
      DO 100 J=1,DIMW                                                   DAT1020
  100 A(I,J)=FACT                                                       DAT1030
      WRITE (P,430) IN,FACT                                             DAT1040
      GO TO 160                                                         DAT1050
  110 IF (IK.EQ.3) WRITE (P,440) IN                                     DAT1060
      DO 130 I=1,DIML                                                   DAT1070
      READ (R,510) (A(I,J),J=1,DIMW)                                    DAT1080
      DO 120 J=1,DIMW                                                   DAT1090
  120 A(I,J)=A(I,J)*FACT                                                DAT1100
  130 IF (IK.EQ.3) WRITE (P,IFMT) I,(A(I,J),J=1,DIMW)                   DAT1110
      GO TO 160                                                         DAT1120
  140 READ (2'IRN) A                                                    DAT1130
      IF (IK.EQ.6) GO TO 160                                            DAT1140
      WRITE (P,440) IN                                                  DAT1150
      DO 150 I=1,DIML                                                   DAT1160
  150 WRITE (P,IFMT) I,(A(I,J),J=1,DIMW)                                DAT1170
  160 IF (IRECD.EQ.1) WRITE (2'IRN) A                                   DAT1180
      RETURN                                                            DAT1190
C                                                                       DAT1200
C     ---INSERT ZERO VALUES IN THE T OR PERM MATRIX AROUND THE          DAT1210
C        BORDER OF THE MODEL---                                         DAT1220
C     **************                                                    DAT1230
      ENTRY MDAT                                                        DAT1240
C     **************                                                    DAT1250
      DO 180 I=1,DIML                                                   DAT1260
      DO 180 J=1,DIMW                                                   DAT1270
      IF (WATER.EQ.CHK(2)) GO TO 170                                    DAT1280
      IF (I.EQ.1.OR.I.EQ.DIML.OR.J.EQ.1.OR.J.EQ.DIMW) T(I,J)=0.         DAT1290
      GO TO 180                                                         DAT1300
  170 IF (I.EQ.1.OR.I.EQ.DIML.OR.J.EQ.1.OR.J.EQ.DIMW) PERM(I,J)=0.      DAT1310
  180 CONTINUE                                                          DAT1320
C     ............................... DELX,DELY .......................DAT1330
      READ (R,490) FACT,IVAR,IPRN,IRECS,IRECD                           DAT1340
      IF (IRECS.EQ.1) GO TO 210                                         DAT1350
      IF (IVAR.EQ.1) READ (R,490) DELX                                  DAT1360
      DO 200 J=1,DIMW                                                   DAT1370
      IF (IVAR.NE.1) GO TO 190                                          DAT1380
      DELX(J)=DELX(J)*FACT                                              DAT1390
```

Program listing—Continued

```
      GO TO 200                                                         DAT1400
  190 DELX(J)=FACT                                                      DAT1410
  200 CONTINUE                                                          DAT1420
      GO TO 220                                                         DAT1430
  210 READ (2'13) DELX                                                  DAT1440
  220 IF (IRECD.EQ.1) WRITE (2'13) DELX                                 DAT1450
      IF (IVAR.EQ.1.OR.IRECS.EQ.1.AND.IPRN.NE.1) WRITE (P,550) DELX     DAT1460
      IF (IVAR.NE.1.AND.IRECS.NE.1) WRITE (P,450) FACT                  DAT1470
      READ (R,490) FACT,IVAR,IPRN,IRECS,IRECD                           DAT1480
      IF (IRECS.EQ.1) GO TO 250                                         DAT1490
      IF (IVAR.EQ.1) READ (R,490) DELY                                  DAT1500
      DO 240 I=1,DIML                                                   DAT1510
      IF (IVAR.NE.1) GO TO 230                                          DAT1520
      DELY(I)=DELY(I)*FACT                                              DAT1530
      GO TO 240                                                         DAT1540
  230 DELY(I)=FACT                                                      DAT1550
  240 CONTINUE                                                          DAT1560
      GO TO 260                                                         DAT1570
  250 READ (2'14) DELY                                                  DAT1580
  260 IF (IRECD.EQ.1) WRITE (2'14) DELY                                 DAT1590
      IF (IVAR.EQ.1.OR.IRECS.EQ.1.AND.IPRN.NE.1) WRITE (P,560) DELY     DAT1600
      IF (IVAR.NE.1.AND.IRECS.NE.1) WRITE (P,460) FACT                  DAT1610
C                                                                       DAT1620
C     ---INITIALIZE VARIABLES---                                        DAT1630
      JNO1=DIMW-1                                                       DAT1640
      INO1=DIML-1                                                       DAT1650
      IF (LEAK.NE.CHK(9).OR.SS.NE.0.) GO TO 280                         DAT1660
      DO 270 I=2,INO1                                                   DAT1670
      DO 270 J=2,JNO1                                                   DAT1680
      IF (M(I,J).EQ.0.) GO TO 270                                       DAT1690
      TL(I,J)=RATE(I,J)/M(I,J)                                          DAT1700
  270 CONTINUE                                                          DAT1710
  280 ETQB=0.0                                                          DAT1720
      ETQD=0.0                                                          DAT1730
      SUBS=0.0                                                          DAT1740
      U=1.0                                                             DAT1750
      TT=0.0                                                            DAT1760
      IM=MIN0(6*DIMW+4,124)                                             DAT1770
      IM=(132-IM)/2                                                     DAT1780
      VF4(3)=DIGIT(IM)                                                  DAT1790
      VF4(8)=DIGIT(IM+5)                                                DAT1800
      WIDTH=0.                                                          DAT1810
      DO 290 J=2,JNO1                                                   DAT1820
  290 WIDTH=WIDTH+DELX(J)                                               DAT1830
      YDIM=0.                                                           DAT1840
      DO 300 I=2,INO1                                                   DAT1850
  300 YDIM=YDIM+DELY(I)                                                 DAT1860
      RETURN                                                            DAT1870
C     ..................................................................DAT1880
C                                                                       DAT1890
C     ---READ TIME PARAMETERS AND PUMPING DATA FOR A NEW PUMPING PERIOD-DAT1900
C     ************************                                          DAT1910
      ENTRY NEWPER                                                      DAT1920
C     ************************                                          DAT1930
C                                                                       DAT1940
      READ (R,490) KP,KPM1,NWEL,TMAX,NUMT,CDLT,DELT                     DAT1950
C                                                                       DAT1960
C     ---COMPUTE ACTUAL DELT AND NUMT---                                DAT1970
      DT=DELT/24.                                                       DAT1980
      TM=0.0                                                            DAT1990
      DO 310 I=1,NUMT                                                   DAT2000
```

Program listing—Continued

```
      DT=CDLT*DT                                                        DAT2010
      TM=TM+DT                                                          DAT2020
      IF (TM.GE.TMAX) GO TO 320                                         DAT2030
  310 CONTINUE                                                          DAT2040
      GO TO 330                                                         DAT2050
  320 DELT=TMAX/TM*DELT                                                 DAT2060
      NUMT=I                                                            DAT2070
  330 WRITE (P,570) KP,TMAX,NUMT,DELT,CDLT                              DAT2080
      DELT=DELT*3600.                                                   DAT2090
      TMAX=TMAX*86400.                                                  DAT2100
C                                                                       DAT2110
C     ---INITIALIZE SUMP, STRT, SL, WELL AND WR---                      DAT2120
      WRITE (P,580) NWEL                                                DAT2130
      IF (KP.GT.KPM1) SUMP=0.                                           DAT2140
      DO 350 I=1,DIML                                                   DAT2150
      DO 350 J=1,DIMW                                                   DAT2160
      IF (KP.EQ.KPM1) GO TO 340                                         DAT2170
      STRT(I,J)=PHI(I,J)                                                DAT2180
  340 IF (LEAK.NE.CHK(9)) GO TO 350                                     DAT2190
      IF (M(I,J).EQ.0.) GO TO 350                                       DAT2200
      SL(I,J)=RATE(I,J)/M(I,J)*(RIVER(I,J)-STRT(I,J))                   DAT2210
  350 WELL(I,J)=0.                                                      DAT2220
      IF (NW.EQ.0) GO TO 370                                            DAT2230
      DO 360 I=1,NW                                                     DAT2240
  360 WR(I)=0.                                                          DAT2250
  370 IF (NWEL.EQ.0) GO TO 410                                          DAT2260
C                                                                       DAT2270
C     ---READ AND WRITE WELL PUMPING RATES AND WELL RADII---            DAT2280
      KW=0                                                              DAT2290
      DO 400 II=1,NWEL                                                  DAT2300
      READ (R,490) I,J,WELL(I,J),RADIUS                                 DAT2310
      IF (RADIUS.EQ.0.) GO TO 380                                       DAT2320
      KW=KW+1                                                           DAT2330
      IF (KW.GT.NW) GO TO 380                                           DAT2340
      NWR(KW,1)=I                                                       DAT2350
      NWR(KW,2)=J                                                       DAT2360
      WR(KW)=RADIUS                                                     DAT2370
      WRITE (P,590) I,J,WELL(I,J),WR(KW)                                DAT2380
      GO TO 390                                                         DAT2390
  380 WRITE (P,590) I,J,WELL(I,J)                                       DAT2400
  390 WELL(I,J)=WELL(I,J)/(DELX(J)*DELY(I))                             DAT2410
  400 CONTINUE                                                          DAT2420
  410 RETURN                                                            DAT2430
C     ..................................................................DAT2440
C                                                                       DAT2450
C     FORMATS:                                                          DAT2460
C                                                                       DAT2470
C     ------------------------------------------------------------------DAT2480
C                                                                       DAT2490
C                                                                       DAT2500
  420 FORMAT ('0',63X,'STARTING HEAD =',G15.7)                          DAT2510
  430 FORMAT ('0',41X,9A4,'=',G15.7)                                    DAT2520
  440 FORMAT ('1',49X,9A4,/,65X,'MATRIX',/,50X,36('-'))                 DAT2530
  450 FORMAT ('0',72X,'DELX =',G15.7)                                   DAT2540
  460 FORMAT ('0',72X,'DELY =',G15.7)                                   DAT2550
  470 FORMAT ('1',60X,'STARTING HEAD MATRIX'/61X,20('-'))               DAT2560
  480 FORMAT ('1',40X,' CONTINUATION - HEAD AFTER ',G20.7,' SEC PUMPING DAT2570
     1'/42X,58('-'))                                                    DAT2580
  490 FORMAT (8G10.0)                                                   DAT2590
  500 FORMAT (A4,6X,5G10.0,A8)                                          DAT2600
  510 FORMAT (20F4.0)                                                   DAT2610
```

Program listing—Continued

```
  520 FORMAT ('0',51X,'NUMBER OF PUMPING PERIODS =',I5/49X,'TIME STEPS BDAT2620
     1ETWEEN PRINTOUTS =',I5//51X,'ERROR CRITERIA FOR CLOSURE =',G15.7/4DAT2630
     21X,'          STEADY STATE ERROR CRITERIA =',G15.7//44X,'SPECIFIC SDAT2640
     3TORAGE OF CONFINING BED =',G15.7/54X,'EVAPOTRANSPIRATION RATE =',GDAT2650
     415.7/56X,'EFFECTIVE DEPTH OF ET =',G15.7//22X,'MULTIPLICATION FACTDAT2660
     5OR FOR TRANSMISSIVITY IN X DIRECTION =',G15.7/63X,'IN Y DIRECTION DAT2670
     6=',G15.7)                                                         DAT2680
  530 FORMAT ('0',I2,2X,20F6.1/(5X,20F6.1))                             DAT2690
  540 FORMAT (8F10.4)                                                   DAT2700
  550 FORMAT (1H1,46X,40HGRID SPACING IN PROTOTYPE IN X DIRECTION/47X,40DAT2710
     1('-')//('0',12F10.0))                                             DAT2720
  560 FORMAT (1H-,46X,40HGRID SPACING IN PROTOTYPE IN Y DIRECTION/47X,40DAT2730
     1('-')//('0',12F10.0))                                             DAT2740
  570 FORMAT ('-',50X,'PUMPING PERIOD NO.',I4,':',F10.2,' DAYS'/51X,38('DAT2750
     1-')//53X,'NUMBER OF TIME STEPS=',I6//59X,'DELT IN HOURS =',F10.3//DAT2760
     253X,'MULTIPLIER FOR DELT =',F10.3)                                DAT2770
  580 FORMAT ('-',63X,I4,' WELLS'/65X,9('-')//50X,'I',9X,'J    PUMPING RDAT2780
     1ATE  WELL RADIUS'/)                                               DAT2790
  590 FORMAT (41X,2I10,2F13.2)                                          DAT2800
  600 FORMAT (4G20.10)                                                  DAT2810
  610 FORMAT ('0',30X,'ON ALPHAMERIC MAP:'/40X,'MULTIPLICATION FACTOR FODAT2820
     1R X DIMENSION =',G15.7/40X,'MULTIPLICATION FACTOR FOR Y DIMENSION DAT2830
     2=',G15.7/55X,'MAP SCALE IN UNITS OF  ',A11/50X,'NUMBER OF ',A8,' PDAT2840
     3ER INCH =',G15.7/43X,'MULTIPLICATION FACTOR FOR DRAWDOWN =',G15.7/DAT2850
     447X,'MULTIPLICATION FACTOR FOR HEAD =',G15.7)                     DAT2860
      END                                                               DAT2870-


      SUBROUTINE STEP(PHI,KEEP,STRT,SURI,T,WELL,PERM,BOTTOM,TOP,DELX,DDNSTP  10
     1,DELY,WR,NWR,TEST3)                                               STP  20
C     ------------------------------------------------------------------STP  30
C     INITIALIZE DATA FOR TIME STEP, CHECK FOR STEADY STATE,            STP  40
C     PRINT AND  PUNCH RESULTS                                          STP  50
C     ------------------------------------------------------------------STP  60
C                                                                       STP  70
C     SPECIFICATIONS:                                                   STP  80
      REAL *8PHI,DBLE,DABS,TEST2,DMAX1,XLABEL,YLABEL,XN1,MESUR,TITLE    STP  90
      REAL *4MINS,M,KEEP                                                STP 100
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,STP 110
     1CONTR,LEAK,RECH,SIP,ADI                                           STP 120
C                                                                       STP 130
      DIMENSION PHI(IZ,JZ), KEEP(IZ,JZ), STRT(IZ,JZ), SURI(IZ,JZ), T(IZ,STP 140
     1JZ), BOTTOM(IP,JP), WELL(IZ,JZ), PERM(IP,JP), TOP(IC,JC), DELX(JZ)STP 150
     2, DDN(JZ), DELY(IZ), WR(IH), NWR(IH,2), ITTO(200), TEST3(IMX1)    STP 160
C                                                                       STP 170
      COMMON /SARRAY/ VF4(11),CHK(15)                                   STP 180
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LESTP 190
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,STP 200
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,STP 210
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DISTP 220
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 STP 230
      COMMON /CK/ ETFLXT,STORT,QRET,CHST,CHDT,FLUXT,PUMPT,CFLUXT,FLXNT  STP 240
      COMMON /ARSIZE/ IZ,JZ,IP,JP,IR,JR,IC,JC,IL,JL,IS,JS,IH,IMAX,IMX1  STP 250
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(5),XN1,MESUR,PRNT(122),BLANKSTP 260
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),STP 270
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2                          STP 280
C                                                                       STP 290
      DATA PIE/3.141593/,YYY/Z00000000/                                 STP 300
      RETURN                                                            STP 310
C     ..................................................................STP 320
C                                                                       STP 330
```

Program listing—Continued

```
C     ---START A NEW TIME STEP---                                       STP 340
C     ********************                                              STP 350
      ENTRY NEWSTP                                                      STP 360
C     ********************                                              STP 370
      KT=KT+1                                                           STP 380
      KOUNT=0                                                           STP 390
      DO 10 I=1,DIML                                                    STP 400
      DO 10 J=1,DIMW                                                    STP 410
   10 KEEP(I,J)=PHI(I,J)                                                STP 420
      DELT=CDLT*DELT                                                    STP 430
      SUM=SUM+DELT                                                      STP 440
      SUMP=SUMP+DELT                                                    STP 450
      DAYSP=SUMP/86400.                                                 STP 460
      YRSP=DAYSP/365.                                                   STP 470
      HRS=SUM/3600.                                                     STP 480
      MINS=HRS*60.                                                      STP 490
      DAYS=HRS/24.                                                      STP 500
      YRS=DAYS/365.                                                     STP 510
      RETURN                                                            STP 520
C     ..................................................................STP 530
C                                                                       STP 540
C     ---CHECK FOR STEADY STATE---                                      STP 550
C     *********************                                             STP 560
      ENTRY STEADY                                                      STP 570
C     *********************                                             STP 580
      TEST2=0.                                                          STP 590
      DO 20 I=2,INO1                                                    STP 600
      DO 20 J=2,JNO1                                                    STP 610
   20 TEST2=DMAX1(TEST2,DABS(DBLE(KEEP(I,J))-PHI(I,J)))                 STP 620
      IF (TEST2.GE.EROR) GO TO 30                                       STP 630
      WRITE (P,330) KT                                                  STP 640
      IFINAL=1                                                          STP 650
      GO TO 40                                                          STP 660
   30 IF (KT.EQ.NUMT) IFINAL=1                                          STP 670
C                                                                       STP 680
C     ---ENTRY FOR TERMINATING COMPUTATIONS IF MAXIMUM ITERATIONS       STP 690
C     EXCEEDED---                                                       STP 700
C     *********************                                             STP 710
      ENTRY TERM1                                                       STP 720
C     *********************                                             STP 730
   40 IF (KT.GT.200) WRITE (P,400)                                      STP 740
      ITTO(KT)=KOUNT                                                    STP 750
      IF (KOUNT.LE.ITMAX) GO TO 80                                      STP 760
      IERR=2                                                            STP 770
      KOUNT=KOUNT-1                                                     STP 780
      ITTO(KT)=KOUNT                                                    STP 790
      IF (KT.EQ.1) GO TO 60                                             STP 800
C                                                                       STP 810
C     ---WRITE ON DISK OR PUNCH CARDS AS SPECIFIED IN THE OPTIONS---    STP 820
      XXX=SUM-DELT                                                      STP 830
      IF (IDK2.EQ.CHK(15)) WRITE (4) ((KEEP(I,J),YYY,I=1,DIML),J=1,DIMW)STP 840
     1,XXX,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETFLXT,FLXNT    STP 850
      IF (PNCH.NE.CHK(1)) GO TO 80                                      STP 860
      WRITE (PU,360) XXX,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETSTP 870
     1FLXT,FLXNT                                                        STP 880
      DO 50 I=1,DIML                                                    STP 890
   50 WRITE (PU,350) (KEEP(I,J),J=1,DIMW)                               STP 900
      GO TO 80                                                          STP 910
   60 IF (IDK2.EQ.CHK(15)) WRITE (4) PHI,SUM,SUMP,PUMPT,CFLUXT,QRET,CHSTSTP 920
     1,CHDT,FLUXT,STORT,ETFLXT,FLXNT                                    STP 930
      IF (PNCH.NE.CHK(1)) GO TO 80                                      STP 940
```

Program listing—Continued

```
      WRITE (PU,360) SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETSTP 950
     1FLXT,FLXNT                                                        STP 960
      DO 70 I=1,DIML                                                    STP 970
   70 WRITE (PU,350) (PHI(I,J),J=1,DIMW)                                STP 980
C                                                                       STP 990
   80 IF (CHCK.EQ.CHK(5)) CALL CHECK                                    STP1000
      IF (IERR.EQ.2) GO TO 90                                           STP1010
C                                                                       STP1020
C     ---PRINT OUTPUT AT DESIGNATED TIME STEPS---                       STP1030
      IF (MOD(KT,KTH).NE.0.AND.IFINAL.NE.1) RETURN                      STP1040
   90 WRITE (P,340) KT,DELT,SUM,MINS,HRS,DAYS,YRS,DAYSP,YRSP            STP1050
      IF (CHCK.EQ.CHK(5)) CALL CWRITE                                   STP1060
      IF (TT.NE.0.) WRITE (P,320) TMIN,TT                               STP1070
      KOUNT=KOUNT+1                                                     STP1080
      WRITE (P,300) (TEST3(J),J=1,KOUNT)                                STP1090
      WRITE (P,290) TEST2                                               STP1100
      I3=1                                                              STP1110
      I5=0                                                              STP1120
  100 I5=I5+40                                                          STP1130
      I4=MIN0(KT,I5)                                                    STP1140
      WRITE (P,390) (I,I=I3,I4)                                         STP1150
      WRITE (P,380)                                                     STP1160
      WRITE (P,370) (ITTO(I),I=I3,I4)                                   STP1170
      WRITE (P,380)                                                     STP1180
      IF (KT.LE.I5) GO TO 110                                           STP1190
      I3=I3+40                                                          STP1200
      GO TO 100                                                         STP1210
C                                                                       STP1220
C     ---PRINT ALPHAMERIC MAPS---                                       STP1230
  110 IF (CONTR.NE.CHK(3)) GO TO 120                                    STP1240
      IF (FACT1.NE.0.) CALL PRNTA(1)                                    STP1250
      IF (FACT2.NE.0.) CALL PRNTA(2)                                    STP1260
  120 IF (HEAD.NE.CHK(8)) GO TO 140                                     STP1270
C                                                                       STP1280
C     ---PRINT HEAD MATRIX---                                           STP1290
      WRITE (P,310)                                                     STP1300
      DO 130 I=1,DIML                                                   STP1310
  130 WRITE (P,VF4) I,(PHI(I,J),J=1,DIMW)                               STP1320
  140 IF (NUM.NE.CHK(4)) GO TO 170                                      STP1330
C                                                                       STP1340
C     ---PRINT DRAWDOWN---                                              STP1350
      WRITE (P,280)                                                     STP1360
C     ******************                                                STP1370
      ENTRY DRDN                                                        STP1380
C     ******************                                                STP1390
      DO 160 I=1,DIML                                                   STP1400
      DO 150 J=1,DIMW                                                   STP1410
  150 DDN(J)=SURI(I,J)-PHI(I,J)                                         STP1420
  160 WRITE (P,VF4) I,(DDN(J),J=1,DIMW)                                 STP1430
  170 IF (NW.EQ.0.OR.IERR.EQ.1) GO TO 230                               STP1440
C     ..................................................................STP1450
C                                                                       STP1460
C     ---COMPUTE APPROXIMATE HEAD FOR PUMPING WELLS---                  STP1470
      WRITE (P,260)                                                     STP1480
      DO 220 KW=1,NW                                                    STP1490
      IF (WR(KW).EQ.0.) GO TO 220                                       STP1500
      I=NWR(KW,1)                                                       STP1510
      J=NWR(KW,2)                                                       STP1520
C                                                                       STP1530
C     COMPUTE EFFECTIVE RADIUS OF WELL IN MODEL---                      STP1540
      RE=(DELX(J)+DELY(I))/9.62                                         STP1550
```

Program listing—Continued

```
      IF (WATER.NE.CHK(2)) GO TO 180                                    STP1560
      IF (CONVRT.NE.CHK(7)) GO TO 190                                   STP1570
      IF (PHI(I,J).LT.TOP(I,J)) GO TO 190                               STP1580
C                                                                       STP1590
C     ---COMPUTATION FOR WELL IN ARTESIAN AQUIFER---                    STP1600
  180 HW=PHI(I,J)+WELL(I,J)*ALOG(RE/WR(KW))/(2.*PIE*T(I,J))*DELX(J)*DELYSTP1610
     1(I)                                                               STP1620
      GO TO 210                                                         STP1630
C                                                                       STP1640
C     ---COMPUTATION FOR WELL IN WATER TABLE AQUIFER                    STP1650
  190 HED=PHI(I,J)-BOTTOM(I,J)                                          STP1660
      ARG=HED*HED+WELL(I,J)*ALOG(RE/WR(KW))/(PIE*PERM(I,J))*DELX(J)*DELYSTP1670
     1(I)                                                               STP1680
      IF (ARG.GT.0.) GO TO 200                                          STP1690
      WRITE (P,270) I,J                                                 STP1700
      GO TO 220                                                         STP1710
  200 HW=SQRT(ARG)+BOTTOM(I,J)                                          STP1720
C                                                                       STP1730
C     ---COMPUTE DRAWDOWN AT THE WELL AND PRINT RESULTS---              STP1740
  210 DRAW=SURI(I,J)-HW                                                 STP1750
      WRITE (P,250) I,J,WR(KW),HW,DRAW                                  STP1760
  220 CONTINUE                                                          STP1770
  230 IF (IERR.NE.2) RETURN                                             STP1780
      STOP                                                              STP1790
C                                                                       STP1800
C     ---DISK OUTPUT---                                                 STP1810
C     ****************                                                  STP1820
      ENTRY DISK                                                        STP1830
C     ****************                                                  STP1840
      WRITE (4) PHI,SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETFSTP1850
     1LXT,FLXNT                                                         STP1860
      RETURN                                                            STP1870
C     ..................................................................STP1880
C                                                                       STP1890
C     ---PUNCHED OUTPUT---                                              STP1900
C     ********************                                              STP1910
      ENTRY PUNCH                                                       STP1920
C     ********************                                              STP1930
      WRITE (PU,360) SUM,SUMP,PUMPT,CFLUXT,QRET,CHST,CHDT,FLUXT,STORT,ETSTP1940
     1FLXT,FLXNT                                                        STP1950
      DO 240 I=1,DIML                                                   STP1960
  240 WRITE (PU,350) (PHI(I,J),J=1,DIMW)                                STP1970
      RETURN                                                            STP1980
C                                                                       STP1990
C     ..................................................................STP2000
C                                                                       STP2010
C     FORMATS:                                                          STP2020
C                                                                       STP2030
C                                                                       STP2040
C     ------------------------------------------------------------------STP2050
C                                                                       STP2060
C                                                                       STP2070
  250 FORMAT (' ',43X,2I5,3F11.2)                                       STP2080
  260 FORMAT ('-',50X,'HEAD AND DRAWDOWN IN PUMPING WELLS'/51X,34('-')//STP2090
     148X,'I    J   WELL RADIUS    HEAD    DRAWDOWN'//)                 STP2100
  270 FORMAT (' ',43X,2I5,'  WELL IS DRY')                              STP2110
  280 FORMAT (1H1,60X,'DRAWDOWN'/61X,8('-'))                            STP2120
  290 FORMAT ('0MAXIMUM CHANGE IN HEAD FOR THIS TIME STEP =',F10.3/' ',5STP2130
     13('-'))                                                           STP2140
  300 FORMAT ('0MAXIMUM HEAD CHANGE FOR EACH ITERATION:'/' ',39('-')/('0STP2150
     1',10F12.4))                                                       STP2160
```

Program listing—Continued

```
  310 FORMAT ('1',60X,'HEAD MATRIX'/61X,11('-'))                        STP2170
  320 FORMAT ('0DIMENSIONLESS TIME FOR THIS STEP RANGES FROM',G15.7,'  TSTP2180
     1O',G15.7)                                                         STP2190
  330 FORMAT ('-*****STEADY STATE AT TIME STEP',I4,'*****')             STP2200
  340 FORMAT (1H1,44X,57('-')/45X,'|',14X,'TIME STEP NUMBER =',I9,14X,'|STP2210
     1'/45X,57('-')//50X,29HSIZE OF TIME STEP IN SECONDS=,F14.2//55X,'TOSTP2220
     2TAL SIMULATION TIME IN SECONDS=',F14.2/80X,8HMINUTES=,F14.2/82X,6HSTP2230
     3HOURS=,F14.2/83X,5HDAYS=,F14.2/82X,'YEARS=',F14.2///45X,'DURATION STP2240
     4OF CURRENT PUMPING PERIOD IN DAYS=',F14.2/82X,'YEARS=',F14.2//)   STP2250
  350 FORMAT (8F10.4)                                                   STP2260
  360 FORMAT (4G20.10)                                                  STP2270
  370 FORMAT ('0ITERATIONS:',40I3)                                      STP2280
  380 FORMAT (' ',10('-'))                                              STP2290
  390 FORMAT ('0TIME STEP :',40I3)                                      STP2300
  400 FORMAT ('0',10('*'),'THE NUMBER OF TIME STEPS EXCEEDS THE DIMENSIOSTP2310
     1N OF THE VECTOR ITTO AND MAY CAUSE UNEXPECTED RESULTS IN ADDITIONASTP2320
     2L'/'0COMPUTATION.  AVOID PROBLEMS BY INCREASING THE DIMENSION OF TSTP2330
     3HE VECTOR ITTO IN STEP',10('*'))                                  STP2340
      END                                                               STP2350-


      SUBROUTINE SOLVE1(PHI,BE,G,TEMP,KEEP,PHE,STRT,T,S,QRE,WELL,TL,SL,DSIP  10
     1EL,ETA,V,XI,DELX,BET,DELY,ALF,TEST3,TR,TC,GRND,SY,TOP,RATE,M,RIVERSIP  20
     2)                                                                 SIP  30
C     ------------------------------------------------------------------SIP  40
C      SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE                      SIP  50
C     ------------------------------------------------------------------SIP  60
C                                                                       SIP  70
C     SPECIFICATIONS:                                                   SIP  80
      REAL *8PHI,DBLE,RHOP(20),G,BE,TEMP,DABS,W,TEST2,DMAX1,RHO,B,D,F,H,SIP  90
     1B1,E,CH,GH,BH,DH,EH,FH,HH,ALFA,BETA,GAMA,RES                      SIP 100
      REAL *4KEEP,M                                                     SIP 110
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,SIP 120
     1CONTR,LEAK,RECH,SIP,IORDER(21),ADI                                SIP 130
C                                                                       SIP 140
      DIMENSION PHI(1), BE(1), G(1), TEMP(1), KEEP(1), PHE(1), STRT(1), SIP 150
     1T(1), S(1), QRE(1), WELL(1), TL(1), SL(1), DEL(1), ETA(1), V(1), XSIP 160
     2I(1), DELX(1), BET(1), DELY(1), ALF(1), TEST3(1), TR(1), TC(1), GRSIP 170
     3ND(1), SY(1), TOP(1), RATE(1), M(1), RIVER(1)                     SIP 180
C                                                                       SIP 190
      COMMON /SARRAY/ VF4(11),CHK(15)                                   SIP 200
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LESIP 210
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,SIP 220
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,SIP 230
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DISIP 240
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 SIP 250
      RETURN                                                            SIP 260
C     ..................................................................SIP 270
C                                                                       SIP 280
C     ---COMPUTE AND PRINT ITERATION PARAMETERS---                      SIP 290
C     ********************                                              SIP 300
      ENTRY ITER1                                                       SIP 310
C     ********************                                              SIP 320
C     ---INITIALIZE ORDER OF ITERATION PARAMETERS (OR REPLACE WITH A    SIP 330
C     READ STATEMENT)---                                                SIP 340
      DATA IORDER/1,2,3,4,5,1,2,3,4,5,11*1/                             SIP 350
      I2=INO1-1                                                         SIP 360
      J2=JNO1-1                                                         SIP 370
      L2=LENGTH/2                                                       SIP 380
      PL2=L2-1.                                                         SIP 390
      W=0.                                                              SIP 400
```

Program listing—Continued

```
      PI=0.                                                             SIP 410
C                                                                       SIP 420
C     ---COMPUTE AVERAGE MAXIMUM PARAMETER FOR PROBLEM---               SIP 430
      DO 10 I=2,INO1                                                    SIP 440
      DO 10 J=2,JNO1                                                    SIP 450
      N=I+DIML*(J-1)                                                    SIP 460
      IF (T(N).EQ.0.) GO TO 10                                          SIP 470
      PI=PI+1.                                                          SIP 480
      DX=DELX(J)/WIDTH                                                  SIP 490
      DY=DELY(I)/YDIM                                                   SIP 500
      W=W+1.-AMIN1(2.*DX*DX/(1.+FACTY*DX*DX/(FACTX*DY*DY)),2.*DY*DY/(1.+SIP 510
     1FACTX*DY*DY/(FACTY*DX*DX)))                                       SIP 520
   10 CONTINUE                                                          SIP 530
      W=W/PI                                                            SIP 540
C                                                                       SIP 550
C     ---COMPUTE PARAMETERS IN GEOMETRIC SEQUENCE---                    SIP 560
      PJ=-1.                                                            SIP 570
      DO 20 I=1,L2                                                      SIP 580
      PJ=PJ+1.                                                          SIP 590
   20 TEMP(I)=1.-(1.-W)**(PJ/PL2)                                       SIP 600
C                                                                       SIP 610
C     ---ORDER SEQUENCE OF PARAMETERS---                                SIP 620
      DO 30 J=1,LENGTH                                                  SIP 630
   30 RHOP(J)=TEMP(IORDER(J))                                           SIP 640
      WRITE (P,370) HMAX                                                SIP 650
      WRITE (P,380) LENGTH,(RHOP(J),J=1,LENGTH)                         SIP 660
      RETURN                                                            SIP 670
C     ..................................................................SIP 680
C                                                                       SIP 690
C     ---INITIALIZE DATA FOR A NEW ITERATION---                         SIP 700
   40 KOUNT=KOUNT+1                                                     SIP 710
      IF (KOUNT.LE.ITMAX) GO TO 50                                      SIP 720
      WRITE (P,360)                                                     SIP 730
      CALL TERM1                                                        SIP 740
   50 IF (MOD(KOUNT,LENGTH)) 60,60,70                                   SIP 750
C     ************************                                          SIP 760
      ENTRY NEWITA                                                      SIP 770
C     ************************                                          SIP 780
   60 NTH=0                                                             SIP 790
   70 NTH=NTH+1                                                         SIP 800
      W=RHOP(NTH)                                                       SIP 810
      TEST3(KOUNT+1)=0.                                                 SIP 820
      TEST=0.                                                           SIP 830
      N=DIML*DIMW                                                       SIP 840
      DO 80 I=1,N                                                       SIP 850
      PHE(I)=PHI(I)                                                     SIP 860
      DEL(I)=0.                                                         SIP 870
      ETA(I)=0.                                                         SIP 880
      V(I)=0.                                                           SIP 890
   80 XI(I)=0.                                                          SIP 900
      BIGI=0.0                                                          SIP 910
C                                                                       SIP 920
C     ---COMPUTE TRANSMISSIVITY AND T COEFFICIENTS IN WATER TABLE       SIP 930
C     OR WATER TABLE-ARTESIAN SIMUATION---                              SIP 940
      IF (WATER.NE.CHK(2)) GO TO 90                                     SIP 950
      CALL TRANS                                                        SIP 960
C                                                                       SIP 970
C     ---CHOOSE SIP NORMAL OR REVERSE ALGORITHM---                      SIP 980
   90 IF (MOD(KOUNT,2)) 100,230,100                                     SIP 990
C     ..................................................................SIP1000
C     ---ORDER EQUATIONS WITH ROW 1 FIRST - 3X3 EXAMPLE:                SIP1010
```

Program listing—Continued

```
C               1 2 3                                                   SIP1020
C               4 5 6                                                   SIP1030
C               7 8 9                                                   SIP1040
C      ..............................................................SIP1050
  100 DO 210 I=2,INO1                                                   SIP1060
      DO 210 J=2,JNO1                                                   SIP1070
      N=I+DIML*(J-1)                                                    SIP1080
      NL=N-DIML                                                         SIP1090
      NR=N+DIML                                                         SIP1100
      NA=N-1                                                            SIP1110
      NB=N+1                                                            SIP1120
C                                                                       SIP1130
C     ---SKIP COMPUTATIONS IF NODE IS OUTSIDE AQUIFER BOUNDARY---       SIP1140
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 210                           SIP1150
C                                                                       SIP1160
C     ---COMPUTE COEFFICIENTS---                                        SIP1170
      D=TR(NL)/DELX(J)                                                  SIP1180
      F=TR(N)/DELX(J)                                                   SIP1190
      B=TC(NA)/DELY(I)                                                  SIP1200
      H=TC(N)/DELY(I)                                                   SIP1210
      IF (EVAP.NE.CHK(6)) GO TO 120                                     SIP1220
C                                                                       SIP1230
C     ---COMPUTE EXPLICIT AND IMPLICIT PARTS OF ET RATE---              SIP1240
      ETQB=0.                                                           SIP1250
      ETQD=0.0                                                          SIP1260
      IF (PHE(N).LE.GRND(N)-ETDIST) GO TO 120                           SIP1270
      IF (PHE(N).GT.GRND(N)) GO TO 110                                  SIP1280
      ETQB=QET/ETDIST                                                   SIP1290
      ETQD=ETQB*(ETDIST-GRND(N))                                        SIP1300
      GO TO 120                                                         SIP1310
  110 ETQD=QET                                                          SIP1320
C                                                                       SIP1330
C     ---COMPUTE STORAGE TERM---                                        SIP1340
  120 IF (CONVRT.EQ.CHK(7)) GO TO 130                                   SIP1350
      RHO=S(N)/DELT                                                     SIP1360
      IF (WATER.EQ.CHK(2)) RHO=SY(N)/DELT                               SIP1370
      GO TO 200                                                         SIP1380
C                                                                       SIP1390
C     ---COMPUTE STORAGE COEFFICIENT FOR CONVERSION PROBLEM---          SIP1400
  130 SUBS=0.0                                                          SIP1410
      IF (KEEP(N).GE.TOP(N).AND.PHE(N).GE.TOP(N)) GO TO 170             SIP1420
      IF (KEEP(N).LT.TOP(N).AND.PHE(N).LT.TOP(N)) GO TO 160             SIP1430
      IF (KEEP(N)-PHE(N)) 140,150,150                                   SIP1440
  140 SUBS=(SY(N)-S(N))/DELT*(KEEP(N)-TOP(N))                           SIP1450
      GO TO 170                                                         SIP1460
  150 SUBS=(S(N)-SY(N))/DELT*(KEEP(N)-TOP(N))                           SIP1470
  160 RHO=SY(N)/DELT                                                    SIP1480
      GO TO 180                                                         SIP1490
  170 RHO=S(N)/DELT                                                     SIP1500
  180 IF (LEAK.NE.CHK(9)) GO TO 200                                     SIP1510
C                                                                       SIP1520
C     ---COMPUTE NET LEAKAGE TERM FOR CONVERSION SIMULATION---          SIP1530
      IF (RATE(N).EQ.0..OR.M(N).EQ.0.) GO TO 200                        SIP1540
      HED1=AMAX1(STRT(N),TOP(N))                                        SIP1550
      U=1.                                                              SIP1560
      HED2=0.                                                           SIP1570
      IF (PHE(N).GE.TOP(N)) GO TO 190                                   SIP1580
      HED2=TOP(N)                                                       SIP1590
      U=0.                                                              SIP1600
  190 SL(N)=RATE(N)/M(N)*(RIVER(N)-HED1)+TL(N)*(HED1-HED2-STRT(N))      SIP1610
  200 CONTINUE                                                          SIP1620
```

Program listing—Continued

```
C                                                                       SIP1630
C     ---SIP 'NORMAL' ALGORITHM---                                      SIP1640
C     ---FORWARD SUBSTITUTE, COMPUTING INTERMEDIATE VECTOR V---         SIP1650
      E=-B-D-F-H-RHO-TL(N)*U-ETQB                                       SIP1660
      CH=DEL(NA)*B/(1.+W*DEL(NA))                                       SIP1670
      GH=ETA(NL)*D/(1.+W*ETA(NL))                                       SIP1680
      BH=B-W*CH                                                         SIP1690
      DH=D-W*GH                                                         SIP1700
      EH=E+W*CH+W*GH                                                    SIP1710
      FH=F-W*CH                                                         SIP1720
      HH=H-W*GH                                                         SIP1730
      ALFA=BH                                                           SIP1740
      BETA=DH                                                           SIP1750
      GAMA=EH-ALFA*ETA(NA)-BETA*DEL(NL)                                 SIP1760
      DEL(N)=FH/GAMA                                                    SIP1770
      ETA(N)=HH/GAMA                                                    SIP1780
      RES=-D*PHI(NL)-F*PHI(NR)-H*PHI(NB)-B*PHI(NA)-E*PHI(N)-RHO*KEEP(N)-SIP1790
     1SL(N)-QRE(N)-WELL(N)+ETQD-SUBS-TL(N)*STRT(N)                      SIP1800
      V(N)=(HMAX*RES-ALFA*V(NA)-BETA*V(NL))/GAMA                        SIP1810
  210 CONTINUE                                                          SIP1820
C                                                                       SIP1830
C     ---BACK SUBSTITUTE FOR VECTOR XI---                               SIP1840
      DO 220 I=1,I2                                                     SIP1850
      I3=DIML-I                                                         SIP1860
      DO 220 J=1,J2                                                     SIP1870
      J3=DIMW-J                                                         SIP1880
      N=I3+DIML*(J3-1)                                                  SIP1890
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 220                           SIP1900
      XI(N)=V(N)-DEL(N)*XI(N+DIML)-ETA(N)*XI(N+1)                       SIP1910
C                                                                       SIP1920
C     ---COMPARE MAGNITUDE OF CHANGE WITH CLOSURE CRITERION--           SIP1930
      TCHK=ABS(XI(N))                                                   SIP1940
      IF (TCHK.GT.BIGI) BIGI=TCHK                                       SIP1950
      PHI(N)=PHI(N)+XI(N)                                               SIP1960
  220 CONTINUE                                                          SIP1970
      IF (BIGI.GT.ERR) TEST=1.                                          SIP1980
      TEST3(KOUNT+1)=BIGI                                               SIP1990
      IF (TEST.EQ.1.) GO TO 40                                          SIP2000
      RETURN                                                            SIP2010
C                                                                       SIP2020
C     ..................................................................SIP2030
C     ---ORDER EQUATIONS WITH THE LAST ROW FIRST - 3X3  EXAMPLE:        SIP2040
C              7 8 9                                                    SIP2050
C              4 5 6                                                    SIP2060
C              1 2 3                                                    SIP2070
C     ..................................................................SIP2080
  230 DO 340 II=1,I2                                                    SIP2090
      I=DIML-II                                                         SIP2100
      DO 340 J=2,JNO1                                                   SIP2110
      N=I+DIML*(J-1)                                                    SIP2120
      NL=N-DIML                                                         SIP2130
      NR=N+DIML                                                         SIP2140
      NA=N-1                                                            SIP2150
      NB=N+1                                                            SIP2160
C                                                                       SIP2170
C     ---SKIP COMPUTATIONS IF NODE IS OUTSIDE AQUIFER BOUNDARY---       SIP2180
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 340                           SIP2190
C                                                                       SIP2200
C     ---COMPUTE COEFFICIENTS---                                        SIP2210
      D=TR(NL)/DELX(J)                                                  SIP2220
      F=TR(N)/DELX(J)                                                   SIP2230
```

Program listing—Continued

```
      B=TC(NA)/DELY(I)                                                  SIP2240
      H=TC(N)/DELY(I)                                                   SIP2250
      IF (EVAP.NE.CHK(6)) GO TO 250                                     SIP2260
C                                                                       SIP2270
C     ---COMPUTE EXPLICIT AND IMPLICIT PARTS OF ET RATE---              SIP2280
      ETQB=0.                                                           SIP2290
      ETQD=0.0                                                          SIP2300
      IF (PHE(N).LE.GRND(N)-ETDIST) GO TO 250                           SIP2310
      IF (PHE(N).GT.GRND(N)) GO TO 240                                  SIP2320
      ETQB=QET/ETDIST                                                   SIP2330
      ETQD=ETQB*(ETDIST-GRND(N))                                        SIP2340
      GO TO 250                                                         SIP2350
  240 ETQD=QET                                                          SIP2360
C                                                                       SIP2370
C     ---COMPUTE STORAGE TERM---                                        SIP2380
  250 IF (CONVRT.EQ.CHK(7)) GO TO 260                                   SIP2390
      RHO=S(N)/DELT                                                     SIP2400
      IF (WATER.EQ.CHK(2)) RHO=SY(N)/DELT                               SIP2410
      GO TO 330                                                         SIP2420
C                                                                       SIP2430
C     ---COMPUTE STORAGE COEFFICIENT FOR CONVERSION PROBLEM---          SIP2440
  260 SUBS=0.0                                                          SIP2450
      IF (KEEP(N).GE.TOP(N).AND.PHE(N).GE.TOP(N)) GO TO 300             SIP2460
      IF (KEEP(N).LT.TOP(N).AND.PHE(N).LT.TOP(N)) GO TO 290             SIP2470
      IF (KEEP(N)-PHE(N)) 270,280,280                                   SIP2480
  270 SUBS=(SY(N)-S(N))/DELT*(KEEP(N)-TOP(N))                           SIP2490
      GO TO 300                                                         SIP2500
  280 SUBS=(S(N)-SY(N))/DELT*(KEEP(N)-TOP(N))                           SIP2510
  290 RHO=SY(N)/DELT                                                    SIP2520
      GO TO 310                                                         SIP2530
  300 RHO=S(N)/DELT                                                     SIP2540
  310 IF (LEAK.NE.CHK(9)) GO TO 330                                     SIP2550
C                                                                       SIP2560
C     ---COMPUTE NET LEAKAGE TERM FOR CONVERSION SIMULATION---          SIP2570
      IF (RATE(N).EQ.0..OR.M(N).EQ.0.) GO TO 330                        SIP2580
      HED1=AMAX1(STRT(N),TOP(N))                                        SIP2590
      U=1.                                                              SIP2600
      HED2=0.                                                           SIP2610
      IF (PHE(N).GE.TOP(N)) GO TO 320                                   SIP2620
      HED2=TOP(N)                                                       SIP2630
      U=0.                                                              SIP2640
  320 SL(N)=RATE(N)/M(N)*(RIVER(N)-HED1)+TL(N)*(HED1-HED2-STRT(N))      SIP2650
  330 CONTINUE                                                          SIP2660
C                                                                       SIP2670
C     ---SIP 'REVERSE' ALGORITHM---                                     SIP2680
C     ---FORWARD SUBSTITUTE, COMPUTING INTERMEDIATE VECTOR V---         SIP2690
      E=-B-D-F-H-RHO-TL(N)*U-ETQB                                       SIP2700
      CH=DEL(NB)*H/(1.+W*DEL(NB))                                       SIP2710
      GH=ETA(NL)*D/(1.+W*ETA(NL))                                       SIP2720
      BH=H-W*CH                                                         SIP2730
      DH=D-W*GH                                                         SIP2740
      EH=E+W*CH+W*GH                                                    SIP2750
      FH=F-W*CH                                                         SIP2760
      HH=B-W*GH                                                         SIP2770
      ALFA=BH                                                           SIP2780
      BETA=DH                                                           SIP2790
      GAMA=EH-ALFA*ETA(NB)-BETA*DEL(NL)                                 SIP2800
      DEL(N)=FH/GAMA                                                    SIP2810
      ETA(N)=HH/GAMA                                                    SIP2820
      RES=-D*PHI(NL)-F*PHI(NR)-H*PHI(NB)-B*PHI(NA)-E*PHI(N)-RHO*KEEP(N)-SIP2830
     1SL(N)-QRE(N)-WELL(N)+ETQD-SUBS-TL(N)*STRT(N)                      SIP2840
```

Program listing—Continued

```
      V(N)=(HMAX*RES-ALFA*V(NB)-BETA*V(NL))/GAMA                        SIP2850
  340 CONTINUE                                                          SIP2860
C                                                                       SIP2870
C     ---BACK SUBSTITUTE FOR VECTOR XI---                               SIP2880
      DO 350 I3=2,INO1                                                  SIP2890
      DO 350 J=1,J2                                                     SIP2900
      J3=DIMW-J                                                         SIP2910
      N=I3+DIML*(J3-1)                                                  SIP2920
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 350                           SIP2930
      XI(N)=V(N)-DEL(N)*XI(N+DIML)-ETA(N)*XI(N-1)                       SIP2940
C                                                                       SIP2950
C     ---COMPARE MAGNITUDE OF CHANGE WITH CLOSURE CRITERION--           SIP2960
      TCHK=ABS(XI(N))                                                   SIP2970
      IF (TCHK.GT.BIGI) BIGI=TCHK                                       SIP2980
      PHI(N)=PHI(N)+XI(N)                                               SIP2990
  350 CONTINUE                                                          SIP3000
      IF (BIGI.GT.ERR) TEST=1.                                          SIP3010
      TEST3(KOUNT+1)=BIGI                                               SIP3020
      IF (TEST.EQ.1.) GO TO 40                                          SIP3030
      RETURN                                                            SIP3040
C                                                                       SIP3050
C     ..................................................................SIP3060
C                                                                       SIP3070
C     ---FORMATS---                                                     SIP3080
C                                                                       SIP3090
C     ------------------------------------------------------------------SIP3100
C                                                                       SIP3110
C                                                                       SIP3120
  360 FORMAT ('0EXCEEDED PERMITTED NUMBER OF ITERATIONS'/' ',39('*'))   SIP3130
  370 FORMAT ('-',44X,'SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE'/45X,SIP3140
     143('_'),//,61X,'BETA=',F5.2)                                      SIP3150
  380 FORMAT (1H0,I5,22H ITERATION PARAMETERS:,6D15.7/(/28X,6D15.7/))   SIP3160
      END                                                               SIP3170-


      SUBROUTINE SOLVE2(PHI,BE,G,TEMP,KEEP,PHE,STRT,T,S,QRE,WELL,TL,SL,DSOR  10
     1EL,ETA,V,XI,DELX,BETA,DELY,ALFA,TEST3,TR,TC,GRND,SY,TOP,RATE,M,RIVSOR  20
     2ER)                                                               SOR  30
C     ------------------------------------------------------------------SOR  40
C     SOLUTION BY LINE SUCCESSIVE OVERRELAXATION                        SOR  50
C     ------------------------------------------------------------------SOR  60
C                                                                       SOR  70
C     SPECIFICATIONS:                                                   SOR  80
      REAL *8PHI,DBLE,RHOP(20),G,BE,TEMP,IMK,DABS,W,PARAM,TEST2,DMAX1,R2SOR  90
     1,A,C,B1,E,Q,RHO,B,D,F,H                                           SOR 100
      REAL *4KEEP,M                                                     SOR 110
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,SOR 120
     1CONTR,LEAK,RECH,SIP,ADI                                           SOR 130
C                                                                       SOR 140
      DIMENSION PHI(1), BE(1), G(1), TEMP(1), KEEP(1), PHE(1), STRT(1), SOR 150
     1T(1), S(1), QRE(1), WELL(1), TL(1), SL(1), DEL(1), ETA(1), V(1), XSOR 160
     2I(1), DELX(1), BETA(1), DELY(1), ALFA(1), TEST3(1), TR(1), TC(1), SOR 170
     3GRND(1), SY(1), TOP(1), RATE(1), M(1), RIVER(1)                   SOR 180
C                                                                       SOR 190
      COMMON /SARRAY/ VF4(11),CHK(15)                                   SOR 200
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LESOR 210
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,SOR 220
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,SOR 230
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DISOR 240
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 SOR 250
      RETURN                                                            SOR 260
```

Program listing—Continued

```
C     ..............................................................SOR 270
C                                                                   SOR 280
C     ---WRITE ACCELERATION PARAMETER---                            SOR 290
C     *********************                                         SOR 300
      ENTRY ITER2                                                   SOR 310
C     *********************                                         SOR 320
      WRITE (P,490)                                                 SOR 330
      WRITE (P,500) HMAX,LENGTH                                     SOR 340
      RETURN                                                        SOR 350
C     ..............................................................SOR 360
C                                                                   SOR 370
C     ---INITIALIZE DATA FOR A NEW ITERATION---                     SOR 380
   10 KOUNT=KOUNT+1                                                 SOR 390
      IF (KOUNT.LE.ITMAX) GO TO 20                                  SOR 400
      WRITE (P,510)                                                 SOR 410
      CALL TERM1                                                    SOR 420
C     ************************                                      SOR 430
      ENTRY NEWITB                                                  SOR 440
C     ************************                                      SOR 450
   20 TEST3(KOUNT+1)=0.                                             SOR 460
      TEST=0.                                                       SOR 470
      N=DIML*DIMW                                                   SOR 480
      DO 30 I=1,N                                                   SOR 490
   30 PHE(I)=PHI(I)                                                 SOR 500
      BIGI=0.0                                                      SOR 510
C                                                                   SOR 520
C     ---COMPUTE TRANSMISSIVITY AND T COEFFICIENTS IN WATER TABLE   SOR 530
C     OR WATER TABLE-ARTESIAN SIMUATION---                          SOR 540
      IF (WATER.NE.CHK(2)) GO TO 40                                 SOR 550
      CALL TRANS                                                    SOR 560
C     ..............................................................SOR 570
C                                                                   SOR 580
C     ---SOLUTION BY LSOR---                                        SOR 590
C     ----------------------                                        SOR 600
   40 NO3=DIMW-2                                                    SOR 610
      TEMP(DIMW)=0.0                                                SOR 620
      DO 170 I=2,INO1                                               SOR 630
      DO 150 J=2,JNO1                                               SOR 640
      N=I+DIML*(J-1)                                                SOR 650
      NA=N-1                                                        SOR 660
      NB=N+1                                                        SOR 670
      NL=N-DIML                                                     SOR 680
      NR=N+DIML                                                     SOR 690
      BE(J)=0.0                                                     SOR 700
      G(J)=0.0                                                      SOR 710
C                                                                   SOR 720
C     ---SKIP COMPUTATIONS IF NODE IS OUTSIDE AQUIFER BOUNDARY---   SOR 730
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 150                       SOR 740
C                                                                   SOR 750
C     ---COMPUTE COEFFICIENTS---                                    SOR 760
      D=TR(N-DIML)/DELX(J)                                          SOR 770
      F=TR(N)/DELX(J)                                               SOR 780
      B=TC(N-1)/DELY(I)                                             SOR 790
      H=TC(N)/DELY(I)                                               SOR 800
      IF (EVAP.NE.CHK(6)) GO TO 60                                  SOR 810
C                                                                   SOR 820
C     ---COMPUTE EXPLICIT AND IMPLICIT PARTS OF ET RATE---          SOR 830
      ETQB=0.                                                       SOR 840
      ETQD=0.0                                                      SOR 850
      IF (PHE(N).LE.GRND(N)-ETDIST) GO TO 60                        SOR 860
      IF (PHE(N).GT.GRND(N)) GO TO 50                               SOR 870
```

Program listing—Continued

```
      ETQB=QET/ETDIST                                                   SOR 880
      ETQD=ETQB*(ETDIST-GRND(N))                                        SOR 890
      GO TO 60                                                          SOR 900
   50 ETQD=QET                                                          SOR 910
C                                                                       SOR 920
C     ---COMPUTE STORAGE TERM---                                        SOR 930
   60 IF (CONVRT.EQ.CHK(7)) GO TO 70                                    SOR 940
      RHO=S(N)/DELT                                                     SOR 950
      IF (WATER.EQ.CHK(2)) RHO=SY(N)/DELT                               SOR 960
      GO TO 140                                                         SOR 970
C                                                                       SOR 980
C     ---COMPUTE STORAGE COEFFICIENT FOR CONVERSION PROBLEM---          SOR 990
   70 SUBS=0.0                                                          SOR1000
      IF (KEEP(N).GE.TOP(N).AND.PHE(N).GE.TOP(N)) GO TO 110             SOR1010
      IF (KEEP(N).LT.TOP(N).AND.PHE(N).LT.TOP(N)) GO TO 100             SOR1020
      IF (KEEP(N)-PHE(N)) 80,90,90                                      SOR1030
   80 SUBS=(SY(N)-S(N))/DELT*(KEEP(N)-TOP(N))                           SOR1040
      GO TO 110                                                         SOR1050
   90 SUBS=(S(N)-SY(N))/DELT*(KEEP(N)-TOP(N))                           SOR1060
  100 RHO=SY(N)/DELT                                                    SOR1070
      GO TO 120                                                         SOR1080
  110 RHO=S(N)/DELT                                                     SOR1090
  120 IF (LEAK.NE.CHK(9)) GO TO 140                                     SOR1100
C                                                                       SOR1110
C     ---COMPUTE NET LEAKAGE TERM FOR CONVERSION SIMULATION---          SOR1120
      IF (RATE(N).EQ.0..OR.M(N).EQ.0.) GO TO 140                        SOR1130
      HED1=AMAX1(STRT(N),TOP(N))                                        SOR1140
      U=1.                                                              SOR1150
      HED2=0.                                                           SOR1160
      IF (PHE(N).GE.TOP(N)) GO TO 130                                   SOR1170
      HED2=TOP(N)                                                       SOR1180
      U=0.                                                              SOR1190
  130 SL(N)=RATE(N)/M(N)*(RIVER(N)-HED1)+TL(N)*(HED1-HED2-STRT(N))      SOR1200
  140 CONTINUE                                                          SOR1210
C                                                                       SOR1220
C     ---FORWARD SUBSTITUTE, COMPUTING INTERMEDIATE VECTOR G---         SOR1230
      E=-D-F-B-H-RHO-TL(N)*U-ETQB                                       SOR1240
      W=E-D*BE(J-1)                                                     SOR1250
      BE(J)=F/W                                                         SOR1260
      Q=-B*PHI(NA)-H*PHI(NB)-RHO*KEEP(N)-SL(N)-QRE(N)-WELL(N)+ETQD-SUBS-SOR1270
     1TL(N)*STRT(N)-D*PHI(NL)-F*PHI(NR)-E*PHI(N)                        SOR1280
      G(J)=(Q-D*G(J-1))/W                                               SOR1290
  150 CONTINUE                                                          SOR1300
C                                                                       SOR1310
C     ---BACK SUBSTITUTE FOR TEMP---                                    SOR1320
      DO 160 KNO4=1,NO3                                                 SOR1330
      NO4=DIMW-KNO4                                                     SOR1340
      TEMP(NO4)=G(NO4)-BE(NO4)*TEMP(NO4+1)                              SOR1350
  160 CONTINUE                                                          SOR1360
C                                                                       SOR1370
C     ---EXTRAPOLATED VALUE OF PHI---                                   SOR1380
      DO 170 J=2,JNO1                                                   SOR1390
      N=I+DIML*(J-1)                                                    SOR1400
      PHI(N)=PHI(N)+HMAX*TEMP(J)                                        SOR1410
C                                                                       SOR1420
C     ---COMPARE DIFFERENCE WITH CLOSURE CRITERION--                    SOR1430
      TCHK=DABS(TEMP(J))                                                SOR1440
      IF (TCHK.GT.BIGI) BIGI=TCHK                                       SOR1450
  170 CONTINUE                                                          SOR1460
      IF (BIGI.GT.ERR) TEST=1.                                          SOR1470
      TEST3(KOUNT+1)=BIGI                                               SOR1480
```

Program listing—Continued

```
      IF (KOUNT.EQ.0) GO TO 10                                          SOR1490
      IF (TEST.EQ.0.) RETURN                                            SOR1500
C                                                                       SOR1510
C     ---TEST FOR TWO DIMENSIONAL CORRECTION---                         SOR1520
      IF (MOD(KOUNT,LENGTH).NE.0) GO TO 10                              SOR1530
      GO TO 200                                                         SOR1540
  180 DO 190 I=2,IN01                                                   SOR1550
      DO 190 J=2,JN01                                                   SOR1560
      N=I+DIML*(J-1)                                                    SOR1570
      IF (T(N).EQ.0.) GO TO 190                                         SOR1580
      PHI(N)=PHI(N)+ALFA(I)+BETA(J)                                     SOR1590
  190 CONTINUE                                                          SOR1600
      GO TO 10                                                          SOR1610
C     ..................................................................SOR1620
C                                                                       SOR1630
C     ---TWO DIMENSIONAL CORRECTION TO LSOR---                          SOR1640
C     ----------------------------------------                          SOR1650
C                                                                       SOR1660
C     ---COMPUTE ALFA CORRECTION FOR ROWS---                            SOR1670
  200 DO 210 I=1,DIML                                                   SOR1680
      ALFA(I)=0.                                                        SOR1690
      BE(I)=0.0                                                         SOR1700
  210 G(I)=0.0                                                          SOR1710
      DO 330 I=2,IN01                                                   SOR1720
      A=0.                                                              SOR1730
      B2=0.                                                             SOR1740
      C=0.                                                              SOR1750
      Q=0.                                                              SOR1760
C                                                                       SOR1770
C     ---SUMMATION OF COEFFICIENTS FOR EACH ROW---                      SOR1780
      DO 320 J=2,JN01                                                   SOR1790
      N=I+DIML*(J-1)                                                    SOR1800
      NA=N-1                                                            SOR1810
      NB=N+1                                                            SOR1820
      NL=N-DIML                                                         SOR1830
      NR=N+DIML                                                         SOR1840
      IF (S(N).LT.0.) GO TO 330                                         SOR1850
      IF (T(N).EQ.0.) GO TO 320                                         SOR1860
C                                                                       SOR1870
C     ---COMPUTE COEFFICIENTS---                                        SOR1880
      D=TR(N-DIML)/DELX(J)                                              SOR1890
      F=TR(N)/DELX(J)                                                   SOR1900
      B=TC(N-1)/DELY(I)                                                 SOR1910
      H=TC(N)/DELY(I)                                                   SOR1920
      IF (EVAP.NE.CHK(6)) GO TO 230                                     SOR1930
C                                                                       SOR1940
C     ---COMPUTE EXPLICIT AND IMPLICIT PARTS OF ET RATE---              SOR1950
      ETQB=0.                                                           SOR1960
      ETQD=0.0                                                          SOR1970
      IF (PHE(N).LE.GRND(N)-ETDIST) GO TO 230                           SOR1980
      IF (PHE(N).GT.GRND(N)) GO TO 220                                  SOR1990
      ETQB=QET/ETDIST                                                   SOR2000
      ETQD=ETQB*(ETDIST-GRND(N))                                        SOR2010
      GO TO 230                                                         SOR2020
  220 ETQD=QET                                                          SOR2030
C                                                                       SOR2040
C     ---COMPUTE STORAGE TERM---                                        SOR2050
  230 IF (CONVRT.EQ.CHK(7)) GO TO 240                                   SOR2060
      RHO=S(N)/DELT                                                     SOR2070
      IF (WATER.EQ.CHK(2)) RHO=SY(N)/DELT                               SOR2080
      GO TO 310                                                         SOR2090
```

Program listing—Continued

```
  240 SUBS=0.0                                                          SOR2100
      IF (KEEP(N).GE.TOP(N).AND.PHE(N).GE.TOP(N)) GO TO 280             SOR2110
      IF (KEEP(N).LT.TOP(N).AND.PHE(N).LT.TOP(N)) GO TO 270             SOR2120
      IF (KEEP(N)-PHE(N)) 250,260,260                                   SOR2130
  250 SUBS=(SY(N)-S(N))/DELT*(KEEP(N)-TOP(N))                           SOR2140
      GO TO 280                                                         SOR2150
  260 SUBS=(S(N)-SY(N))/DELT*(KEEP(N)-TOP(N))                           SOR2160
  270 RHO=SY(N)/DELT                                                    SOR2170
      GO TO 290                                                         SOR2180
  280 RHO=S(N)/DELT                                                     SOR2190
  290 IF (LEAK.NE.CHK(9)) GO TO 310                                     SOR2200
C                                                                       SOR2210
C     ---COMPUTE NET LEAKAGE TERM FOR CONVERSION SIMULATION---          SOR2220
      IF (RATE(N).EQ.0..OR.M(N).EQ.0.) GO TO 310                        SOR2230
      HED1=AMAX1(STRT(N),TOP(N))                                        SOR2240
      U=1.                                                              SOR2250
      HED2=0.                                                           SOR2260
      IF (PHE(N).GE.TOP(N)) GO TO 300                                   SOR2270
      HED2=TOP(N)                                                       SOR2280
      U=0.                                                              SOR2290
  300 SL(N)=RATE(N)/M(N)*(RIVER(N)-HED1)+TL(N)*(HED1-HED2-STRT(N))      SOR2300
  310 CONTINUE                                                          SOR2310
C                                                                       SOR2320
      A=A-B                                                             SOR2330
      B1=B+H+RHO+TL(N)*U+ETQB                                           SOR2340
      B2=B2+B1                                                          SOR2350
      C=C-H                                                             SOR2360
      Q=Q+(D*PHI(NL)+F*PHI(NR)+B*PHI(NA)+H*PHI(NB)+RHO*KEEP(N)+SL(N)+QRESOR2370
     1(N)+WELL(N)-ETQD+SUBS+TL(N)*STRT(N)-(D+F+B1)*PHI(N))              SOR2380
  320 CONTINUE                                                          SOR2390
C                                                                       SOR2400
C     ---COMPUTATION OF INTERMEDIATE VECTOR G---                        SOR2410
      W=B2-A*BE(I-1)                                                    SOR2420
      BE(I)=C/W                                                         SOR2430
      G(I)=(Q-A*G(I-1))/W                                               SOR2440
  330 CONTINUE                                                          SOR2450
C                                                                       SOR2460
C     ---BACK SUBSTITUTE FOR ALFA---                                    SOR2470
      NO3=DIML-2                                                        SOR2480
      DO 340 KNO4=1,NO3                                                 SOR2490
      NO4=DIML-KNO4                                                     SOR2500
  340 ALFA(NO4)=G(NO4)-BE(NO4)*ALFA(NO4+1)                              SOR2510
C     ******************************************************************SOR2520
C                                                                       SOR2530
C     ---COMPUTE BETA CORRECTION FOR COLUMNS---                         SOR2540
      DO 350 J=1,DIMW                                                   SOR2550
      BETA(J)=0.                                                        SOR2560
      BE(J)=0.0                                                         SOR2570
  350 G(J)=0.0                                                          SOR2580
      DO 470 J=2,JNO1                                                   SOR2590
      A=0.                                                              SOR2600
      B2=0.                                                             SOR2610
      C=0.                                                              SOR2620
      Q=0.                                                              SOR2630
C                                                                       SOR2640
C     ---SUMMATION OF COEFFICIENTS FOR EACH COLUMN---                   SOR2650
      DO 460 I=2,INO1                                                   SOR2660
      N=I+DIML*(J-1)                                                    SOR2670
      NA=N-1                                                            SOR2680
      NB=N+1                                                            SOR2690
      NL=N-DIML                                                         SOR2700
```

Program listing—Continued

```
      NR=N+DIML                                                         SOR2710
      IF (S(N).LT.0.) GO TO 470                                         SOR2720
      IF (T(N).EQ.0.) GO TO 460                                         SOR2730
      D=TR(N-DIML)/DELX(J)                                              SOR2740
      F=TR(N)/DELX(J)                                                   SOR2750
      B=TC(N-1)/DELY(I)                                                 SOR2760
      H=TC(N)/DELY(I)                                                   SOR2770
      IF (EVAP.NE.CHK(6)) GO TO 370                                     SOR2780
C                                                                       SOR2790
C     ---COMPUTE EXPLICIT AND IMPLICIT PARTS OF ET RATE---              SOR2800
      ETQB=0.                                                           SOR2810
      ETQD=0.0                                                          SOR2820
      IF (PHE(N).LE.GRND(N)-ETDIST) GO TO 370                           SOR2830
      IF (PHE(N).GT.GRND(N)) GO TO 360                                  SOR2840
      ETQB=QET/ETDIST                                                   SOR2850
      ETQD=ETQB*(ETDIST-GRND(N))                                        SOR2860
      GO TO 370                                                         SOR2870
  360 ETQD=QET                                                          SOR2880
C                                                                       SOR2890
C     ---COMPUTE STORAGE TERM---                                        SOR2900
  370 IF (CONVRT.EQ.CHK(7)) GO TO 380                                   SOR2910
      RHO=S(N)/DELT                                                     SOR2920
      IF (WATER.EQ.CHK(2)) RHO=SY(N)/DELT                               SOR2930
      GO TO 450                                                         SOR2940
C                                                                       SOR2950
C     ---COMPUTE STORAGE COEFFICIENT FOR CONVERSION PROBLEM---          SOR2960
  380 SUBS=0.0                                                          SOR2970
      IF (KEEP(N).GE.TOP(N).AND.PHE(N).GE.TOP(N)) GO TO 420             SOR2980
      IF (KEEP(N).LT.TOP(N).AND.PHE(N).LT.TOP(N)) GO TO 410             SOR2990
      IF (KEEP(N)-PHE(N)) 390,400,400                                   SOR3000
  390 SUBS=(SY(N)-S(N))/DELT*(KEEP(N)-TOP(N))                           SOR3010
      GO TO 420                                                         SOR3020
  400 SUBS=(S(N)-SY(N))/DELT*(KEEP(N)-TOP(N))                           SOR3030
  410 RHO=SY(N)/DELT                                                    SOR3040
      GO TO 430                                                         SOR3050
  420 RHO=S(N)/DELT                                                     SOR3060
  430 IF (LEAK.NE.CHK(9)) GO TO 450                                     SOR3070
C                                                                       SOR3080
C     ---COMPUTE NET LEAKAGE TERM FOR CONVERSION SIMULATION---          SOR3090
      IF (RATE(N).EQ.0..OR.M(N).EQ.0.) GO TO 450                        SOR3100
      HED1=AMAX1(STRT(N),TOP(N))                                        SOR3110
      U=1.                                                              SOR3120
      HED2=0.                                                           SOR3130
      IF (PHE(N).GE.TOP(N)) GO TO 440                                   SOR3140
      HED2=TOP(N)                                                       SOR3150
      U=0.                                                              SOR3160
  440 SL(N)=RATE(N)/M(N)*(RIVER(N)-HED1)+TL(N)*(HED1-HED2-STRT(N))      SOR3170
  450 CONTINUE                                                          SOR3180
C                                                                       SOR3190
      A=A-D                                                             SOR3200
      B1=D+F+RHO+TL(N)*U+ETQB                                           SOR3210
      B2=B2+B1                                                          SOR3220
      C=C-F                                                             SOR3230
      Q=Q+(D*PHI(NL)+F*PHI(NR)+B*PHI(NA)+H*PHI(NB)+RHO*KEEP(N)+SL(N)+QRESOR3240
     1(N)+WELL(N)-ETQD+SUBS+TL(N)*STRT(N)-(B+H+B1)*PHI(N))              SOR3250
  460 CONTINUE                                                          SOR3260
C                                                                       SOR3270
C     ---COMPUTATION OF INTERMEDIATE VECTOR G---                        SOR3280
      W=B2-A*BE(J-1)                                                    SOR3290
      BE(J)=C/W                                                         SOR3300
      G(J)=(Q-A*G(J-1))/W                                               SOR3310
```

Program listing—Continued

```
  470 CONTINUE                                                          SOR3320
C                                                                       SOR3330
C     ---BACK SUBSTITUTE FOR BETA---                                    SOR3340
      NO3=DIMW-2                                                        SOR3350
      DO 480 KNO4=1,NO3                                                 SOR3360
      NO4=DIMW-KNO4                                                     SOR3370
  480 BETA(NO4)=G(NO4)-BE(NO4)*BETA(NO4+1)                              SOR3380
      GO TO 180                                                         SOR3390
C     ..................................................................SOR3400
C                                                                       SOR3410
C     ---FORMATS---                                                     SOR3420
C                                                                       SOR3430
C     ------------------------------------------------------------------SOR3440
C                                                                       SOR3450
C                                                                       SOR3460
  490 FORMAT ('-',45X,'SOLUTION BY LINE SUCCESSIVE OVERRELAXATION'/46X,4SOR3470
     12('_'))                                                           SOR3480
  500 FORMAT ('-',26X,'ACCELERATION PARAMETER =',F6.3,'  TWO DIMENSIONALSOR3490
     1 CORRECTION EVERY',I5,' ITERATIONS')                              SOR3500
  510 FORMAT ('0EXCEEDED PERMITTED NUMBER OF ITERATIONS'/' ',39('*'))   SOR3510
      END                                                               SOR3520-
      SUBROUTINE SOLVE3(PHI,BE,G,TEMP,KEEP,PHE,STRT,T,S,QRE,WELL,TL,SL,DADI  10
     1EL,ETA,V,XI,DELX,BETA,DELY,ALFA,XII,TEST3,TR,TC,GRND,SY,TOP,RATE,MADI  20
     2,RIVER)                                                           ADI  30
C     ------------------------------------------------------------------ADI  40
C     SOLUTION BY THE ALTERNATING DIRECTION IMPLICIT PROCEDURE          ADI  50
C     ------------------------------------------------------------------ADI  60
C                                                                       ADI  70
C     SPECIFICATIONS:                                                   ADI  80
      REAL *8PHI,DBLE,RHOP(20),G,BE,TEMP,IMK,DABS,W,PARAM,TEST2,DMAX1,DTADI  90
     1ERMS,B1,E,Q,B,D,F,H,RHO,XII                                       ADI 100
      REAL *4KEEP,M                                                     ADI 110
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,ADI 120
     1CONTR,LEAK,RECH,SIP,ADI                                           ADI 130
C                                                                       ADI 140
      DIMENSION PHI(1), BE(1), G(1), TEMP(1), KEEP(1), PHE(1), STRT(1), ADI 150
     1T(1), S(1), QRE(1), WELL(1), TL(1), SL(1), DEL(1), ETA(1), V(1), XADI 160
     2I(1), DELX(1), BETA(1), DELY(1), ALFA(1), XII(1), TEST3(1), TR(1),ADI 170
     3 TC(1), GRND(1), SY(1), TOP(1), RATE(1), M(1), RIVER(1)           ADI 180
C                                                                       ADI 190
      COMMON /SARRAY/ VF4(11),CHK(15)                                   ADI 200
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LEADI 210
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,ADI 220
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,ADI 230
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DIADI 240
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 ADI 250
      RETURN                                                            ADI 260
C     ..................................................................ADI 270
C                                                                       ADI 280
C     ---COMPUTE AND PRINT ITERATION PARAMETERS---                      ADI 290
C     ********************                                              ADI 300
      ENTRY ITER3                                                       ADI 310
C     ********************                                              ADI 320
      HMIN=2.                                                           ADI 330
      IN4=DIMW-2                                                        ADI 340
      IN5=DIML-2                                                        ADI 350
      XVAL=3.1415**2/(2.*IN4*IN4)                                       ADI 360
      YVAL=3.1415**2/(2.*IN5*IN5)                                       ADI 370
      DO 10 I=2,INO1                                                    ADI 380
```

Program listing—Continued

```
      DO 10 J=2,JNO1                                                    ADI 390
      N=I+DIML*(J-1)                                                    ADI 400
      IF (T(N).EQ.0.) GO TO 10                                          ADI 410
      XPART=XVAL*(1/(1+DELX(J)**2*FACTY/DELY(I)**2*FACTX))              ADI 420
      YPART=YVAL*(1/(1+DELY(I)**2*FACTX/DELX(J)**2*FACTY))              ADI 430
      HMIN=AMIN1(HMIN,XPART,YPART)                                      ADI 440
   10 CONTINUE                                                          ADI 450
      ALPHA=EXP(ALOG(HMAX/HMIN)/(LENGTH-1))                             ADI 460
      RHOP(1)=HMIN                                                      ADI 470
      DO 20 NTIME=2,LENGTH                                              ADI 480
   20 RHOP(NTIME)=RHOP(NTIME-1)*ALPHA                                   ADI 490
      WRITE (P,400)                                                     ADI 500
      WRITE (P,410) LENGTH,(RHOP(J),J=1,LENGTH)                         ADI 510
      RETURN                                                            ADI 520
C     ..................................................................ADI 530
C                                                                       ADI 540
C     ---INITIALIZE DATA FOR A NEW ITERATION---                         ADI 550
   30 KOUNT=KOUNT+1                                                     ADI 560
      IF (KOUNT.LE.ITMAX) GO TO 40                                      ADI 570
      WRITE (P,390)                                                     ADI 580
      CALL TERM1                                                        ADI 590
   40 IF (MOD(KOUNT,LENGTH)) 50,50,60                                   ADI 600
C     ************************                                          ADI 610
      ENTRY NEWITC                                                      ADI 620
C     ************************                                          ADI 630
   50 NTH=0                                                             ADI 640
   60 NTH=NTH+1                                                         ADI 650
      PARAM=RHOP(NTH)                                                   ADI 660
      TEST3(KOUNT+1)=0.                                                 ADI 670
      TEST=0.                                                           ADI 680
      N=DIML*DIMW                                                       ADI 690
      DO 70 I=1,N                                                       ADI 700
   70 PHE(I)=PHI(I)                                                     ADI 710
      BIGI=0.0                                                          ADI 720
C                                                                       ADI 730
C     ---COMPUTE TRANSMISSIVITY AND T COEFFICIENTS IN WATER TABLE       ADI 740
C     OR WATER TABLE-ARTESIAN SIMUATION---                              ADI 750
      IF (WATER.NE.CHK(2)) GO TO 80                                     ADI 760
      CALL TRANS                                                        ADI 770
C     ..................................................................ADI 780
C                                                                       ADI 790
C     ---SOLUTION BY ADI---                                             ADI 800
C     --------------------                                              ADI 810
C     ---COMPUTE IMPLICITLY ALONG ROWS---                               ADI 820
   80 NO3=DIMW-2                                                        ADI 830
      DO 90 J=1,DIMW                                                    ADI 840
      N=1+DIML*(J-1)                                                    ADI 850
   90 TEMP(J)=PHI(N)                                                    ADI 860
      DO 230 I=2,DIML                                                   ADI 870
      DO 200 J=2,JNO1                                                   ADI 880
      N=I+DIML*(J-1)                                                    ADI 890
      NA=N-1                                                            ADI 900
      NB=N+1                                                            ADI 910
      NL=N-DIML                                                         ADI 920
      NR=N+DIML                                                         ADI 930
      BE(J)=0.0                                                         ADI 940
      G(J)=0.0                                                          ADI 950
C                                                                       ADI 960
C     ---SKIP COMPUTATIONS IF NODE IS OUTSIDE AQUIFER BOUNDARY---       ADI 970
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 200                           ADI 980
C                                                                       ADI 990
```

Program listing—Continued

```
C     ---COMPUTE COEFFICIENTS---                                        ADI1000
      D=TR(N-DIML)/DELX(J)                                              ADI1010
      F=TR(N)/DELX(J)                                                   ADI1020
      B=TC(N-1)/DELY(I)                                                 ADI1030
      H=TC(N)/DELY(I)                                                   ADI1040
      IF (EVAP.NE.CHK(6)) GO TO 110                                     ADI1050
C                                                                       ADI1060
C     ---COMPUTE EXPLICIT AND IMPLICIT PARTS OF ET RATE---              ADI1070
      ETQB=0.                                                           ADI1080
      ETQD=0.0                                                          ADI1090
      IF (PHE(N).LE.GRND(N)-ETDIST) GO TO 110                           ADI1100
      IF (PHE(N).GT.GRND(N)) GO TO 100                                  ADI1110
      ETQB=QET/ETDIST                                                   ADI1120
      ETQD=ETQB*(ETDIST-GRND(N))                                        ADI1130
      GO TO 110                                                         ADI1140
  100 ETQD=QET                                                          ADI1150
C                                                                       ADI1160
C     ---COMPUTE STORAGE TERM---                                        ADI1170
  110 IF (CONVRT.EQ.CHK(7)) GO TO 120                                   ADI1180
      RHO=S(N)/DELT                                                     ADI1190
      IF (WATER.EQ.CHK(2)) RHO=SY(N)/DELT                               ADI1200
      GO TO 190                                                         ADI1210
C                                                                       ADI1220
C     ---COMPUTE STORAGE COEFFICIENT FOR CONVERSION PROBLEM---          ADI1230
  120 SUBS=0.0                                                          ADI1240
      IF (KEEP(N).GE.TOP(N).AND.PHE(N).GE.TOP(N)) GO TO 160             ADI1250
      IF (KEEP(N).LT.TOP(N).AND.PHE(N).LT.TOP(N)) GO TO 150             ADI1260
      IF (KEEP(N)-PHE(N)) 130,140,140                                   ADI1270
  130 SUBS=(SY(N)-S(N))/DELT*(KEEP(N)-TOP(N))                           ADI1280
      GO TO 160                                                         ADI1290
  140 SUBS=(S(N)-SY(N))/DELT*(KEEP(N)-TOP(N))                           ADI1300
  150 RHO=SY(N)/DELT                                                    ADI1310
      GO TO 170                                                         ADI1320
  160 RHO=S(N)/DELT                                                     ADI1330
  170 IF (LEAK.NE.CHK(9)) GO TO 190                                     ADI1340
C                                                                       ADI1350
C     ---COMPUTE NET LEAKAGE TERM FOR CONVERSION SIMULATION---          ADI1360
      IF (RATE(N).EQ.0..OR.M(N).EQ.0.) GO TO 190                        ADI1370
      HED1=AMAX1(STRT(N),TOP(N))                                        ADI1380
      U=1.                                                              ADI1390
      HED2=0.                                                           ADI1400
      IF (PHE(N).GE.TOP(N)) GO TO 180                                   ADI1410
      HED2=TOP(N)                                                       ADI1420
      U=0.                                                              ADI1430
  180 SL(N)=RATE(N)/M(N)*(RIVER(N)-HED1)+TL(N)*(HED1-HED2-STRT(N))      ADI1440
  190 CONTINUE                                                          ADI1450
C                                                                       ADI1460
C     ---CALCULATE VALUES FOR PARAMETERS USED IN THOMAS ALGORITHM       ADI1470
C     AND FORWARD SUBSTITUTE TO COMPUTE INTERMEDIATE VECTOR G---        ADI1480
      IMK=(B+D+F+H)*PARAM                                               ADI1490
      E=-D-F-RHO-IMK-TL(N)*U-ETQB                                       ADI1500
      W=E-D*BE(J-1)                                                     ADI1510
      BE(J)=F/W                                                         ADI1520
      Q=-B*PHI(NA)+(B+H-IMK-E)*PHI(N)-H*PHI(NB)-RHO*KEEP(N)-SL(N)-QRE(N)ADI1530
     1-WELL(N)+ETQD-SUBS-TL(N)*STRT(N)-D*PHI(NL)-F*PHI(NR)              ADI1540
      G(J)=(Q-D*G(J-1))/W                                               ADI1550
  200 CONTINUE                                                          ADI1560
C                                                                       ADI1570
C     ---BACK SUBSTITUTE FOR HEAD VALUES AND PLACE THEM IN TEMP---      ADI1580
      XII(DIMW)=0.D0                                                    ADI1590
      DO 220 KNO4=1,NO3                                                 ADI1600
```

Program listing—Continued

```
      NO4=DIMW-KNO4                                                     ADI1610
      N=I+DIML*(NO4-1)                                                  ADI1620
C                                                                       ADI1630
C     ---FIRST PLACE TEMP VALUES IN PHI(N-1)---                         ADI1640
      PHI(N-1)=TEMP(NO4)                                                ADI1650
      IF (T(N).NE.0..AND.S(N).GE.0.) GO TO 210                          ADI1660
      XII(NO4)=0.D0                                                     ADI1670
      GO TO 220                                                         ADI1680
  210 XII(NO4)=G(NO4)-BE(NO4)*XII(NO4+1)                                ADI1690
  220 TEMP(NO4)=PHI(N)+XII(NO4)                                         ADI1700
  230 CONTINUE                                                          ADI1710
C     ..............................................................ADI1720
C                                                                       ADI1730
C     ---COMPUTE IMPLICITLY ALONG COLUMNS---                            ADI1740
      NO3=DIML-2                                                        ADI1750
      DO 240 I=1,DIML                                                   ADI1760
  240 TEMP(I)=PHI(I)                                                    ADI1770
      DO 380 J=2,DIMW                                                   ADI1780
      DO 350 I=2,INO1                                                   ADI1790
      N=I+DIML*(J-1)                                                    ADI1800
      NA=N-1                                                            ADI1810
      NB=N+1                                                            ADI1820
      NL=N-DIML                                                         ADI1830
      NR=N+DIML                                                         ADI1840
      BE(I)=0.0                                                         ADI1850
      G(I)=0.0                                                          ADI1860
C                                                                       ADI1870
C     ---SKIP COMPUTATIONS IF NODE IS OUTSIDE AQUIFER BOUNDARY---       ADI1880
      IF (T(N).EQ.0..OR.S(N).LT.0.) GO TO 350                           ADI1890
C                                                                       ADI1900
C     ---COMPUTE COEFFICIENTS---                                        ADI1910
      D=TR(N-DIML)/DELX(J)                                              ADI1920
      F=TR(N)/DELX(J)                                                   ADI1930
      B=TC(N-1)/DELY(I)                                                 ADI1940
      H=TC(N)/DELY(I)                                                   ADI1950
      IF (EVAP.NE.CHK(6)) GO TO 260                                     ADI1960
C                                                                       ADI1970
C     ---COMPUTE EXPLICIT AND IMPLICIT PARTS OF ET RATE---              ADI1980
      ETQB=0.                                                           ADI1990
      ETQD=0.0                                                          ADI2000
      IF (PHE(N).LE.GRND(N)-ETDIST) GO TO 260                           ADI2010
      IF (PHE(N).GT.GRND(N)) GO TO 250                                  ADI2020
      ETQB=QET/ETDIST                                                   ADI2030
      ETQD=ETQB*(ETDIST-GRND(N))                                        ADI2040
      GO TO 260                                                         ADI2050
  250 ETQD=QET                                                          ADI2060
C                                                                       ADI2070
C     ---COMPUTE STORAGE TERM---                                        ADI2080
  260 IF (CONVRT.EQ.CHK(7)) GO TO 270                                   ADI2090
      RHO=S(N)/DELT                                                     ADI2100
      IF (WATER.EQ.CHK(2)) RHO=SY(N)/DELT                               ADI2110
      GO TO 340                                                         ADI2120
C                                                                       ADI2130
C     ---COMPUTE STORAGE COEFFICIENT FOR CONVERSION PROBLEM---          ADI2140
  270 SUBS=0.0                                                          ADI2150
      IF (KEEP(N).GE.TOP(N).AND.PHE(N).GE.TOP(N)) GO TO 310             ADI2160
      IF (KEEP(N).LT.TOP(N).AND.PHE(N).LT.TOP(N)) GO TO 300             ADI2170
      IF (KEEP(N)-PHE(N)) 280,290,290                                   ADI2180
  280 SUBS=(SY(N)-S(N))/DELT*(KEEP(N)-TOP(N))                           ADI2190
      GO TO 310                                                         ADI2200
  290 SUBS=(S(N)-SY(N))/DELT*(KEEP(N)-TOP(N))                           ADI2210
```

Program listing—Continued

```
  300 RHO=SY(N)/DELT                                                    ADI2220
      GO TO 320                                                         ADI2230
  310 RHO=S(N)/DELT                                                     ADI2240
  320 IF (LEAK.NE.CHK(9)) GO TO 340                                     ADI2250
C                                                                       ADI2260
C     ---COMPUTE NET LEAKAGE TERM FOR CONVERSION SIMULATION---          ADI2270
      IF (RATE(N).EQ.0..OR.M(N).EQ.0.) GO TO 340                        ADI2280
      HED1=AMAX1(STRT(N),TOP(N))                                        ADI2290
      U=1.                                                              ADI2300
      HED2=0.                                                           ADI2310
      IF (PHE(N).GE.TOP(N)) GO TO 330                                   ADI2320
      HED2=TOP(N)                                                       ADI2330
      U=0.                                                              ADI2340
  330 SL(N)=RATE(N)/M(N)*(RIVER(N)-HED1)+TL(N)*(HED1-HED2-STRT(N))      ADI2350
  340 CONTINUE                                                          ADI2360
C                                                                       ADI2370
C     ---CALCULATE VALUES FOR PARAMETERS USED IN THOMAS ALGORITHM       ADI2380
C     AND FORWARD SUBSTITUTE TO COMPUTE INTERMEDIATE VECTOR G---        ADI2390
      IMK=(B+D+F+H)*PARAM                                               ADI2400
      E=-B-H-RHO-IMK-TL(N)*U-ETQB                                       ADI2410
      W=E-B*BE(I-1)                                                     ADI2420
      BE(I)=H/W                                                         ADI2430
      Q=-D*PHI(NL)+(D+F-IMK-E)*PHI(N)-F*PHI(NR)-RHO*KEEP(N)-SL(N)-QRE(N)ADI2440
     1-WELL(N)+ETQD-SUBS-TL(N)*STRT(N)-B*PHI(NA)-H*PHI(NB)              ADI2450
      G(I)=(Q-B*G(I-1))/W                                               ADI2460
  350 CONTINUE                                                          ADI2470
C                                                                       ADI2480
C     ---BACK SUBSTITUTE FOR HEAD VALUES AND PLACE THEM IN TEMP---      ADI2490
      XII(DIML)=0.D0                                                    ADI2500
      DO 370 KNO4=1,NO3                                                 ADI2510
      NO4=DIML-KNO4                                                     ADI2520
      N=NO4+DIML*(J-1)                                                  ADI2530
C                                                                       ADI2540
C     ---FIRST PLACE TEMP VALUES IN PHI(N-DIML)----                     ADI2550
      PHI(N-DIML)=TEMP(NO4)                                             ADI2560
      IF (T(N).NE.0..AND.S(N).GE.0.) GO TO 360                          ADI2570
      XII(NO4)=0.D0                                                     ADI2580
      TEMP(NO4)=PHI(N)                                                  ADI2590
      GO TO 370                                                         ADI2600
  360 XII(NO4)=G(NO4)-BE(NO4)*XII(NO4+1)                                ADI2610
      TEMP(NO4)=PHI(N)+XII(NO4)                                         ADI2620
C                                                                       ADI2630
C     ---COMPARE CHANGE IN HEAD WITH CLOSURE CRITERION--                ADI2640
      TCHK=ABS(SNGL(TEMP(NO4))-PHE(N))                                  ADI2650
      IF (TCHK.GT.BIGI) BIGI=TCHK                                       ADI2660
  370 CONTINUE                                                          ADI2670
  380 CONTINUE                                                          ADI2680
      IF (BIGI.GT.ERR) TEST=1.                                          ADI2690
      TEST3(KOUNT+1)=BIGI                                               ADI2700
      IF (TEST.EQ.1.) GO TO 30                                          ADI2710
      RETURN                                                            ADI2720
C     ..................................................................ADI2730
C                                                                       ADI2740
C     ---FORMATS---                                                     ADI2750
C                                                                       ADI2760
C     ------------------------------------------------------------------ADI2770
C                                                                       ADI2780
C                                                                       ADI2790
  390 FORMAT ('0EXCEEDED PERMITTED NUMBER OF ITERATIONS'/' ',39('*'))   ADI2800
  400 FORMAT ('-',38X,'SOLUTION BY THE ALTERNATING DIRECTION IMPLICIT PRADI2810
     1OCEDURE'/39X,56('_'))                                             ADI2820
```

Program listing—Continued

```
  410 FORMAT (///1H0,I5,22H ITERATION PARAMETERS:,8D12.3//28X,10D12.3)  ADI2830
      END                                                              ADI2840-

      SUBROUTINE COEF(PHI,KEEP,PHE,STRT,SURI,T,TR,TC,S,WELL,TL,SL,PERM,BCOF  10
     1OTTOM,SY,RATE,RIVER,M,TOP,GRND,DELX,DELY)                        COF  20
C     ------------------------------------------------------------------COF  30
C     COMPUTE COEFFICIENTS                                              COF  40
C     ------------------------------------------------------------------COF  50
C                                                                       COF  60
C     SPECIFICATIONS:                                                   COF  70
      REAL *8PHI,DBLE,RHO,B,D,F,H                                       COF  80
      REAL *4KEEP,M                                                     COF  90
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,COF 100
     1CONTR,LEAK,RECH,SIP,ADI                                           COF 110
C                                                                       COF 120
      DIMENSION PHI(1), KEEP(1), PHE(1), STRT(1), SURI(1), T(1), TR(1), COF 130
     1TC(1), S(1), WELL(1), TL(1), SL(1), PERM(1), BOTTOM(1), SY(1), RATCOF 140
     2E(1), RIVER(1), M(1), TOP(1), GRND(1), DELX(1), DELY(1)           COF 150
C                                                                       COF 160
      COMMON /SARRAY/ VF4(11),CHK(15)                                   COF 170
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LECOF 180
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,COF 190
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,COF 200
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DICOF 210
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 COF 220
C                                                                       COF 230
      DATA PIE/3.141593/                                                COF 235
      RETURN                                                            COF 240
C     ..................................................................COF 250
C                                                                       COF 260
C     ---COMPUTE COEFFICIENTS FOR TRANSIENT PART OF LEAKAGE TERM---     COF 270
C     ********************                                              COF 280
      ENTRY CLAY                                                        COF 290
C     ********************                                              COF 300
      TMIN=1.E30                                                        COF 310
      TT=0.0                                                            COF 320
      PRATE=0.                                                          COF 330
      DO 50 I=1,DIML                                                    COF 340
      DO 50 J=1,DIMW                                                    COF 350
      N=I+DIML*(J-1)                                                    COF 360
C                                                                       COF 370
C     ---SKIP COMPUTATIONS IF T, RATE OR M = 0, OR IF CONSTANT          COF 380
C        HEAD BOUNDARY---                                               COF 390
      IF (RATE(N).LE.0..OR.T(N).EQ.0..OR.M(N).EQ.0..OR.S(N).LT.0.) GO TOCOF 400
     1 50                                                               COF 410
C                                                                       COF 420
C     ---IF VALUE FOR TL(N  ) WILL EQUAL VALUE FOR PREVIOUS NODE,       COF 430
C     SKIP PART OF COMPUTATIONS---                                      COF 440
      IF (RATE(N)*M(N).EQ.PRATE) GO TO 40                               COF 450
      DIMT=RATE(N)*SUMP/(M(N)*M(N)*SS*3)                                COF 460
      IF (DIMT.GT.TT) TT=DIMT                                           COF 470
      IF (DIMT.LT.TMIN) TMIN=DIMT                                       COF 480
      PPT=PIE*PIE*DIMT                                                  COF 490
C                                                                       COF 500
C     ---RECOMPUTE PPT IF DIMT WITHIN RANGE FOR SHORT TIME COMPUTATION--COF 510
      IF (DIMT.LT.1.0E-03) PPT=1.0/DIMT                                 COF 520
      CC=(2.3-PPT)/(2.*PPT)                                             COF 530
C                                                                       COF 540
C     ---COMPUTE SUM OF EXPONENTIALS---                                 COF 550
      SUMN=0.0                                                          COF 560
```

Program listing—Continued

```
      DO 20 K=1,200                                                     COF 570
      POWER=K*K*PPT                                                     COF 580
      IF (POWER.LE.150.) GO TO 10                                       COF 590
      POWER=150                                                         COF 600
   10 PEX=EXP(-POWER)                                                   COF 610
      SUMN=SUMN+PEX                                                     COF 620
      IF (PEX.GT.0.00009) GO TO 20                                      COF 630
      IF (K.GT.CC) GO TO 30                                             COF 640
   20 CONTINUE                                                          COF 650
C                                                                       COF 660
C     ---COMPUTE DENOMINATER DEPENDING ON VALUE OF DIMT---              COF 670
   30 DENOM=1.0                                                         COF 680
      IF (DIMT.LT.1.0E-03) DENOM=SQRT(PIE*DIMT)                         COF 690
C                                                                       COF 700
C     ---HEAD VALUES ARE NOT INCLUDED IN COMPUTATION OF Q FACTOR SINCE  COF 710
C        LEAKAGE IS CONSIDERED IMPLICITLY---                            COF 720
   40 Q1=RATE(N)/(M(N)*DENOM)                                           COF 730
      TL(N)=Q1+2.*Q1*SUMN                                               COF 740
      PRATE=RATE(N)*M(N)                                                COF 750
   50 CONTINUE                                                          COF 760
      TMIN=TMIN*3.0                                                     COF 770
      TT=TT*3.0                                                         COF 780
      RETURN                                                            COF 790
C     ..................................................................COF 800
C                                                                       COF 810
C     ---COMPUTE TRANSMISSIVITY IN WT OR WT-ARTESIAN CONVERSION PROBLEM-COF 820
C     ********************                                              COF 830
      ENTRY TRANS                                                       COF 840
C     ********************                                              COF 850
      DO 60 I=1,DIML                                                    COF 860
      DO 60 J=1,DIMW                                                    COF 870
      N=I+DIML*(J-1)                                                    COF 880
      IF (PERM(N).EQ.0.) GO TO 60                                       COF 890
      HED=PHI(N)                                                        COF 900
      IF (CONVRT.EQ.CHK(7)) HED=AMIN1(SNGL(PHI(N)),TOP(N))              COF 910
      T(N)=PERM(N)*(HED-BOTTOM(N))                                      COF 920
      IF (T(N).GT.0.) GO TO 60                                          COF 930
      IF (WELL(N).LT.0.) GO TO 70                                       COF 940
C                                                                       COF 950
C     ---THE FOLLOWING STATEMENTS APPLY WHEN NODES (EXCEPT WELL NODES)  COF 960
C     GO DRY---                                                         COF 970
      PERM(N)=0.                                                        COF 980
      T(N)=0.0                                                          COF 990
      TR(N-DIML)=0.                                                     COF1000
      TR(N)=0.                                                          COF1010
      TC(N-1)=0.                                                        COF1020
      TC(N)=0.                                                          COF1030
      PHI(N)=SURI(N)                                                    COF1040
      WRITE (P,150) I,J                                                 COF1050
   60 CONTINUE                                                          COF1060
      IF (KT.EQ.0) RETURN                                               COF1070
      GO TO 90                                                          COF1080
C                                                                       COF1090
C     ---START PROGRAM TERMINATION WHEN A WELL GOES DRY---              COF1100
   70 WRITE (P,120) I,J                                                 COF1110
      WRITE (P,130)                                                     COF1120
      IERR=1                                                            COF1130
      CALL DRDN                                                         COF1140
      DO 80 I=2,INO1                                                    COF1150
      DO 80 J=2,JNO1                                                    COF1160
      N=I+DIML*(J-1)                                                    COF1170
```

Program listing—Continued

```
   80 PHI(N)=KEEP(N)                                                    COF1180
      SUM=SUM-DELT                                                      COF1190
      SUMP=SUMP-DELT                                                    COF1200
      KT=KT-1                                                           COF1210
      IF (KT.EQ.0) STOP                                                 COF1220
      IF (IDK2.EQ.CHK(15)) CALL DISK                                    COF1230
      IF (PNCH.EQ.CHK(1)) CALL PUNCH                                    COF1240
      IF (MOD(KT,KTH).EQ.0) STOP                                        COF1250
      WRITE (P,140) KT,SUM                                              COF1260
      CALL DRDN                                                         COF1270
      IF (CHCK.EQ.CHK(5)) CALL CWRITE                                   COF1280
      STOP                                                              COF1290
C                                                                       COF1300
C     ---COMPUTE T COEFFICIENTS---                                      COF1310
C     ********************                                              COF1320
      ENTRY TCOF                                                        COF1330
C     ********************                                              COF1340
   90 DO 110 I=1,INO1                                                   COF1350
      DO 110 J=1,JNO1                                                   COF1360
      N=I+DIML*(J-1)                                                    COF1370
      NR=N+DIML                                                         COF1380
      NB=N+1                                                            COF1390
      IF (T(N).EQ.0.) GO TO 110                                         COF1400
      IF (T(NR).EQ.0.) GO TO 100                                        COF1410
      TR(N)=(2.*T(NR)*T(N))/(T(N)*DELX(J+1)+T(NR)*DELX(J))*FACTX        COF1420
  100 IF (T(NB).EQ.0.) GO TO 110                                        COF1430
      TC(N)=(2.*T(NB)*T(N))/(T(N)*DELY(I+1)+T(NB)*DELY(I))*FACTY        COF1440
  110 CONTINUE                                                          COF1450
      RETURN                                                            COF1460
C                                                                       COF1470
C     ---FORMATS---                                                     COF1480
C                                                                       COF1490
C     ------------------------------------------------------------------COF1500
C                                                                       COF1510
C                                                                       COF1520
  120 FORMAT ('-************WELL',I3,',',I3,' GOES DRY**************') COF1530
  130 FORMAT ('1',50X,'DRAWDOWN WHEN WELL WENT DRY')                    COF1540
  140 FORMAT ('1',32X,'DRAWDOWN FOR TIME STEP',I3,'; SIMULATION TIME =',COF1550
     11PE15.7,' SECONDS')                                               COF1560
  150 FORMAT ('-',20('*'),' NODE ',I4,',',I4,' GOES DRY ',20('*'))      COF1570
      END                                                               COF1580-


      SUBROUTINE CHECKI(PHI,KEEP,PHE,STRT,T,TR,TC,S,QRE,WELL,TL,PERM,BOTCHK  10
     1TOM,SY,RATE,RIVER,M,TOP,GRND,DELX,DELY)                           CHK  20
C     ------------------------------------------------------------------CHK  30
C     COMPUTE A MASS BALANCE                                            CHK  40
C     ------------------------------------------------------------------CHK  50
C                                                                       CHK  60
C     SPECIFICATIONS:                                                   CHK  70
      REAL *8PHI,DBLE                                                   CHK  80
      REAL *4KEEP,M                                                     CHK  90
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CHK 100
     1CONTR,LEAK,RECH,SIP,ADI                                           CHK 110
C                                                                       CHK 120
      DIMENSION PHI(IZ,JZ), KEEP(IZ,JZ), PHE(IZ,JZ), STRT(IZ,JZ), T(IZ,JCHK 130
     1Z), TR(IZ,JZ), TC(IZ,JZ), S(IZ,JZ), QRE(IZ,JZ), WELL(IZ,JZ), TL(IZCHK 140
     2,JZ), PERM(IZ,JZ), BOTTOM(IP,JP), SY(IP,JP), RATE(IR,JR), RIVER(IRCHK 150
     3,JR), M(IR,JR), TOP(IC,JC), GRND(IL,JL), DELX(JZ), DELY(IZ)       CHK 160
C                                                                       CHK 170
      COMMON /SARRAY/ VF4(11),CHK(15)                                   CHK 180
```

Program listing—Continued

```
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LECHK 190
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,CHK 200
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,CHK 210
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DICHK 220
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                CHK 230
      COMMON /CK/ ETFLXT,STORT,QRET,CHST,CHDT,FLUXT,PUMPT,CFLUXT,FLXNT  CHK 240
      COMMON /ARSIZE/ IZ,JZ,IP,JP,IR,JR,IC,JC,IL,JL,IS,JS,IH,IMAX,IMX1  CHK 250
      RETURN                                                            CHK 260
C     ..................................................................CHK 270
C     ********************                                              CHK 280
      ENTRY CHECK                                                       CHK 290
C     ********************                                              CHK 300
C     ---INITIALIZE VARIABLES---                                        CHK 310
      PUMP=0.                                                           CHK 320
      STOR=0.                                                           CHK 330
      FLUXS=0.0                                                         CHK 340
      CHD1=0.0                                                          CHK 350
      CHD2=0.0                                                          CHK 360
      QREFLX=0.                                                         CHK 370
      CFLUX=0.                                                          CHK 380
      FLUX=0.                                                           CHK 390
      ETFLUX=0.                                                         CHK 400
      FLXN=0.0                                                          CHK 410
C     ..................................................................CHK 420
C                                                                       CHK 430
C     ---COMPUTE RATES,STORAGE AND PUMPAGE FOR THIS STEP---             CHK 440
      DO 240 I=2,DIML                                                   CHK 450
      DO 240 J=2,DIMW                                                   CHK 460
      IF (T(I,J).EQ.0.) GO TO 240                                       CHK 470
      AREA=DELX(J)*DELY(I)                                              CHK 480
      IF (S(I,J).GE.0.) GO TO 120                                       CHK 490
C                                                                       CHK 500
C     ---COMPUTE FLOW RATES TO AND FROM CONSTANT HEAD BOUNDARIES---     CHK 510
      IF (S(I,J-1).LT.0..OR.T(I,J-1).EQ.0.) GO TO 30                    CHK 520
      X=(STRT(I,J)-PHI(I,J-1))*TR(I,J-1)*DELY(I)                        CHK 530
      IF (X) 10,30,20                                                   CHK 540
   10 CHD1=CHD1+X                                                       CHK 550
      GO TO 30                                                          CHK 560
   20 CHD2=CHD2+X                                                       CHK 570
   30 IF (S(I,J+1).LT.0..OR.T(I,J+1).EQ.0.) GO TO 60                    CHK 580
      X=(STRT(I,J)-PHI(I,J+1))*TR(I,J)*DELY(I)                          CHK 590
      IF (X) 40,60,50                                                   CHK 600
   40 CHD1=CHD1+X                                                       CHK 610
      GO TO 60                                                          CHK 620
   50 CHD2=CHD2+X                                                       CHK 630
   60 IF (S(I-1,J).LT.0..OR.T(I-1,J).EQ.0.) GO TO 90                    CHK 640
      X=(STRT(I,J)-PHI(I-1,J))*TC(I-1,J)*DELX(J)                        CHK 650
      IF (X) 70,90,80                                                   CHK 660
   70 CHD1=CHD1+X                                                       CHK 670
      GO TO 90                                                          CHK 680
   80 CHD2=CHD2+X                                                       CHK 690
   90 IF (S(I+1,J).LT.0..OR.T(I+1,J).EQ.0.) GO TO 240                   CHK 700
      X=(STRT(I,J)-PHI(I+1,J))*TC(I,J)*DELX(J)                          CHK 710
      IF (X) 100,240,110                                                CHK 720
  100 CHD1=CHD1+X                                                       CHK 730
      GO TO 240                                                         CHK 740
  110 CHD2=CHD2+X                                                       CHK 750
      GO TO 240                                                         CHK 760
C                                                                       CHK 770
C     ---RECHARGE AND WELLS---                                          CHK 780
  120 QREFLX=QREFLX+QRE(I,J)*AREA                                       CHK 790
```

Program listing—Continued

```
      IF (WELL(I,J)) 130,150,140                                        CHK 800
  130 PUMP=PUMP+WELL(I,J)*AREA                                          CHK 810
      GO TO 150                                                         CHK 820
  140 CFLUX=CFLUX+WELL(I,J)*AREA                                        CHK 830
  150 IF (EVAP.NE.CHK(6)) GO TO 190                                     CHK 840
C                                                                       CHK 850
C     ---COMPUTE ET RATE---                                             CHK 860
      IF (PHI(I,J).GE.GRND(I,J)-ETDIST) GO TO 160                       CHK 870
      ETQ=0.0                                                           CHK 880
      GO TO 180                                                         CHK 890
  160 IF (PHI(I,J).LE.GRND(I,J)) GO TO 170                              CHK 900
      ETQ=QET                                                           CHK 910
      GO TO 180                                                         CHK 920
  170 ETQ=QET/ETDIST*(PHI(I,J)+ETDIST-GRND(I,J))                        CHK 930
  180 ETFLUX=ETFLUX-ETQ*AREA                                            CHK 940
C                                                                       CHK 950
C     ---COMPUTE VOLUME FROM STORAGE---                                 CHK 960
  190 STORE=S(I,J)                                                      CHK 970
      IF (WATER.EQ.CHK(2)) STORE=SY(I,J)                                CHK 980
      IF (CONVRT.NE.CHK(7)) GO TO 230                                   CHK 990
      X=KEEP(I,J)-PHI(I,J)                                              CHK1000
      IF (X) 200,210,210                                                CHK1010
  200 HED1=PHI(I,J)                                                     CHK1020
      HED2=KEEP(I,J)                                                    CHK1030
      X=ABS(X)                                                          CHK1040
      GO TO 220                                                         CHK1050
  210 HED1=KEEP(I,J)                                                    CHK1060
      HED2=PHI(I,J)                                                     CHK1070
  220 STORE=S(I,J)                                                      CHK1080
      IF (HED1-TOP(I,J).LE.0.) STORE=SY(I,J)                            CHK1090
      IF ((HED1-TOP(I,J))*(HED2-TOP(I,J)).LT.0.0) STORE=(HED1-TOP(I,J))/CHK1100
     1X*S(I,J)+(TOP(I,J)-HED2)/X*SY(I,J)                                CHK1110
  230 STOR=STOR+STORE*(KEEP(I,J)-PHI(I,J))*AREA                         CHK1120
C                                                                       CHK1130
C     ---COMPUTE LEAKAGE RATE---                                        CHK1140
      IF (LEAK.NE.CHK(9)) GO TO 240                                     CHK1150
      IF (M(I,J).EQ.0.) GO TO 240                                       CHK1160
      HED1=STRT(I,J)                                                    CHK1170
      IF (CONVRT.EQ.CHK(7)) HED1=AMAX1(STRT(I,J),TOP(I,J))              CHK1180
      HED2=PHI(I,J)                                                     CHK1190
      IF (CONVRT.EQ.CHK(7)) HED2=AMAX1(SNGL(PHI(I,J)),TOP(I,J))         CHK1200
      XX=RATE(I,J)*(RIVER(I,J)-HED1)*AREA/M(I,J)                        CHK1210
      YY=TL(I,J)*(HED1-HED2)*AREA                                       CHK1220
      FLUX=FLUX+XX                                                      CHK1230
      XNET=XX+YY                                                        CHK1240
      FLUXS=FLUXS+XNET                                                  CHK1250
      IF (XNET.LT.0.) FLXN=FLXN-XNET                                    CHK1260
  240 CONTINUE                                                          CHK1270
C     ..................................................................CHK1280
C                                                                       CHK1290
C     ---COMPUTE CUMULATIVE VOLUMES, TOTALS, AND DIFFERENCES---         CHK1300
      STORT=STORT+STOR                                                  CHK1310
      STOR=STOR/DELT                                                    CHK1320
      ETFLXT=ETFLXT-ETFLUX*DELT                                         CHK1330
      FLUXT=FLUXT+FLUXS*DELT                                            CHK1340
      FLXNT=FLXNT+FLXN*DELT                                             CHK1350
      FLXPT=FLUXT+FLXNT                                                 CHK1360
      QRET=QRET+QREFLX*DELT                                             CHK1370
      CHDT=CHDT-CHD1*DELT                                               CHK1380
      CHST=CHST+CHD2*DELT                                               CHK1390
      PUMPT=PUMPT-PUMP*DELT                                             CHK1400
```

Program listing—Continued

```
      CFLUXT=CFLUXT+CFLUX*DELT                                          CHK1410
      TOTL1=STORT+QRET+CFLUXT+CHST+FLXPT                                CHK1420
      TOTL2=CHDT+PUMPT+ETFLXT+FLXNT                                     CHK1430
      SUMR=QREFLX+CFLUX+CHD2+CHD1+PUMP+ETFLUX+FLUXS+STOR                CHK1440
      DIFF=TOTL2-TOTL1                                                  CHK1450
      PERCNT=0.0                                                        CHK1460
      IF (TOTL2.EQ.0.) GO TO 250                                        CHK1470
      PERCNT=DIFF/TOTL2*100.                                            CHK1480
  250 RETURN                                                            CHK1490
C     ..............................................................CHK1500
C                                                                       CHK1510
C     ---PRINT RESULTS---                                               CHK1520
C     ************************                                          CHK1530
      ENTRY CWRITE                                                      CHK1540
C     ************************                                          CHK1550
C                                                                       CHK1560
      WRITE (P,260) STOR,QREFLX,STORT,CFLUX,QRET,PUMP,CFLUXT,ETFLUX,CHSTCHK1570
     1,FLXPT,CHD2,TOTL1,CHD1,FLUX,FLUXS,ETFLXT,CHDT,SUMR,PUMPT,FLXNT,TOTCHK1580
     2L2,DIFF,PERCNT                                                    CHK1590
      RETURN                                                            CHK1600
C                                                                       CHK1610
C     ---FORMATS---                                                     CHK1620
C                                                                       CHK1630
C     ..............................................................CHK1640
C                                                                       CHK1650
C                                                                       CHK1660
  260 FORMAT ('0',10X,'CUMULATIVE MASS BALANCE:',16X,'L**3',23X,'RATES FCHK1670
     1OR THIS TIME STEP:',16X,'L**3/T'/11X,24('-'),43X,25('-')//20X,'SOUCHK1680
     2RCES:',69X,'STORAGE =',F20.4/20X,8('-'),68X,'RECHARGE =',F20.4/27XCHK1690
     3,'STORAGE =',F20.2,35X,'CONSTANT FLUX =',F20.4/26X,'RECHARGE =',F2CHK1700
     40.2,41X,'PUMPING =',F20.4/21X,'CONSTANT FLUX =',F20.2,30X,'EVAPOTRCHK1710
     5ANSPIRATION =',F20.4/21X,'CONSTANT HEAD =',F20.2,34X,'CONSTANT HEACHK1720
     6D:'/27X,'LEAKAGE =',F20.2,46X,'IN =',F20.4/21X,'TOTAL SOURCES =',FCHK1730
     720.2,45X,'OUT =',F20.4/96X,'LEAKAGE:'/20X,'DISCHARGES:',45X,'FROM CHK1740
     8PREVIOUS PUMPING PERIOD =',F20.4/20X,11('-'),68X,'TOTAL =',F20.4/1CHK1750
     96X,'EVAPOTRANSPIRATION =',F20.2/21X,'CONSTANT HEAD =',F20.2,36X,'SCHK1760
     $UM OF RATES =',F20.4/19X'QUANTITY PUMPED =',F20.2/27X,'LEAKAGE =',CHK1770
     $F20.2/19X,'TOTAL DISCHARGE =',F20.2//17X,'DISCHARGE-SOURCES =',F20CHK1780
     $.2/15X,'PER CENT DIFFERENCE =',F20.2//)                           CHK1790
      END                                                               CHK1800-


      SUBROUTINE PRNTAI(PHI,SURI,T,S,WELL,DELX,DELY)                    PRN  10
C     ..............................................................PRN  20
C     PRINT MAPS OF DRAWDOWN AND HYDRAULIC HEAD                         PRN  30
C     ..............................................................PRN  40
C                                                                       PRN  50
C     SPECIFICATIONS:                                                   PRN  60
      REAL *8PHI,Z,XLABEL,YLABEL,TITLE,XN1,MESUR                        PRN  70
      REAL *4K                                                          PRN  80
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,PRN  90
     1CONTR,LEAK,RECH,SIP,ADI                                           PRN 100
C                                                                       PRN 110
      DIMENSION PHI(IZ,JZ), SURI(IZ,JZ), S(IZ,JZ), WELL(IZ,JZ), DELX(JZ)PRN 120
     1, DELY(IZ), T(IZ,JZ)                                              PRN 130
C                                                                       PRN 140
      COMMON /SARRAY/ VF4(11),CHK(15)                                   PRN 150
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LEPRN 160
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,PRN 170
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,PRN 180
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DIPRN 190
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 PRN 200
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Program listing—Continued

```
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(5),XN1,MESUR,PRNT(122),BLANKPRN 210
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),PRN 220
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2                          PRN 230
      COMMON /ARSIZE/ IZ,JZ,IP,JP,IR,JR,IC,JC,IL,JL,IS,JS,IH,IMAX,IMX1  PRN 240
      RETURN                                                            PRN 250
C     ..................................................................PRN 260
C                                                                       PRN 270
C     ---INITIALIZE VARIABLES FOR PLOT---                               PRN 280
C     ********************                                              PRN 290
      ENTRY MAP                                                         PRN 300
C     ********************                                              PRN 310
   10 XSF=DINCH*XSCALE                                                  PRN 320
      YSF=DINCH*YSCALE                                                  PRN 330
      NYD=YDIM/YSF                                                      PRN 340
      IF (NYD*YSF.LE.YDIM-DELY(INO1)/2.) NYD=NYD+1                      PRN 350
      IF (NYD.LE.12) GO TO 20                                           PRN 360
      DINCH=YDIM/(12.*YSCALE)                                           PRN 370
      WRITE (P,310) DINCH                                               PRN 380
      IF (YSCALE.LT.1.0) WRITE (P,320)                                  PRN 390
      GO TO 10                                                          PRN 400
   20 NXD=WIDTH/XSF                                                     PRN 410
      IF (NXD*XSF.LE.WIDTH-DELX(JNO1)/2.) NXD=NXD+1                     PRN 420
      N4=NXD*N1+1                                                       PRN 430
      N5=NXD+1                                                          PRN 440
      N6=NYD+1                                                          PRN 450
      N8=N2*NYD+1                                                       PRN 460
      NA(1)=N4/2-1                                                      PRN 470
      NA(2)=N4/2                                                        PRN 480
      NA(3)=N4/2+3                                                      PRN 490
      NC=(N3-N8-10)/2                                                   PRN 500
      ND=NC+N8                                                          PRN 510
      NE=MAX0(N5,N6)                                                    PRN 520
      VF1(3)=DIGIT(ND)                                                  PRN 530
      VF2(3)=DIGIT(ND)                                                  PRN 540
      VF3(3)=DIGIT(NC)                                                  PRN 550
      XLABEL(3)=MESUR                                                   PRN 560
      YLABEL(6)=MESUR                                                   PRN 570
      DO 40 I=1,NE                                                      PRN 580
      NNX=N5-I                                                          PRN 590
      NNY=I-1                                                           PRN 600
      IF (NNY.GE.N6) GO TO 30                                           PRN 610
      YN(I)=YSF*NNY/YSCALE                                              PRN 620
   30 IF (NNX.LT.0) GO TO 40                                            PRN 630
      XN(I)=XSF*NNX/YSCALE                                              PRN 640
   40 CONTINUE                                                          PRN 650
      RETURN                                                            PRN 660
C     ..................................................................PRN 670
C                                                                       PRN 680
C     ********************                                              PRN 690
      ENTRY PRNTA(NG)                                                   PRN 700
C     ********************                                              PRN 710
C     ---VARIABLES INITIALIZED EACH TIME A PLOT IS REQUESTED---         PRN 720
      DIST=WIDTH-DELX(JNO1)/2.                                          PRN 730
      JJ=JNO1                                                           PRN 740
      LL=1                                                              PRN 750
      Z=NXD*XSF                                                         PRN 760
      IF (NG.EQ.1) WRITE (P,280) (TITLE(I),I=1,2)                       PRN 770
      IF (NG.EQ.2) WRITE (P,280) (TITLE(I),I=3,5)                       PRN 780
      DO 270 I=1,N4                                                     PRN 790
C                                                                       PRN 800
C     ---LOCATE X AXES---                                               PRN 810
```

Program listing—Continued

```
      IF (I.EQ.1.OR.I.EQ.N4) GO TO 50                                   PRN 820
      PRNT(1)=SYM(12)                                                   PRN 830
      PRNT(N8)=SYM(12)                                                  PRN 840
      IF ((I-1)/N1*N1.NE.I-1) GO TO 70                                  PRN 850
      PRNT(1)=SYM(14)                                                   PRN 860
      PRNT(N8)=SYM(14)                                                  PRN 870
      GO TO 70                                                          PRN 880
C                                                                       PRN 890
C     ---LOCATE Y AXES---                                               PRN 900
   50 DO 60 J=1,N8                                                      PRN 910
      IF ((J-1)/N2*N2.EQ.J-1) PRNT(J)=SYM(14)                           PRN 920
   60 IF ((J-1)/N2*N2.NE.J-1) PRNT(J)=SYM(13)                           PRN 930
C                                                                       PRN 940
C     ---COMPUTE LOCATION OF NODES AND DETERMINE APPROPRIATE SYMBOL---  PRN 950
   70 IF (DIST.LT.0..OR.DIST.LT.Z-XN1*XSF) GO TO 220                    PRN 960
      YLEN=DELY(2)/2.                                                   PRN 970
      DO 200 L=2,INO1                                                   PRN 980
      J=YLEN*N2/YSF+1.5                                                 PRN 990
      IF (T(L,JJ).EQ.0.) GO TO 140                                      PRN1000
      IF (S(L,JJ).LT.0.) GO TO 190                                      PRN1010
      INDX3=0                                                           PRN1020
      GO TO (80,90), NG                                                 PRN1030
   80 K=(SURI(L,JJ)-PHI(L,JJ))*FACT1                                    PRN1040
C     -TO CYCLE SYMBOLS FOR DRAWDOWN, REMOVE C FROM COL. 1 OF NEXT CARD-PRN1050
C     K=AMOD(K,10.)                                                     PRN1060
      GO TO 100                                                         PRN1070
   90 K=PHI(L,JJ)*FACT2                                                 PRN1080
  100 IF (K) 110,140,120                                                PRN1090
  110 IF (J-2.GT.0) PRNT(J-2)=SYM(13)                                   PRN1100
      N=-K                                                              PRN1110
      IF (N.LT.100) GO TO 130                                           PRN1120
      GO TO 170                                                         PRN1130
  120 N=K                                                               PRN1140
      IF (N.LT.100) GO TO 130                                           PRN1150
      IF (N.GT.999) GO TO 170                                           PRN1160
      INDX3=N/100                                                       PRN1170
      IF (J-2.GT.0) PRNT(J-2)=SYM(INDX3)                                PRN1180
      N=N-INDX3*100                                                     PRN1190
  130 INDX1=MOD(N,10)                                                   PRN1200
      IF (INDX1.EQ.0) INDX1=10                                          PRN1210
C     -TO CYCLE SYMBOLS FOR DRAWDOWN, REMOVE C FROM COL. 1 OF NEXT CARD-PRN1220
C     IF (NG.EQ.1) GO TO 150                                            PRN1230
      INDX2=N/10                                                        PRN1240
      IF (INDX2.GT.0) GO TO 160                                         PRN1250
      INDX2=10                                                          PRN1260
      IF (INDX3.EQ.0) INDX2=15                                          PRN1270
      GO TO 160                                                         PRN1280
  140 INDX1=15                                                          PRN1290
  150 INDX2=15                                                          PRN1300
  160 IF (J-1.GT.0) PRNT(J-1)=SYM(INDX2)                                PRN1310
      PRNT(J)=SYM(INDX1)                                                PRN1320
      GO TO 200                                                         PRN1330
  170 DO 180 II=1,3                                                     PRN1340
      JI=J-3+II                                                         PRN1350
  180 IF (JI.GT.0) PRNT(JI)=SYM(11)                                     PRN1360
  190 IF (S(L,JJ).LT.0.) PRNT(J)=SYM(16)                                PRN1370
  200 YLEN=YLEN+(DELY(L)+DELY(L+1))/2.                                  PRN1380
  210 DIST=DIST-(DELX(JJ)+DELX(JJ-1))/2.                                PRN1390
      JJ=JJ-1                                                           PRN1400
      IF (JJ.EQ.0) GO TO 220                                            PRN1410
      IF (DIST.GT.Z-XN1*XSF) GO TO 210                                  PRN1420
```

Program listing—Continued

```
  220 CONTINUE                                                          PRN1430
C                                                                       PRN1440
C     ---PRINT AXES,LABELS, AND SYMBOLS---                              PRN1450
      IF (I-NA(LL).EQ.0) GO TO 240                                      PRN1460
      IF ((I-1)/N1*N1-(I-1)) 250,230,250                                PRN1470
  230 WRITE (P,VF1) (BLANK(J),J=1,NC),(PRNT(J),J=1,N8),XN(1+(I-1)/6)    PRN1480
      GO TO 260                                                         PRN1490
  240 WRITE (P,VF2) (BLANK(J),J=1,NC),(PRNT(J),J=1,N8),XLABEL(LL)       PRN1500
      LL=LL+1                                                           PRN1510
      GO TO 260                                                         PRN1520
  250 WRITE (P,VF2) (BLANK(J),J=1,NC),(PRNT(J),J=1,N8)                  PRN1530
C                                                                       PRN1540
C     ---COMPUTE NEW VALUE FOR Z AND INITIALIZE PRNT---                 PRN1550
  260 Z=Z-2.*XN1*XSF                                                    PRN1560
      DO 270 J=1,N8                                                     PRN1570
  270 PRNT(J)=SYM(15)                                                   PRN1580
C                                                                       PRN1590
C     ---NUMBER AND LABEL Y AXIS AND PRINT LEGEND---                    PRN1600
      WRITE (P,VF3) (BLANK(J),J=1,NC),(YN(I),I=1,N6)                    PRN1610
      WRITE (P,300) (YLABEL(I),I=1,6)                                   PRN1620
      IF (NG.EQ.1) WRITE (P,290) FACT1                                  PRN1630
      IF (NG.EQ.2) WRITE (P,290) FACT2                                  PRN1640
      RETURN                                                            PRN1650
C                                                                       PRN1660
C     ---FORMATS---                                                     PRN1670
C                                                                       PRN1680
C     ----------------------------------------------------------------PRN1690
C                                                                       PRN1700
C                                                                       PRN1710
  280 FORMAT ('1',53X,4A8//)                                            PRN1720
  290 FORMAT ('0EXPLANATION'/' ',11('-')//' R = CONSTANT HEAD BOUNDARY'/PRN1730
     1' *** = VALUE EXCEEDED 3 FIGURES'/' MULTIPLICATION FACTOR =',F8.3)PRN1740
  300 FORMAT ('0',39X,6A8)                                              PRN1750
  310 FORMAT ('0',25X,10('*'),' TO FIT MAP WITHIN 12 INCHES, DINCH REVISPRN1760
     1ED TO',G15.7,1X,10('*'))                                          PRN1770
  320 FORMAT ('0',45X,'NOTE: GENERALLY SCALE SHOULD BE > OR = 1.0')     PRN1780
      END                                                               PRN1790-


      BLOCK DATA                                                        BLD  10
C     ----------                                                        BLD  20
      REAL *8XLABEL,YLABEL,TITLE,XN1,MESUR,RHO,B,D,F,H                  BLD  30
      INTEGER R,P,PU,DIML,DIMW,CHK,WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,BLD  40
     1CONTR,LEAK,RECH,SIP,ADI                                           BLD  50
C                                                                       BLD  60
      COMMON /DPARAM/ RHO,B,D,F,H                                       BLD  70
      COMMON /SARRAY/ VF4(11),CHK(15)                                   BLD  80
      COMMON /SPARAM/ WATER,CONVRT,EVAP,CHCK,PNCH,NUM,HEAD,CONTR,EROR,LEBLD  90
     1AK,RECH,SIP,U,SS,TT,TMIN,ETDIST,QET,ERR,TMAX,CDLT,HMAX,YDIM,WIDTH,BLD 100
     2NUMS,LSOR,ADI,DELT,SUM,SUMP,SUBS,STORE,TEST,ETQB,ETQD,FACTX,FACTY,BLD 110
     3IERR,KOUNT,IFINAL,NUMT,KT,KP,NPER,KTH,ITMAX,LENGTH,NWEL,NW,DIML,DIBLD 120
     4MW,JNO1,INO1,R,P,PU,I,J,IDK1,IDK2                                 BLD 130
      COMMON /PR/ XLABEL(3),YLABEL(6),TITLE(5),XN1,MESUR,PRNT(122),BLANKBLD 140
     1(60),DIGIT(122),VF1(6),VF2(6),VF3(7),XSCALE,DINCH,SYM(17),XN(100),BLD 150
     2YN(13),NA(4),N1,N2,N3,YSCALE,FACT1,FACT2                          BLD 160
      COMMON /ARSIZE/ IZ,JZ,IP,JP,IR,JR,IC,JC,IL,JL,IS,JS,IH,IMAX,IMX1  BLD 170
C     ****************************************************************BLD 180
C                                                                       BLD 190
      DATA IZ,JZ,IP,JP,IR,JR,IC,JC,IL,JL,IS,JS,IMAX/13*20/,IH/1/        BLD 200
      DATA CHK/'PUNC','WATE','CONT','NUME','CHEC','EVAP','CONV','HEAD','BLD 210
```

Program listing—Continued

```
     1LEAK',' RECH',' SIP ',' LSOR',' ADI',' DK1 ',' DK2 '/,R,P,PU/5,6,7/,B,D,BLD 220
     2F,H/4*0.D0/                                                            BLD 230
      DATA SYM/'1','2','3','4','5','6','7','8','9','0','*','|','-','+','BLD 240
     1 ','R','W'/                                                            BLD 250
      DATA PRNT/122*' '/,N1,N2,N3,XN1/6,10,133,.833333333D-1/,BLANK/60*'BLD 260
     1 '/,NA(4)/1000/                                                        BLD 270
      DATA XLABEL/' X DIS- ',' TANCE IN','  MILES '/,YLABEL/'DISTANCE',' BLD 280
     1FROM OR',' IGIN IN ',' Y DIRECT',' ION, IN ',' MILES   '/,TITLE/'PLOT BLD 290
     2OF ',' DRAWDOWN',' PLOT OF ',' HYDRAULI',' C HEAD'/                    BLD 300
      DATA DIGIT/'1','2','3','4','5','6','7','8','9','10','11','12','13'BLD 310
     1,'14','15','16','17','18','19','20','21','22','23','24','25','26',BLD 320
     2'27','28','29','30','31','32','33','34','35','36','37','38','39','BLD 330
     340','41','42','43','44','45','46','47','48','49','50','51','52','5BLD 340
     43','54','55','56','57','58','59','60','61','62','63','64','65','66BLD 350
     5','67','68','69','70','71','72','73','74','75','76','77','78',' 79BLD 360
     6','80','81','82','83','84','85','86','87','88','89','90','91','92'BLD 370
     7,'93','94','95','96','97','98','99','100','101','102','103',' 104'BLD 380
     8,'105','106','107','108','109','110','111','112','113','114','115'BLD 390
     9,'116','117','118','119','120','121','122'/                            BLD 400
      DATA VF1/'(1H ',',','    ','A1,F','10.2',')'/                          BLD 410
      DATA VF2/'(1H ',',','    ','A1,1','X,A8',')'/                          BLD 420
      DATA VF3/'(1H0',',','    ','A1,F','3.1','12F1','0.2)'/                 BLD 430
      DATA VF4/'(1H0',',','    ','X,I2',',2X,','20F6',',1/(','    ','X,2BLD 440
     10','F6.1','))'/                                                        BLD 450
C     ****************************************************************BLD 460
      END                                                                    BLD 470-
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