APPENDIX A

DRAINMOD - COMPUTER PROGRAM DOCUMENTATION

The program documentation consists of five parts, as follows:

1. A brief description of each segment of the program and a discussion of its function.

2. A program listing complete with definitions of all variable names.

3. An example set of input data.

4. An example of the program output - results of the simulation.

Program Segments and Their Functions

A. Main Program

The main program is written in PL1. It reads year, month, and hourly rainfall for each hour of the month from HISARS files. It also reads the maximum and minimum daily temperatures and calculates PET using the Thornthwaite method. Inputs to main through the EXECUTE JCL card are the station ID for the hourly rainfall file and the station ID and latitude for the temperature file. These are usually the same station, but can be different so that PET can be estimated from temperature records at a nearby station when necessary. Other inputs are the beginning and ending years of simulation and the heat index for the PET calculation.

The main program transfers the hourly rainfall and daily ET value for the entire month to subroutine FORSUB. The simulation is made in FORSUB for the month; control is returned to the MAIN program; another month's data is read from the file, and the process is repeated until the simulation has been conducted for the desired period.

A FORTRAN version of MAIN was also developed to read hourly rainfall and daily PET directly from cards. This program was used to test the validity of DRAINMOD by reading in measured hourly rainfall and outlet water level elevations. Observed water table elevations were also read in and deviations between predicted and observed were computed. The predicted and observed water table depths were also plotted by the computer for visual comparison.

B. Subroutine FORSUB

FORSUB accepts hourly rainfall and daily PET values for a one month period from the main program. At the beginning of simulation it reads soil properties, crop parameters, and water management system parameters, and initializes variables. The basic water management simulation is carried out in this subroutine. It determines if rainfall occurs on a given day, calculates infiltration, surface runoff, drainage or subirrigation, water table depth, depth of the dry zone, etc. These values may be printed out on a daily or monthly basis at the option of the user. It also calculates, stores and prints out water management system objective functions - those functions which the water management system is designed to provide at some minimal level. Objective functions or parameters are: working days during a given period, SEW-30, dry days during the growing season, or the amount of waste water irrigation. The operations of this subroutine depend on other subroutines which are called to read certain input data, to perform detailed calculations such as determining drainage flux, and to store and rank objective function values.

This subroutine can be divided into the following sections:

1. Obtain hourly rainfall and daily ET values from main program. Change values from inches to cm.

2. Read input parameters on the first time through the simulation. Most are read in directly; others are read in by calling subroutines PROP and ROOT.

3. Initialization of variables prior to beginning of simulation.

4. Determine hourly rainfall, PET, and initialize other variables for a new day.

5. Determine infiltration and conduct water balance on an hourly basis, if rain or irrigation occurs that day or if water was stored on the surface at the beginning of the day.

6. Conducts water balance calculations on a two-hour interval or one-day interval, depending on drainage flux, when there is no rain or surface irrigation.

7. Reevaluates the water balance for the day, determines water table depth, dry zone depth, etc., for the end of the day, and updates some variables to be used the next day.

8. Determines objective parameters, such as SEW-30 and working days, accumulates and stores these values and prints out daily values for all water management components if the user calls for daily output.

9. Computes yearly summaries and prints out monthly and yearly summaries. Calls subroutine ORDER to store and rank yearly summaries.

C. Subroutine PROP

This routine reads in the soil water characteristic (h v. θ) as a table of values. It interpolates between the values of water contents, θ, at 1 cm increments of pressure head from 0 to -500 cm of water. The relationship between air volume in the profile and water table depth is determined from the soil water characteristic by assuming a drained to equilibrium profile. Air volumes are calculated for incremental water table depths from 0 to 500 cm. As an alternative, the relationship between water table depth, air volume (or drainage volume) and steady state upward flux can be read in and interpolated for intermediate values at the user's option. In either case, the water table depth-air volume relationship is stored in arrays such that the air volume can be easily determined for a given water table or wet zone depth and the water table or wet zone depth can be immediately determined for a given air volume. For example, the value stored as VOL(1) would be the air volume for a water table depth of 0.0 cm, VOL(6) the volume for a 5 cm water table depth, etc. Conversely, the value stored as WTD(6) would be the water table depth corresponding to an air volume of 0.5 cm, WTD(51) corresponds to a volume of 5 cm and so on.

PROP also reads in a tabular relationship between water table depth and the Green-Ampt infiltration constants, A and B. These values are read in and interpolated for unit water table depth increments from 0 to 500 cm and stored in arrays for easy retrieval.

D. Subroutine ROOT

This subroutine reads in tabular values of effective root depth versus Julian data and interpolates between the values so that the root depth for any day can be called directly.

E. Subroutine SURIRR

This subroutine determines if surface irrigation for waste water disposal is scheduled and if conditions are suitable for irrigation. The amount of surface irrigation is considered as additional rain. If the air volume in the soil is less than the required air volume for surface irrigation, REQDAR, the irrigation day may be skipped (if INSIRR = 0) and no surface irrigation is done until the next preplanned day. If INSIRR > 0, the irrigation will be postponed to the next day rather than skipped as discussed in Chapter 3. If rainfall in excess of AMTRN occurs on the first scheduled hour of surface irrigation, the operation for that day is postponed and surface irrigation is tried again the next day. The rate of irrigation, AMTSIM(MO), is read in for each month. Simulations can also be conducted to apply the maximum amount of water possible at each irrigation by reading in a negative value for AMTSIM(MO). This option is discussed in more detail in Chapter 3. The program also counts the number of skips, number of postponements, and the number of irrigation days.

F. Subroutine WET

Determines the pressure head and water content distribution in the wet zone by assuming a hydrostatic condition above the water table.

G. Subroutine EVAP

The daily PET is distributed over the daylight hours of approximately 6:00 a.m. to 6:00 p.m. in this subroutine. PET for any hour, between these times, HPET, is calculated by dividing the daily PET by 12, assumed number of daylight hours. Then, HPET for any hour in which rainfall occurs is set equal to zero. When the critical depth concept is used for determining the limit of upward water movement, HPET is also set equal to zero for any hour that the depth of dry zone exceeds the root depth. Finally, the daily PET, adjusted for hours when rainfall occurs is obtained by summing the hourly values. The hourly and daily PET values so determined are taken as the actual ET values in FORSUB when the critical depth concept is used. Otherwise, the PET values are used in subroutine ETFLUX to determine actual ET values.

H. Subroutine SOAK

This subroutine finds the infiltration constants A and B for the Green-Ampt infiltration equation, $f = (A/F) + B$, where f is infiltration rate, and F, cumulative infiltration. Infiltration constants vary from soil to soil and with initial water content or depth of water table. In this subroutine, the values of A and B are chosen from a stored array using the water table depth at the beginning of the infiltration event as the index. When a dry zone exists, an effective water table depth, which would correspond to the total air volume in the profile is defined and used as the index for obtaining A and B. Once the values of A and B are chosen, they are not changed until the infiltration event ends. The only exception is when the water table rises to the surface; then A is set to $A = 0$ and B is set equal to the sum of the drainage and ET fluxes.

I. Subroutine DRAINS

This subroutine determines the effective lateral hydraulic conductivity based on the conductivities of the profile layers from the input data and on the position of the water table. Then, the drainage (or subirrigation) flux is determined using the Hooghoudt equation as discussed in the text of the report. Convergence near the drain has already been accounted for by adjusting the depth from the drain to the impermeable layer in the input parameters.

J. Subroutine ETFLUX

This subroutine uses the adjusted PET values, either hourly or daily, obtained from subroutine EVAP to determine actual ET which may be limited by soil water conditions. The water table depth, rooting depth, depth of the dry zone, and upward flux from the water table are used as inputs to determine the actual ET. If upward flux is insufficient to meet the ET demand, water is removed from the root zone to make up the difference. If root zone water is not available, ET is limited to the amount that will be transferred by upward flux.

K. Subroutine YDITCH

The purpose of this subroutine is to determine the water level in the drain at all times during the simulation. For a conventional drainage system, this water level would probably be constant; i.e., the outlet would be designed to have sufficient capacity to hold the water level at a constant elevation. For subirrigation, the water in the drainage outlet or drainage ditches would also probably be held at the elevation of the weir by pumping. However, in controlled drainage situations, the weir would be set at a given elevation and the ditch water level may be at or below that elevation depending on drainage and runoff. YDITCH was written to compute the water level in parallel ditch drains which are trapezoidal in cross-sections (Figure A.1).

If YD is the water level in the ditch, then the total volume of water would be:

$$CV = \frac{B + (2\ YD)\ S}{2} \cdot YD \qquad (A.1)$$

Where S is the slope of the ditch bank, B is the bottom width and CV is the total volume of water stored in the ditch in cm^3 per cm of ditch length. Hence, if CV is known, then YD could be found easily:

$$YD = \frac{1}{2}\left(\frac{B}{S}\right)2 + \frac{4\ CV^{1/2}}{S} - \frac{1}{2}\frac{B}{S} \text{ in cm} \qquad (A.2)$$

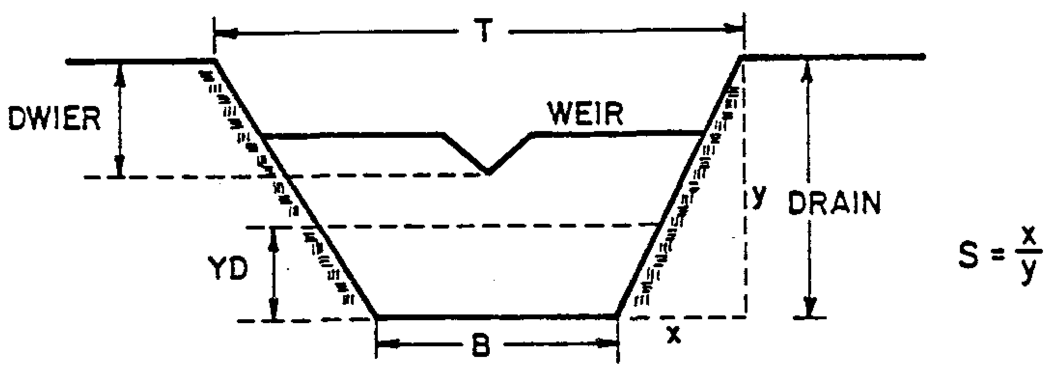

Figure A.1. Schematic of drainage ditch with water table control weir.

The change in CV during a given time increment can be found as:

$$\Delta\ CV = (RO + DVOL) \cdot SDRAIN \qquad (A.3)$$

Where SDRAIN is the drain spacing, RO is the runoff in cm (cm^3 per unit area), and DVOL is the drainage volume in cm. Thus, after a time increment, Δt the water available for ditch storage is:

$$CV_{t + \Delta t} = CV_t + \Delta CV \qquad (A.4)$$

and the new YD can be obtained by substituting this value for CV in Equation A.2. However, the maximum value of YD is DDRAIN - DWEIR and this corresponds to a maximum value CV_{max} which may be obtained from Equation A.1. Therefore, when the new value of YD is greater than YD_{max}, the water lost from the system, WLOSS, may be determined as:

$$WLOSS = (CV_{t + \Delta t} - CV_{max})/SDRAIN \qquad (A.5)$$

in cm (or cm^3/cm^2).

When the ditch water level is higher than the water table in the field, subirrigation will occur and DVOL will be negative. Then, the ditch water level will decrease with time.

When drain tubes, rather than parallel ditches empty into an outlet ditch or canal, the storage available in the outlet may be partitioned to the parallel drains by computing effective ditch dimensions. For example, consider a system of parallel drain tubes 500 m long spaced 50 m apart emptying into a rectangular canal 5 m wide. If the drain depth is 1 m, the storage volume available per tube above the drain depth would be 1 m x 5 m x 50 m = 250 m^3. Since each tube is 500 m long, the storage per unit length is 250 m^3/500 m = 0.5 m^3/m. So, an effective ditch dimension for this case would be a rectangular ditch 0.5 m wide and 1 m deep. This assumes that drains enter the main ditch from only one side.

When drain tubes are used for both mains and laterals, storage would usually be negligible and small values of B and S would be used in the program. Internal division by S prohibits the use of S=0 although B=0 is allowed.

Note again that this subroutine is important when the program is used in the controlled drainage mode. When conventional drainage or subirrigation are used, the water level is normally assumed to be constant. A possible exception would be some schemes of subirrigation which would raise the water level in the field on a periodic basis, then allow it to decline.

L. Subroutine WORK

The purpose of this subroutine is to determine if conditions are suitable for field work on a given day. Three criteria are used to determine if the day is a working day. First, there must be a minimum air volume (or drained volume), AMIN. If the air volume is less than AMIN, it is not a working day. Second, if the rainfall exceeds a given amount, field operations are stopped on that day. Third, field operations cannot resume until a given amount of time has passed since rainfall caused them to be terminated.

Two working periods may be considered, usually spring seedbed preparation and fall harvest, with separate working day criteria and with specified maximum day lengths for each period. Partial working days may result when rainfall interrupts field operations; this possibility is also considered in the program.

M. Subroutine ORDER

This subroutine stores yearly totals for the objective functions (SEW-30, working days, etc.) determines the average values over the simulation period and prints out the yearly values along with their rank after the simulation is completed. At the end of the simulation, ORDER calls subroutine RANK for each objective function and it ranks the values from smallest to largest.

N. Subroutine RANK

The yearly values of the objective functions are ranked from smallest to largest by this subroutine.

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C                   D R A I N M O D
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     THIS MAIN PROGRAM READS HOURLY PRECIP AND DAILY MAX AND MIN
C     TEMPTURES FROM EITHER CARDS OR DISK (I/O UNIT 4), DETERMINES PET
C     USING THORNTHWAITE METHOD, AND TRANSFERS HOURLY PRECIP AND DAILY
C     PET VALUES BY MONTH TO THE SUBROUTINE FORSUB.
C
      DIMENSION E(241),TMAX(31),TMIN(31),RDA(24),TITLE(20)
      DIMENSION FACTOR(12)
      DIMENSION HOURLY(744),ET(31),SET(12),IDAYBG(12),REL(366)
      INTEGER TMAX,TMIN,TITLE
      DATA SET/.03,.05,.08,.11,.14,.17,.16,.14,.11,.08,.04,.02/
      DATA IDAYBG/0,31,
     1     60,91,121,152,182,213,244,274,305,335/,LOOP/0/
C
C
      READ(1,610) TITLE
      WRITE(6,620) TITLE
      READ(1,600)  IRID,ITID,IYST,IMST,IYED,IMED,LAT,HIDX
      READ(1,630) (FACTOR(K),K=1,12)
      I = LAT/100
      J = LAT-I*100
      WRITE(6,640) IRID,ITID,IYST,IMST,IYED,IMED,I,J,HIDX
      WRITE(6,645) (FACTOR(K),K=1,12)
  645 FORMAT(' ET MULTIPLICATION FACTOR FOR EACH MONTH',/
     *2X,12F6.2/)
      XLAT1 = FLOAT(I)
      XLAT2 = FLOAT(J)
C
C   START OF THORNTHWAITE INITIAL CALCULATION
C   REL(1-366) ACCOUNTS FOR EVERYDAY IN A YEAR
C
      RLAT=0.0174533*XLAT1+0.0002909*XLAT2
      SINLAT=SIN(RLAT)
      COSLAT=COS(RLAT)
      DO 50 ND=1,366
      XND=ND
      XM=0.0172264*(-6.E-1+XND)
      XLAM=4.874239+XM+0.0334762*SIN(XM)+0.0003502*SIN(XM+XM)
      YD=0.397900*SIN(XLAM)
      XD=SQRT(1.-YD*YD)
      D=ATAN2(YD,XD)
      XD=(-0.014544-(SINLAT*SIN(D)))/(COSLAT*COS(D))
      YD=SQRT(1.-XD*XD)
      REL(ND)= 0.0111111*ATAN2(YD,XD)*57.29578
   50 CONTINUE
C
C   E(1-241) ACCOUNTS FOR DAILY TEMPERATURE VARIATION
C
      Y = ALOG(HIDX)
      F = 49239.E-5 + HIDX*(1792.E-5 + HIDX*(-771.E-7 + HIDX *
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     1   675.E-9))
      DO 60 NT =1,124
      XNT = NT
      X = -3863357.E-6 + F * (1021651.E-6 + ALOG(XNT) - Y)
      ETEMP = EXP(X)
      E(NT+65) = 24.E-2
   60 CONTINUE
      DO 70 I = 1,65
      E(I)=0.0
   70 CONTINUE
      DO 80 I = 190,241
      E(I)=24.E-2
   80 CONTINUE
C
C
C
C  POSITION THE RAINFALL AND TEMP FILES TO START SIMULATION
C
 100   READ(2,700,END=300) ITDA,IYDAT,IMDAT,(TMAX(I),TMIN(I),I=1,31)
C  IF NOT DESIRED STATION TRY AGAIN
      IF(ITDA.NE.ITID) GO TO 100
C  FOUND STATION, DESIRED YEAR AVAILABLE?
120   IF (IYDAT.EQ.IYST) GO TO 110
      IF (IYDAT.GT.IYST) GO TO 300
C   ELSE,
      READ(2,700,END=300) ITDA,IYDAT,IMDAT,(TMAX(I),TMIN(I),I=1,31)
      IF (ITDA.NE.ITID) GO TO 300
      GO TO 120
C
C  FOUND STATION AND YEAR, IS DESIRED MONTH AVAILABLE?
C
110   IF (IMDAT.EQ.IMST) GO TO 130
      IF (IMDAT.GT.IMST) GO TO 210
C   ELSE,
      READ(2,700,END=300) ITDA,IYDAT,IMDAT,(TMAX(I),TMIN(I),I=1,31)
      IF (ITDA.NE.ITID) GO TO 300
      IF (IYDAT.NE.IYST) GO TO 200
C   ELSE,
      GO TO 110
C
200   WRITE(6,900) IMST,IYST,IMDAT,IYDAT
900   FORMAT(' DESIRED MONTH ',I2,' COULD NOT BE FOUND WITHIN YEAR ',
     *   I4,', START SIMULATION AT MONTH ',I2,'  AND YEAR ',I4)
      IMST = IMDAT
      IYST = IYDAT
      GO TO 130
210   WRITE(6,910) IMST, IMDAT
910   FORMAT(' DESIRED MONTH ',I2,' COULD NOT BE FOUND, START',
     *      ' SIMULATION AT MONTH ',I2)
      IMST = IMDAT
C     GO TO 130
C
C
C   TEMP FILE POSITIONED, POSITION RAINFALL
C
```

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C
130   READ(4,710,END=310) IRDA,IYDAR,IMDAR,IDDAR,(RDA(I),I=1,24)
C
C   IF NOT DESIRED STATION, TRY AGAIN
C
      IF (IRDA.NE.IRID) GO TO 130
C
C   FOUND STATION, IS DESIRED YEAR AVAILABLE?
C
140   IF (IYDAR.EQ.IYST) GO TO 150
      IF (IYDAR.GT.IYST) GO TO 310
C    ELSE,
      READ(4,710,END=310) IRDA,IYDAR,IMDAR,IDDAR,(RDA(I),I=1,24)
      IF (IRDA.NE.IRID) GO TO 310
C    ELSE,
      GO TO 140
C
C
C
C
300   WRITE(6,950) ITID,IYST,ITDA,IYDAT,IMDAT
950   FORMAT(' STATION AND YEAR ',I6,1X,I4,' COULD NOT BE FOUND.',
     *     ' LAST RECORD READ WAS ',I6,1X,I4,1X,I2)
      GO TO 999
C
310   WRITE(6,960) IRID,IYST,IRDA,IYDAR,IMDAR
960   FORMAT(' RAINFALL STATION AND YEAR ',I6,1X,I4,' COULD NOT BE',
     *     ' FOUND. LAST RECORD READ WAS ',I6,1X,I4,1X,I2)
      GO TO 999
C
C
C   FOUND STATION AND YEAR
C
C
150   IF (IMDAR.EQ.IMST) GO TO 160
      IF (IMDAR.GT.IMST) GO TO 220
      READ(4,710,END=310) IRDA,IYDAR,IMDAR,IDDAR,(RDA(I),I=1,24)
      IF (IRDA.NE.IRID) GO TO 310
      IF (IYDAR.NE.IYST) GO TO 220
C    ELSE,
      GO TO 150
C
220   WRITE(6,930) IMST,IYDAR,IMDAR
930   FORMAT(' COULD NOT FIND MONTH ',I2,' BUT WILL ASSUME NO ',
     *      'RAINFALL UP TO BUT NOT INCLUDING ',I4,1X,I2)
C     GO TO 160
C
C
C
160      CONTINUE
C
C   SET "CURRENT POINTERS AS A REFERENCE
C
      IRCT = IRID
      ITCT = ITID
```

```
      IYCT = IYST
      IMCT = IMST
C
C   NOW START SIMULATION
C
      DO 290 LOOP = 1,999999
           DO 170 I =1,744
              HOURLY(I)=0.0
170        CONTINUE
C   IF MONTH DOESN'T EXIST FOR RAIN USE ZEROS
           IF (IMDAR.GT.IMCT) GO TO 250
C    ELSE, READ MONTHLY RAINFALL
180        DO 190 I=1,24
              HOURLY((IDDAR-1)*24 + I) = RDA(I)
190        CONTINUE
      READ(4,710,END=250) IRDA,IYDAR,IMDAR,IDDAR,(RDA(I),I=1,24)
      IF ((IRDA.EQ.IRCT).AND.(IYDAR.EQ.IYCT).AND.
     *      (IMDAR.EQ.IMCT)) GO TO 180
C   RAINFALL READY, PREPARE TEMP DATA
250        DO 260 I=1,31
                NT=TMAX(I) + TMIN(I) +1
                ET(I)=SET(IMCT)
         IF((NT.GT.1).AND.(IFLAG.EQ.0)) ET(I)=E(NT)*REL(IDAYBG(IMCT)+I)
260        CONTINUE
C
C   TEMPERATURE READY, NOW SIMULATE WITH THIS MONTH
C
      CALL FORSUB(IYCT,IMCT,ET,HOURLY,LOOP,IYED,FACTOR(IMCT))
C
C   READ NEXT MONTH OF TEMP DATA
C
      IMCT=IMCT+1
      IF(IMCT.EQ.13) IYCT=IYCT+1
      IF(IMCT.EQ.13) IMCT=1
      IF(IFLAG.EQ.1) GO TO 275
      READ(2,700,END=800) ITDA,IYDAT,IMDAT,(TMAX(I),TMIN(I),I=1,31)
  275   IF(IMDAT.NE.IMCT) IFLAG=1
        IF(IMDAT.EQ.IMCT) IFLAG=0
        IF(IFLAG.EQ.1) GO TO 270
           IF (ITDA.NE.ITCT) GO TO 800
           IF (IYDAT.GT.IYED) GO TO 800
           IF ((IYDAT.EQ.IYED).AND.(IMDAT.GT.IMED)) GO TO 800
C
C   SEE IF RAINFALL DATA IS CONSISTANT WITH TEMPERTURE
C
270   IF (IYDAR.GT.IYCT) GO TO 290
      IF ((IYDAR.EQ.IYCT).AND.(IMDAR.GE.IMCT)) GO TO 290
C    ELSE,READ RAINFALL UNTIL CONSISTANT
      READ(4,710,END=810) IRDA,IYDAR,IMDAR,IDDAR,(RDA(I),I=1,24)
C
C   IS THIS DESIRED RAINFALL
C
      IF (IRDA.NE.IRCT) GO TO 810
      GO TO 270
C
```

```
C
290   CONTINUE
      WRITE(6,890)
890   FORMAT(' TERMINATE SIMULATION DUE TO END OF LOOP ')
      GO TO 999
C
800   WRITE(6,830) ITDA,IYDAT,IMDAT
830   FORMAT(' SIMULATION TERMINATED NORMALLY. ',I6,1X,I4,1X,I2)
      GO TO 999
810   WRITE(6,840) IRDA,IYDAR,IMDAR
840   FORMAT(' SIMULATION TERMINATED NORMALLY. ',I6,1X,I4,1X,I2)
      GO TO 999
C
C
C
C
C
999   STOP
C
C
600   FORMAT(2(I6,1X),2(I4,1X,I2,1X),I4,1X,F3.0)
630   FORMAT(12F5.2)
610   FORMAT(20A4)
620   FORMAT(1H1,26X,20A4/1X/
     *           47X,'INPUT PARAMETERS USED IN THIS SIMULATION'/1X/
     *     46X,'DESCRIPTION',44X,'(VARIABLE)     VALUE   UNIT'/
     *    1X,132(1H-))
640   FORMAT(' RAINFALL STATION NUMBER',78(1H.),'(RAINID)',5X,I6/
     * ' TEMPERATURE STATION NUMBER',75(1H.),'(TEMPID)',5X,I6/
     * ' STARTING YEAR OF SIMULATION',70(1H.),'(START YEAR)',7X,I4,
     * 3X,'YEAR'/
     * ' STARTING MONTH OF SIMULATION',68(1H.),'(START MONTH)',9X,I2,
     * 3X,'MONTH'/
     * ' ENDING YEAR OF SIMULATION',74(1H.),'(END YEAR)',7X,I4,
     * 3X,'YEAR'/
     * ' ENDING MONTH OF SIMULATION',72(1H.),'(END MONTH)',9X,I2,
     * 3X,'MONTH'/
     ● ' TEMPERATURE STATION LATITUDE',71(1H.),'(TEMP LAT)',6X,I2,
     * '.',I2,3X,'DEG.MIN'/
     ● ' HEAT INDEX',94(1H.),'(HID)',5X,F6.2/)
700   FORMAT(I6,2X,I4,I2/24I3/24I3/24I3)
710   FORMAT(I6,2X,I4,I2,I2,2X,24F4.2)
C
C
      END
      SUBROUTINE FORSUB(IR,MO,ET,HOURLY,LOOP, IEDYR,FACTOR)
C ************************************************************************
C ● THIS SUBROUTINE IS THE MAIN BODY OF THE MODEL, DRAINMOD.            *
C ● IT CONDUCTS THE BASIC WATER BALANCE CALCULATIONS ON INTERVALS OF 1  *
C * HR., 2HR., OR 1DAY.                                                 *
C ● INFILTRATION, SURFACE STORAGE, AND WATER MANAGEMENT PARAMETERS SUCH *
C * AS SEW-30 ARE CALCULATED WITHIN THIS SUBROUTINE.                    *
C * OTHER COMPONENTS SUCH AS DRAINAGE FLUX AND ET ARE CALLED FROM ADD-  *
C * ITIONAL SUBROUTINES.                                                 *
C ************************************************************************
```

```
C
C ************************************************************************
C *                             SECTION 1                                *
C * THIS SECTION RECEIVES DAILY PET AND HOURLY RAINFALL VALUES FOR ONE   *
C * MONTH FROM THE MAIN PROGRAM AND CHANGES THE VALUE FROM INCHES TO CM. *
C ************************************************************************
      DIMENSION ET(31),HOURLY(744),DAYM(12),FACTOR(12)
      DIMENSION DROOT(370)
      INTEGER DAYM,DAY
      DATA DAYM/31,28,31,30,31,30,31,31,30,31,30,31/
C
      IF(MO.NE.2) GO TO 5
      IR1=IR/4
      IR2=IR1*4
      DAYM(2)=28
      IF(IR .EQ.IR2)DAYM(2)=29
    5 DO 10 I=1,744
      HOURLY(I)=HOURLY(I)*2.54
   10 CONTINUE
      DO 15 I=1,31
      ET(I)=ET(I)*2.54*FACTOR(MO)
   15 CONTINUE
      DAY=0
      IF(LOOP.GT.1)GO TO 30
      IRFST=IR
C
C |----------------------------------------------------------------------|
C |                        END OF SECTION 1                              |
C | IF LOOP=0, I.E. FIRST TIME THROUGH THIS SECTION, GO TO SECTION 2 TO  |
C | READ INITIAL DATA;  OTHERWISE GO TO SECTION 4.                       |
C |----------------------------------------------------------------------|
C
C ************************************************************************
C *                        SECTION 2                                     *
C * STORAGE BLOCKS ARE ALLOCATED AND ARRAYS ARE DIMENSIONED.  SOILS,     *
C * SYSTEM PARAMETER AND PLANT ROOT DATA ARE READ IN AND LISTED ON THE   *
C * OUTPUT IN THIS SECTION.                                              *
C ************************************************************************
C
      INTEGER BWKDY1,BWKDY2,SWKHR1,SWKHR2,EWKHR1,EWKHR2,EWKDY1,EWKDY2
      INTEGER FDAYSI,HOUR
      COMMON /IWK/SWKHR1,EWKHR1,SWKHR2,EWKHR2
      COMMON /WRK/AMIN1,ROUTA1,ROUTT1,AMIN2,ROUTA2,ROUTT2
      COMMON/ICNT/ISICNT,ISKIP,IPOST,IK,IPCNT
      COMMON/JCNT/JSICNM,JSKIPM,JPOSTM
      COMMON/IDAY/FDAYSI,NDAYSI,INTDAY,NOIRR1,NOIRR2,NOIRR3,NOIRR4
      COMMON/IHR/IHRSTA,IHREND,INSIRR
      COMMON/PAR/TAV,REQDAR,AMTRN,AMTSI,DAMTSI
      COMMON/WHX/WATER(500),W(101),H(101),X(101),NN
      COMMON/ABDT/EDTWT,AA(500),BB(500),A,B
      COMMON/EVAPO/PET,DDZ,ROOTD
      COMMON/DRABLK/HDRAIN,DEPTH,CONK(5),DZ(5)
      COMMON/DLK/SDRAIN,DDRAIN,DC,ADEPTH
      COMMON/POND/STOR,GEE,STORRO
      COMMON/DBLK/DRNSTO
```

```
      COMMON/PLT/YODTWT(31),YCDTWT(31),XDATE(31)
      COMMON/RAIN/R(24)
      COMMON/ORDR/TOSIRR(50),TOTDD(50),TOTWD(50),SEW(50),IRY(50)
C
      DIMENSION RVOLM(12),FVOLM(12),ROM(12),DVOLM(12),PUMPVM(12)
      DIMENSION DWIER(12),DACHNG(12),TWLOSS(12)
      DIMENSION DRYDAY(12),WETDAY(12),WRKDAY(12),WATDAY(12)
      DIMENSION ISICNM(12),ISKIPM(12),IPOSTM(12),SIRRMO(12)
      DIMENSION F(24),FRATE(24),HET(24),ACCR(24)
      DIMENSION WTD(1000),VOL(501)
      DIMENSION SWIER(12)
      DIMENSION WATERL(31)
      DIMENSION SEWM(12)
      DIMENSION UPFLUX(500),HPET1(24)
      DIMENSION SUMAET(12)
      DIMENSION AMTSIM(12)
C
C READ INPUT
      READ(1,600)INSIRR,FDAYSI,INTDAY,IHRSTA,IHREND,NOIRR1,NOIRR2,
     $NOIRR3,NOIRR4
      READ(1,610)REQDAR,AMTRN,(AMTSIM(I),I=1,12)
      READ(1,620)DDRAIN,HDRAIN,SDRAIN,STMAX,DEPTH,XNI,DC,ADEPTH
      READ(1,620)STORRO,GEE
      READ(1,625)(DZ(I),CONK(I),I=1,5)
      READ (1,630)AMINC,NOPORT,NMONTH
      READ(1,640)(DACHNG(I),DWIER(I),I=1,12)
      READ(1,645) BWKDY1,EWKDY1,SWKHR1,EWKHR1,AMIN1,ROUTA1,ROUTT1
      READ(1,645) BWKDY2,EWKDY2,SWKHR2,EWKHR2,AMIN2,ROUTA2,ROUTT2
      READ(1,650)DITCHB,DITCHS,ROOTD,CRITD,WP,DTWT
      READ(1,670)ISEWMS,ISEWDS,ISEWME,ISEWDE,SEWX
      READ(1,670)IDRYMS,IDRYDS,IDRYME,IDRYDE
      READ(1,670)INDET,INWIER
C         IF INDET .GT.0 USE VALUES READ  IN SUB PROP TO CALCULATE ET AS
C         LIMITED BY SOIL CONDITIONS.  IF INDET .GT.0 USE LIMITING DEPTH
C         CONCEPT.
C       START SEW CALCULATION ON ISEWDS IN MO. ISEWMW.
C         END IT ON DAY ISEWDE IN MO. ISEWME.
C         SEW CALCULATES DAYS W.T. IS ABOVE SEWX CM.
C
C PRINT INPUT
      WRITE(6,790)
      WRITE(6,800)DDRAIN,HDRAIN,SDRAIN,STMAX,DEPTH,XNI
      WRITE(6,801)DC,ADEPTH
      WRITE(6,802)STORRO,GEE
      WRITE(6,810)AMIN1,ROUTA1,ROUTT1,AMIN2,ROUTA2,ROUTT2
      WRITE(6,815)BWKDY1,EWKDY1,SWKHR1,EWKHR1,BWKDY2,EWKDY2,
     $SWKHR2,EWKHR2
      WRITE(6,820)ROOTD,CRITD,WP,DTWT,DITCHB,DITCHS
      WRITE(6,850)FDAYSI,INTDAY,IHRSTA,IHREND,NOIRR1,NOIRR2,
     $NOIRR3,NOIRR4
      WRITE(6,860)REQDAR,AMTRN,(AMTSIM(I),I=1,12)
      WRITE(6,861) (FACTOR(I),I=1,12)
861   FORMAT(//,'  ET CORRECTION FACTOR FOR EACH MONTH'/,4X,12F6.2/)
      WRITE(6,822)
      CST1=0.0
```

```
      DO 824 I=1,5
      CST2=DZ(I)
      IF(CONK(I).GT..1E-5) WRITE(6,828)CST1,CST2,CONK(I)
  824 CST1=CST2
      WRITE(6,830)(DACHNG(I),I=1,12)
      WRITE(6,840)(DWIER(I),I=1,12)
      WRITE(6,835)NOPORT
C
C SOIL PROPERTIES
      WRITE(6,870) INDET
      CALL PROP(WTD,VOL,WATER,AA,BB,UPFLUX)
C
C   SOME SOIL  PROPERTIES ARE READ IN AND INITIALIZED IN SUBROUTINE PROP
C
      CALL ROOT(DROOT)
      JDAY=0
C
C |-----------------------------------------------------------------------|
C |                         END OF SECTION 2                              |
C |-----------------------------------------------------------------------|
C
C ************************************************************************
C *                              SECTION 3                               *
C * INITIALIZATION OF VARIABLES PRIOR TO BEGINNING OF SIMULATION         *
C ************************************************************************
C
      DC=DC/24.
      TOFSIR=IHREND-IHRSTA
      IPCNT=0
      EDTWT=DTWT
      LRAIN = 0
      DDAY=0.
      ISKIP=0
      IPOST=0
      IK=0
      ISICNT=0
      IRRDAY=0
      DEBT=0.0
      DDZ=0.0
      DRNSTO=0.0
      STOR=0.0
      TOTR=0.
      TOTF=0.
      TOTD=0.
      TOTRO=0.
      TOTNT=0.
      TOTFD=0.
      TOTWF=0.
      TPUMPV=0.0
      YTAV=0.0
      YSUMET=0.0
      WETZ=DTWT
      ID=DTWT+1.0
      YDEBT=0.0
      CRITD1=CRITD+1.
```

```
      ICRIT=CRITD1
      CRITAV=VOL(ICRIT)
      AVOL=VOL(ID)
      TAV=AVOL
      UPQ=UPFLUX(ID)
      UPVOL=UPQ*24.
      UPVOL2=UPQ
      DELX=DEPTH/XNI
      NI=XNI
      NN=NI+1
      NR1=NOIRR1
      NR2=NOIRR2
      NDAYSI=FDAYSI
      DO 20 I=1,12
      ISICNM(I)=0
      ISKIPM(I)=0
      IPOSTM(I)=0
      SIRRMO(I)=0.
      TWLOSS(I)=0.0
      SUMAET(I)=0.0
      RVOLM(I)=0.0
      ROM(I)=0.0
      FVOLM(I)=0.0
      DVOLM(I)=0.0
      PUMPVM(I)=0.0
      WRKDAY(I)=0.0
      WETDAY(I)=0.0
      WATDAY(I)=0.0
      DRYDAY(I)=0.
      SWIER(I)=DWIER(I)
      SEWM(I)=0.0
   20 CONTINUE
      DO 23 I=1,50
      IRY(I)=0
      SEW(I)=0.0
      TOTDD(I)=0.0
      TOTWD(I)=0.0
   23 TOSIRR(I)=0.0
C
      X(1)=0.0
      DO 25 I=2,NN
      X(I)=X(I-1)+DELX
   25 CONTINUE
C
C |-------------------------------------------------------------------|
C |                         END OF SECTION 3                          |
C |-------------------------------------------------------------------|
C
C **********************************************************************
C *                              SECTION 4                             *
C * INCREMENT DAY, DETERMINE HOURLY RAINFALL, WEIR DEPTH, AND ROOT DEPTH *
C * FOR NEW DAY.  INITIALIZE VARIABLES FOR A NEW DAY.                  *
C **********************************************************************
C
   30 DAY=DAY+1
```

```
      IRRDAY=IRRDAY+1
      JDAY=JDAY+1
      ROOTD=DROOT(JDAY)
      AMTSI=AMTSIM(MO)
      IF(AMTSI .LT. 0.0)AMTSI=(TAV+AMTSI)/TOFSIR
      IF(AMTSI .LT. 0.0) AMTSI=0.0
C
      DWIER(MO)=SWIER(MO)
      PDEBT=ROOTD*(WATER(1)-WP)
      IF(DAY.LT.DACHNG(MO).AND.MO.EQ.1)GO TO 31
      IF (DAY.LT.DACHNG(MO))DWIER(MO)=DWIER(MO-1)
      GO TO 32
   31 DWIER(MO)=DWIER(12)
C
   32 DAMTSI=0.0
      DEEPET=DEPTH-DDZ
      JPOSTM=0
      JSKIPM=0
      JSICNM=0
      WLOSS=0.0
      RO=0.0
      RVOL=0.0
      DVOL=0.0
      PUMPV=0.0
      DELTWK=0.0
      AMRAIN=0.0
      STOR1=STOR
      STOR2=STOR
      AVOL1=AVOL
      HSEW=0.0
C
C   FIND HOURLY RAINFALL VALUES FOR NEW DAY
C
      L=(DAY-1)*24
      DO 35 I=1,24
      K=L+I
      R(I)=HOURLY(K)
      AMRAIN=AMRAIN+R(I)
      ACCR(I)=AMRAIN
   35 CONTINUE
C
C CHECK IF SURFACE IRRIGATION IS PREPLANNED ON THAT DAY
      IF(IRRDAY.EQ.FDAYSI.OR.IRRDAY.EQ.NDAYSI)CALL SURIRR
C
C FIND WATER CONTENT AND HEAD DISTRIBUTION
      CALL WET(WETZ)
C
      PET=ET(DAY)
C   GET POTENTIAL DAILY EVAPOTRANSPIRATION FOR NEW DAY - DISTRIBUTES PET TO
C   HOURLY VALUES
C
      CALL EVAP(AET,HET,HPET1,TPET)
C
      DO 40 I=1,24
      IF(R(I).GT.0.0)GO TO 45
```

```
   40 CONTINUE
      IRAIN=24
      IF(STOR.GT.0.001)GO TO 50
      GO TO 130
C
C IF IT RAINS OR IF PREVIOUS SURFACE STORAGE, FIND HOURLY INFILTRATION
C BY USING THREE MINUTE TIME INCREMENT
C
C |-----------------------------------------------------------------------|
C |                          END OF SECTION 4                             |
C |-----------------------------------------------------------------------|
C
C ************************************************************************
C *                               SECTION 5                              *
C * DETERMINES INFILTRATION AND CONDUCTS WATER BALANCE CALCULATIONS ON AN *
C * HOURLY BASIS.  ACCUMULATE TOTALS SO AT END OF SECTION 5 HAVE ESTIMATED*
C * ALL PARAMETERS FOR THE DAY.                                          *
C ************************************************************************
C *               SECTION 5A - INFILTRATION CALCULATION                  *
C ************************************************************************
C
   45 IRAIN=I
   50 DT=1.0
      DDT=0.05
      DTMDT=DT-0.01*DDT
C
      RDT=23-LRAIN+IRAIN
      F(1)=0.001
      IF(RDT.LT.2.5)F(1)=F(LRAIN)
      IF(STOR.GT.0.01)F(1)=F(24)
      IF(DTWT.LT.0.001) F(1)=0.0
      IF(F(1).LT.0.001)F(1)=0.001
      YESF=F(1)
      LRAIN=1
C
      DO 55 I=1,24
      RVOL=RVOL+R(I)
      IF(R(I).GT.0.0001)LRAIN=I
   55 CONTINUE
C
      J=1
      IF(F(J).LT.0.01)CALL SOAK
      IF((DAYSTR.GE.2).AND.(DTWT.GT.0.0)) CALL SOAK
C DETERMINES INFILTRATION CONSTANTS FOR SMALL INITIAL INFILTRATION
C
   60 CALL DRAINS(DTWT,DFLUX)
      IF(AVOL1.LE.0.01)A=0.0
      IF((A.LT.0.00001).AND.(DTWT.GT.0.10)) CALL SOAK
      IF(A.EQ.0.0)B=HET(J)+DFLUX
      IF((A.LE.0.000001).AND.(B.LT.0.0))B=0.0
      FRATE(J)=A/F(J)+B
      IF(STOR.GT.0.0)GO TO 65
      IF(FRATE(J).GT.R(J))GO TO 90
C
   65 RAT1=FRATE(J)
```

```
   70 SUM=0.0
      F1=F(J)
C
   75 DF=RAT1*DDT
      F2=F1+DF
      RAT2=A/F2+B
      IF(STOR.GT.0.0)GO TO 80
      IF(RAT2.GT.R(J))RAT2=R(J)
   80 DF=0.5*(RAT1+RAT2)*DDT
      SPR=STOR+R(J)*DDT
      IF(DF.GT.SPR)DF=SPR
      F1=F1+DF
      SUM=SUM+DDT
      RAT1=A/F1+B
      IF(STOR.GT.0.0)GO TO 85
      IF(RAT1.GT.R(J))RAT1=R(J)
   85 STOR=STOR+R(J)*DDT-DF
      IF(STOR.GT.STMAX)STOR=STMAX
      IF(SUM.GE.DTMDT)GO TO 100
      GO TO 75
C
   90 F1=F(J)+R(J)*DT
      RAT1=A/F1+B
      IF(RAT1.GT.R(J))GO TO 95
      RAT1=R(J)
      GO TO 70
C
   95 RAT1=R(J)
  100 F(J)=F1
      DVOL1=DFLUX*DT
      DVOL=DVOL+DVOL1
      IF(DVOL1.LT.0.0)PUMPV=PUMPV+DVOL1
      IF(J.EQ.1)GO TO 105
      FVOL=F(J)-F(J-1)
      GO TO 110
C
C ***************************************************************************
C * SECTION 5B - WATER BALANCE CALCULATION FOR ONE HOUR INTERVAL            *
C ***************************************************************************
C
C REEVALUATION OF WETZ,DDZ ETC
  105 FVOL=F(1)-YESF
  110 WETZ=DTWT-DDZ
      IF(INDET.GT.0) GO TO 117
      IF(WETZ.GT.CRITD)GO TO 115
      IF(DEBT.GT.0.01)GO TO 115
      TVOL=FVOL-HET(J)-DVOL1
      AVOL1=AVOL1-TVOL
      GO TO 120
  115 AVOL1=AVOL1+DVOL1
      DEBT=DEBT+HET(J)-FVOL
      IF(DEBT.GT.0.0)GO TO 120
      AVOL1=AVOL1+DEBT
      DEBT=0.0
      GO TO 120
```

```
  117 CONTINUE
      CALL ETFLUX(AVOL1,DEBT,FVOL,DVOL1,UPVOL2,HPET1(J),HET(J),PDEBT)
  120 DDZ=DEBT/(WATER(1)-WP)
      IF(AVOL1.GT.0.001)GO TO 125
      STOR=STOR-AVOL1
      IF(STOR.GT.STMAX)STOR=STMAX
      F(J)=F(J)+AVOL1
      FVOL=FVOL+AVOL1
      AVOL1=0.0
  125 IAVOL=10.*AVOL1+1.0
      AV=10.*AVOL1+1.0
      XV=IAVOL
      WETZ=WTD(IAVOL)+(AV-XV)*(WTD(IAVOL+1)-WTD(IAVOL))
      IWET=WETZ+1.
      UPQ=UPFLUX(IWET)
      IF(WETZ.GT.DEEPET)UPQ=0.0
      UPVOL2=UPQ*DT
      DTWT=WETZ+DDZ
      TAV1=AVOL1+DEBT
      DSTOR=STOR-STOR2
      STOR2=STOR
      RO=R(J)-FVOL-DSTOR
      CALL YDITCH(DWIER(MO),DVOL1,YD,RO,WLO,DITCHB,DITCHS)
      IF(INWIER.GT. 0.0)YD=DDRAIN-DWIER(MO)
      HDRAIN=DEPTH-DDRAIN+YD
      WLOSS=WLOSS+WLO
      IF(DTWT.LT.SEWX)HSEW=HSEW+SEWX-DTWT
C        THE FOLLOWING STATEMENTS DETERMINE IF THIS HOUR IS COUNTED
C        AS AN HOUR IN WHICH FIELD WORK CAN BE DONE
      DWRKDY=0.0
      IF((JDAY .GE. BWKDY1) .AND. (JDAY .LE. EWKDY1))
     *  CALL WORK(1,J,TAV1,DWRKDY,ACCR(J),DDAY,YTAV)
      IF((JDAY .GE. BWKDY2) .AND. (JDAY .LE. EWKDY2))
     *  CALL WORK(2,J,TAV1,DWRKDY,ACCR(J),DDAY,YTAV)
      IF(R(J) .LT. 0.01) DDAY=DDAY+1./24.
      DELTWK=DELTWK+DWRKDY
      J=J+1
      IF(J.GT.24)GO TO 155
      F(J)=F(J-1)
      IF(F(J).LT.0.001)F(J)=0.001
      GO TO 60
C
C  WHEN CALCULATIONS HAVE BEEN MADE FOR HOUR, J=24, GO TO SECTION 7
C |------------------------------------------------------------------|
C |                      END OF SECTION 5                            |
C |------------------------------------------------------------------|
C
C *******************************************************************
C *                          SECTION 6                              *
C * WATER BALANCE CALCULATION WHEN HAVE NO RAIN OR SURFACE IRRIGATION *
C * DURING THE DAY OR SURFACE STORAGE AT THE BEGINING OF THE DAY.   *
C * THE WATER BALANCE CALCULATION IS BASED ON A 1 DAY TIME INTERVAL IF *
C * DRAINAGE FLUX AT BEGINING OF DAY IS LESS THAN .02 CM./DAY AND ON A *
C * 2 HR. INTERVAL IF DFLUX IS GREATER THAN THAT VALUE.             *
C *******************************************************************
```

```
  130 HOUR=0
      YESF=0.0
      FVOL=0.0
      DO 135 I=1,24
      F(I)=0.0
      FRATE(I)=0.0
  135 CONTINUE
C
      CALL DRAINS(DTWT,DFLUX)
      DVOL1=24.*DFLUX
C      IFINDET>0 USE SUBROUTINE ETFLUX TO ESTIMATE AET
C      THEN CAN GET GOOD ESTIMATE OF DVOL
      UPVOL=UPQ*24.0
      IF(INDET.LE.0) GO TO 137
      CALL ETFLUX (AVOL1,DEBT,FVOL,DVOL1,UPVOL,TPET,AET,PDEBT)
      AVOL1=AVOL
      DDZ=DEBT*ROOTD/PDEBT
  137 CONTINUE
C CHECK FOR DRAINAGE VOLUME. FOR SMALL VOLUME, TAKE 24 HOUR INCREMENT
C AND FOR LARGE VOLUME TAKE 2 HOURLY INCREMENT
      IF(ABS(DVOL1).LE.0.02)GO TO 145
      AVOL1=AVOL
      DEBT=YDEBT
      AET=AET/12.
      H2PET=TPET/12.
C
  140 HOUR=HOUR+2
      UPVOL1=UPQ*2.0
      DVOL1=2.0*DFLUX
  145 CONTINUE
      IF(INDET.LE.0) GO TO 147
      IF(HOUR.EQ.0) GO TO 147
      CALL ETFLUX(AVOL1,DEBT,FVOL,DVOL1,UPVOL1,H2PET,AET,PDEBT)
      IF(AVOL1.LT.0.0) AVOL1=0.0
      GO TO 148
  147 TVOL=FVOL-AET-DVOL1
      AVOL1=AVOL1-TVOL
      IF(AVOL1.LT.0.0)AVOL1=0.0
      IF(WETZ.GT.CRITD)AVOL1=AVOL1+DVOL1
  148 IAVOL=10.*AVOL1+1.0
      AV=10.*AVOL1+1.0
      XV=IAVOL
      WETZ=WTD(IAVOL)+(AV-XV)*(WTD(IAVOL+1)-WTD(IAVOL))
      IWET=WETZ+1.
      UPQ=UPFLUX(IWET)
      DDZ=DEBT*ROOTD/PDEBT
      DTWT=WETZ+DDZ
      IF(WETZ.GT.DEEPET)UPQ=0.0
      CALL YDITCH(DWIER(MO),DVOL1,YD,RO,WLO,DITCHB,DITCHS)
      IF(INWIER.GT. 0.0)YD=DDRAIN-DWIER(MO)
      HDRAIN=DEPTH-DDRAIN+YD
      WLOSS=WLOSS+WLO
      IF(DVOL1.LT.0.0) PUMPV=PUMPV+DVOL1
      DVOL=DVOL+DVOL1
      CALL DRAINS(DTWT,DFLUX)
```

```
      IF(DTWT.LT.SEWX)HSEW=HSEW+2.0*(SEWX-DTWT)
      IF(HOUR.GE.24)AET=AET*12.0
      IF(HOUR.GE.24)GO TO 155
      IF(HOUR.EQ.0)GO TO 150
      GO TO 140
C
  150 DVOL2=24.*DFLUX
      HSEW=12.0*HSEW
      DVOL=0.5*(DVOL1+DVOL2)
      IF(DVOL.LT.0.0) PUMPV=DVOL
      CALL YDITCH(DWIER(MO),DVOL,YD,RO,WLO,DITCHB,DITCHS)
      IF(INWIER.GT. 0.0)YD=DDRAIN-DWIER(MO)
      HDRAIN=DEPTH-DDRAIN+YD
C
C |-------------------------------------------------------------------|
C |                          END OF SECTION 6                         |
C |-------------------------------------------------------------------|
C
C **********************************************************************
C *                                SECTION 7                           *
C * REEVALUATION OF WATER TABLE DEPTH, DRY ZONE DEPTH, WET ZONE DEPTH, AIR*
C * VOLUMES, AND RUNOFF AT END OF DAY.  ALSO UPDATE SOME VARIABLES TO BE  *
C * USED DURING NEXT DAY SUCH AS UPQ.                                    *
C **********************************************************************
  155 FVOL=F(24)-YESF
      DEBT=YDEBT
      UPVOL=0.5*(24.0*UPQ+UPVOL)
      IF(INDET.LE.0)GO TO 157
      CALL ETFLUX(AVOL,DEBT,FVOL,DVOL,UPVOL,TPET ,AET,PDEBT)
      GO TO 165
C
C **********************************************************************
C * THE FOLLOWING SECTION (TO STATEMENT NO.165) USES THE CRITICAL DEPTH  *
C * (CRITD) CONCEPT TO ESTIMATE WHEN UPWARD MOVEMENT OF WATER FROM WATER *
C * TABLE IS LIMITED.                                                    *
C **********************************************************************
  157 CONTINUE
      WETZ=DTWT-DDZ
      IF(WETZ.GE.CRITD)GO TO 160
      IF(DEBT.GT.0.01)GO TO 160
      TVOL=FVOL-AET-DVOL
      AVOL=AVOL-TVOL
      GO TO 165
C
  160 AVOL=AVOL+DVOL
      DEBT=DEBT+AET-FVOL
      IF(DEBT.GT.0.0)GO TO 161
      AVOL=AVOL+DEBT
      DEBT=0.0
      GO TO 165
  161 TAV=AVOL+DEBT
      IF(WETZ.GT.CRITD1)GO TO 165
      AVOL=CRITAV
      DEBT=TAV-AVOL
C THE NEXT ARE NEEDED WHEN HOURLY WETZ<CRITD BUT DEBT>0
```

```
      IF(DEBT.GE.0.)GO TO 165
      AVOL=AVOL+DEBT
      DEBT=0.
C
  165 DDZ=DEBT/(WATER(1)-WP)
  166 DSTOR=STOR-STOR1
      RO=RVOL-DSTOR-FVOL
      IF(AVOL.LT.0.0)AVOL=0.0
      AV=10.*AVOL+1
      IAVOL=AV
      XV=IAVOL
      WETZ=WTD(IAVOL)+((AV-XV)*(WTD(IAVOL+1)-WTD(IAVOL)))
      IWET=WETZ+1.
      UPQ=UPFLUX(IWET)
      DTWT=WETZ+DDZ
      IF(WETZ.GT.DEEPET)UPQ=0.0
      TAV=AVOL+DEBT
      TAV1=TAV
      TV=10*TAV+1
      ITAV=TV
      XV=ITAV
      EDTWT=WTD(ITAV)+(TV-XV)*(WTD(ITAV+1)-WTD(ITAV))
      YDEBT=DEBT
      SEWD=0.0
C
C |---------------------------------------------------------------|
C |                        END OF SECTION 7                       |
C |---------------------------------------------------------------|
C
C ***********************************************************************
C *                              SECTION 8                              *
C * DETERMINATION OF PLANT GROWTH AND TRAFFICABILITY PARAMETERS, OUTPUT *
C * OF DAILY SUMMARIES IF DESIRED, AND MONTHLY SUMMARY CACULATIONS.     *
C ***********************************************************************
      IF((MO.LT.ISEWMS).OR.(MO.GT.ISEWME))GO TO 169
      IF((MO.EQ.ISEWMS).AND.(DAY.LT.ISEWDS))GO TO 169
      IF((MO.EQ.ISEWME).AND.(DAY.GT.ISEWDE))GO TO 169
      IF(DTWT.GT.SEWX)GO TO 168
      SEWD=SEWX-DTWT
  168 CONTINUE
      IF(HSEW.GT.0.01)SEWD=HSEW/24.0
  169 CONTINUE
C
C
C
C
      IF(NOPORT.EQ.0)GO TO 175
C
      IF(DAY.NE.1)GO TO 170
C
C DAILY SUMMERIES
      WRITE(6,900)
      WRITE(6,910)IR,MO
      WRITE(6,920)
  170 WRITE(6,930)DAY,RVOL,FVOL,AET,DVOL,AVOL,TAV,DDZ,WETZ,DTWT,
```

```
     $STOR,RO,WLOSS,YD,DRNSTO,SEWD,DAMTSI
C
C MONTHLY CALCULATIONS
  175 RVOLM(MO)=RVOLM(MO)+RVOL
      FVOLM(MO)=FVOLM(MO)+FVOL
      ROM(MO)=ROM(MO)+RO
      DVOLM(MO)=DVOLM(MO)+DVOL
      PUMPVM(MO)=PUMPVM(MO)+PUMPV
      TWLOSS(MO)=TWLOSS(MO)+WLOSS
      SUMAET(MO)=SUMAET(MO)+AET
      SIRRMO(MO)=SIRRMO(MO)+DAMTSI
      ISICNM(MO)=ISICNM(MO)+JSICNM
      ISKIPM(MO)=ISKIPM(MO)+JSKIPM
      IPOSTM(MO)=IPOSTM(MO)+JPOSTM
      SEWM(MO)= SEWM(MO)+SEWD
      IF(DDZ.GE.(ROOTD-1.0)) GO TO 172
      IF(RVOL .GT. 0.005) GO TO 176
      GO TO 173
  172 IF((MO.LT.IDRYMS).OR.(MO.GT.IDRYME)) GO TO 173
      IF((MO.EQ.IDRYMS).AND.(DAY.LT.IDRYDS)) GO TO 173
      IF((MO.EQ.IDRYME).AND.(DAY.GT.IDRYDE)) GO TO 173
      DRYDAY(MO)=DRYDAY(MO)+1.0
  173 CONTINUE
      DELTWK=0.0
      IF((JDAY .GE. BWKDY1) .AND. (JDAY .LE. EWKDY1))
     *  CALL WORK(1,-1,TAV,DELTWK,0.0,DDAY,YTAV)
      IF((JDAY .GE. BWKDY2) .AND. (JDAY .LE. EWKDY2))
     *  CALL WORK(2,-1,TAV,DELTWK,0.0,DDAY,YTAV)
      DDAY=DDAY+1
  176 WRKDAY(MO)=WRKDAY(MO)+DELTWK
      IF(TAV.LT.AMINC)WATDAY(MO)=WATDAY(MO)+1.
C
      IF(DAY.GE.DAYM(MO))GO TO 180
      YTAV=TAV
      GO TO 30
C
C   IF PREVIOUS DAY WAS LAST DAY OF MONTH GO TO SECTION 9;  OTHERWISE
C   RETURN TO SECTION 4
C |-------------------------------------------------------------------|
C |                        END OF SECTION 8                           |
C |-------------------------------------------------------------------|
C
C ***********************************************************************
C *                            SECTION 9                                *
C * IF MONTH JUST COMPLETED WAS LESS THAN 12, RETURNS TO MAIN PROGRAM FOR *
C * NEW SET OF RAINFALL AND ET DATA.  IF MONTH=12, THIS SECTION PRINTS OUT*
C * MONTHLY SUMMARIES, COMPUTES YEARLY SUMMARIES, PRINTS, AND DETERMINES  *
C * AVERAGES OVER PREVIOUS YEARS OF SIMULATION.                          *
C ***********************************************************************
  180 DAYMT=DAYM(MO)
      WETDAY(MO)=DAYMT-WRKDAY(MO)
      IF(MO.LT.12)RETURN
      IF(NMONTH.NE.0) GO TO 181
C
C MONTHLY SUMMARIES
```

```
      WRITE(6,940)IR
      WRITE(6,950)
      WRITE(6,960)(MO,RVOLM(MO),FVOLM(MO),ROM(MO),DVOLM(MO),SUMAET(MO),
     2DRYDAY(MO),WRKDAY(MO),           TWLOSS(MO),SEWM(MO),SIRRMO(MO),
     $ISICNM(MO),PUMPVM(MO),IPOSTM(MO),MO=1,12)
C
  181 CONTINUE
      YEARS=IR-IRFST+1
      IYEAR=YEARS
      IRY(IYEAR)=IR
C
C
      DO 185 I=1,12
      TOTR=TOTR+RVOLM(I)
      YSUMET=YSUMET+SUMAET(I)
      TOTF=TOTF+FVOLM(I)
      TOTRO=TOTRO+ROM(I)
      TOTD=TOTD+DVOLM(I)
      TPUMPV=TPUMPV+PUMPVM(I)
      TOTDD(IYEAR)=TOTDD(IYEAR)+DRYDAY(I)
      TOSIRR(IYEAR)=TOSIRR(IYEAR)+SIRRMO(I)
      TOTNT=TOTNT+WETDAY(I)
      TOTWD(IYEAR)=TOTWD(IYEAR)+WRKDAY(I)
      TOTFD=TOTFD+WATDAY(I)
      TOTWF=TOTWF+TWLOSS(I)
      SEW(IYEAR)=SEW(IYEAR)+SEWM(I)
      WETDAY(I)=0.0
      WRKDAY(I)=0.0
      DRYDAY(I )=0.0
      PUMPVM(I)=0.0
      RVOLM(I)=0.0
      FVOLM(I)=0.0
      ROM(I)=0.0
      WATDAY(I)=0.
      TWLOSS(I)=0.
      DVOLM(I)=0.0
      SIRRMO(I)=0.0
      SUMAET(I)=0.0
      ISICNM(I)=0
      ISKIPM(I)=0
      SEWM(I)=0.0
      IPOSTM(I)=0
  185 CONTINUE
C
C YEARLY SUMMARIES
      WRITE(6,990)TOTR,TOTF,TOTRO,TOTD,YSUMET,TOTDD(IYEAR),TOTWD(IYEAR),
     $      TOTWF,SEW(IYEAR),TOSIRR(IYEAR),TPUMPV
C
C REINITIALIZATION
      TOTR=0.
      TOTF=0.
      TOTRO=0.
      YSUMET=0.0
      TOTD=0.
      TPUMPV=0.0
```

```
      TOTNT=0.
      TOTFD=0.
      TOTWF=0.
      ISKIP=0
      IPOST=0
      JDAY=0
      IK=0
      ISICNT=0
      IRRDAY=0
      NDAYSI=FDAYSI
      NOIRR1=NR1
      NOIRR2=NR2
C
      IF(IR.EQ.IEDYR) CALL ORDER(IYEAR)
C
  600 FORMAT(2I5,7I10)
  610 FORMAT(2F10.5,12F5.2)
 620  FORMAT(8E10.2)
  625 FORMAT(10F5.2)
  630 FORMAT(F10.2,2I5)
  640 FORMAT(12(F2.0,F3.0))
  645 FORMAT(2I3,2I2,3F10.2)
  650 FORMAT(6E10.2)
  660 FORMAT(20F4.1)
  670 FORMAT(4I2,2X,F10.2)
C
  790 FORMAT(1H1/1X,'INPUT PARAMETER VALUES USED IN THIS SIMULATION'/)
 800  FORMAT(/1X,'DEPTH TO DRAIN=',F5.1,'CM'/1X,'EFFECTIVE DEPTH FROM
     $DRAIN TO IMPERMEABLE LAYER =',F5.1,'CM'/1X,'DISTANCE BETWEEN
     $DRAINS =',F7.1,'CM'
     $/1X,'MAXIMUM DEPTH OF SURFACE PONDING =',F5.2,'CM'/1X,'EFFECTIVE
     $DEPTH IMPERMEABLE LAYER=',F6.1,'CM'/1X,'NUMBER OF DEPTH INCREMENTS
     $=',F5.0)
  801 FORMAT(1X,'DRAINAGE COEFFICIENT(AS LIMITED BY SUBSURFACE OUTLET
     $)=',F5.2,'CM/DAY'/1X,'ACTUAL DEPTH FROM SURFACE TO IMPERMEABLE
     $LAYER=',F5.1,'CM')
  802 FORMAT(1X,'SURFACE STORAGE THAT MUST BE FILLED BEFORE WATER CAN
     $MOVE TO DRAIN (FIG.2-12) =',F5.2,'CM'/1X,'FACTOR -G- IN KIRKHAM
     $EQ. 2-17 =',F10.2)
  810 FORMAT(1X,'MINIMUM AIR VOL REQUIRED FOR TRAFFICABILITY FOR FIRST
     $WORK PERIOD(AMIN1)=',F5.2,
     $'CM'/1X,'MINIUM DAILY RAINFALL TO STOP FIELD OPERATIONS FOR FIRST
     $PERIOD (ROUTA1)=',F5.2,'CM'/
     $1X,'MINIMUM TIME AFTER RAIN BEFORE CAN TILL FIRST PERIOD (ROUTT1)
     $=',F5.0,'DAYS',
     $/1X,'MINIMUM AIR VOL REQUIRED FOR TRAFFICABILITY FOR SECOND WORK
     $PERIOD (AMIN2)=',F5.2,
     $'CM'/1X,'MINIUM DAILY RAINFALL TO STOP FIELD OPERATIONS FOR SECOND
     $PERIOD (ROUTA2)=',F5.2,'CM'/
     $1X,'MINIMUM TIME AFTER RAIN BEFORE CAN TILL SECOND PERIOD (ROUTT2)
     $=',F5.0,'DAYS')
  815 FORMAT(1X,'JULIAN DATE TO BEGIN COUNTING WORK DAYS- 1ST PERIOD=',
     $I3
     $/1X,'JULIAN DATE TO END COUNTING WORK DAYS- FIRST PERIOD=',I3/
     $1X,'HOUR TO BEGIN WORK- FIRST PERIOD=',I2/
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     $1X,'HOUR TO END WORK-FIRST PERIOD=',I2/1X,'JULIAN DATE TO BEGIN CO
     $UNTING WORK DAYS-SECOND PERIOD=',I3/
     $1X,'JULIAN DATE TO END COUNTING WORK DAYS- SECOND PERIOD=',I3/
     $1X,'HOUR TO BEGIN WORK- SECOND PERIOD=',I2/
     $1X,'HOUR TO END WORK- SECOND PERIOD=',I2)
 820 FORMAT (1X,'MAXIMUM ROOTING DEPTH=',F5.1,'CM'/1X,'CRITICAL DEPTH W
     $ET ZONE=',F5.1,'CM'/1X,'WILTING POINT=',F5.2/1X,'INITIAL WATER TAB
     $LE DEPTH=',F5.1/1X,'WIDTH OF DITCH BOTTOM=',F5.1,'CM'/
     $1X,'SIDE SLOPES OF DITCH=',F5.1,':1')
 822 FORMAT(///8X,'DEPTH',9X,'SATURATED HYDRAULIC CONDUCTIVITY'/)
 828 FORMAT(3X,F7.2,' - ',F7.2,12X,F11.5)
 830 FORMAT(1X//5X,'DEPTHS OF WIERS FROM THE SURFACE'//1X,'DATE',9X,'1/
     $',F3.0,3X,'2/',F3.0,3X,'3/',F3.0,3X,'4/',F3.0,3X,'5/',F3.0,3X,'6/'
     $,F3.0,3X,'7/',F3.0,3X,'8/',F3.0,3X,'9/',F3.0,3X,'10/',F3.0,2X,'11/
     $',F3.0,2X,'12/',F3.0)
 835 FORMAT(//1X,'INDICATER FOR DAILY SUMMERY=',I5)
 840 FORMAT(1X,'WIER DEPTH',12F8.1)
 850 FORMAT(1X,'FIRST DAY OF SURFACE IRRIGATION=',I2/1X,
     $'INTERVAL BETWEEN SURFACE IRRIGATION DAYS=',I2/1X,
     $'STARTING HOUR OF SURFACE IRRIGATION=',I3/1X,
     $'ENDING HOUR OF SURFACE IRRIGATION=',I3/1X,
     $'NO SURFACE IRRIGATION INTERVAL 1=',I4,2X,I4/1X,
     $'NO SURFACE IRRIGATION INTERVAL 2=',I4,2X,I4)
 860 FORMAT(1X,'MINIMUM AIR REQUIRED TO HAVE SURFACE IRRIGATION=',
     $F6.2,'CM'/1X,'AMOUNT OF RAIN TO POSTPONE SURFACE IRRIGATION=',
     $F6.2,'CM'/1X,'SURFACE IRRIGATION FOR ONE HOUR=',12F6.2,'CM')
 870 FORMAT(1X,'INDET=',I2,'WHEN INDET.GT. 0 USE READ IN VALUES TO DETE
     2RMINE ET WHEN LIMITED BY SOIL CONDITIONS')
 900 FORMAT(1H1)
 910 FORMAT(2I10)
 920 FORMAT(//2X,'DAY',3X,'RAIN',3X,'INFIL',6X,'ET',4X,'DRAIN',2X,
     $'AIR VOL',3X,'TVOL',4X,'DDZ',4X,'WETZ',3X,'DTWT',4X,'STOR',
     $1X,'RUNOFF',2X,'WLOSS',3X,'YD',3X,'DRNSTO',2X,'SEW',2X,'DMTSI')
 930 FORMAT(2X,I3,8F8.2 ,8F7.2)
 940 FORMAT(1H0,15X,'MONTHLY VOLUMES IN CENTIMETERS FOR YEAR',I6)
 950 FORMAT( 2X,'MONTH',1X,'RAINFALL',1X,'INFILTRATION',1X,'RUNOFF',1X,
     $'DRAINAGE',1X,'    ET    ',   'DRY DAYS ',   'WRK DAYS',
     $    1X ,'WATER LOSS',4X,'SEW',3X,'MIR',4X,'MCN',1X,'PUMP',2X,'MPT
     3')
 960 FORMAT(1X,I3,F10.2,F11.2,F10.2,F8.2,F10.2,2F8.2,      F11.2,F10.2,
     23X,F5.2,I4,F7.3,I4)
 990 FORMAT(1H0/1X,'TOTALS',7F9.2,4X,4F9.2)
C
      RETURN
      END
C
C |-------------------------------------------------------------------|
C |                        END OF SECTION 9                           |
C |                        END OF FORSUB                              |
C | RETURN TO MAIN FOR NEW SET OF DATA TO START SIMULATION FOR FIRST MONTH|
C | OF THE NEXT YEAR.                                                 |
C |-------------------------------------------------------------------|
C
C **********************************************************************
C *            DEFINITION OF TERMS IN SUBROUTINE FORSUB                *
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C *                                                                          * 781A
C *A. INPUTS TO SUBROUTINE LISTED IN ORDER OF INPUT                           * 782A
C *                                                                          * 783A
C *   FDAYSI: FIRST DAY OF WASTE WATER IRRIGATION (JULIAN DATE).             * 784A
C *   INTDAY: INTERVAL BETWEEN IRRIGATION (DAYS).                            * 785A
C *   IHRSTA: HOUR IRRIGATION STARTS.                                        * 786A
C *   IHREND: HOUR IRRIGATION ENDS.                                          * 787A
C *   NOIRR1: BEGINNING JULIAN DATE OF FIRST NO IRRIGATION INTERVAL.         * 788A
C *   NOIRR2: ENDING JULIAN DATE OF FIRST NO IRRIGATION INTERVAL.            * 789A
C *   NOIRR3: BEGINNING JULIAN DATE OF SECOND NO IRRIGATION INTERVAL.        * 790A
C *   NOIRR4: ENDING JULIAN DATE OF SECOND NO IRRIGATION INTERVAL.           * 791A
C *   REQDAR: AMOUNT OF DRAINED VOLUME OR AIR VOLUME, CM., BEFORE IRRI-      * 792A
C *           GATION OF WASTE WATER IS ALLOWED.                              * 793A
C *   AMTRN : AMOUNT OF RAINFALL REQUIRED TO POSTPONE IRRIGATION TO NEXT     * 794A
C *           DAY.  RAINFALL MUST OCCUR ON FIRST HOUR OF SCHEDULED IRRI-     * 795A
C *           GATION.                                                        * 796A
C *   AMTSIM(I) : RATE OF IRRIGATION OF WASTEWATER (CM/HR) FOR EACH MONTH;*A796A
C *           IF AMTSIM<0,THE RATE IRRIGATED IS (TAV+AMTSIM(I))/TOFSIR      *B796A
C *           WHICH WOULD BE MAXIMUM AMOUNT SOIL WOULD ACCEPT ON THAT DAY.*C796A
C *   AMTSI : RATE OF IRRIGATION OF WASTE WATER, CM/HR.                      * 797A
C *   DDRAIN: DEPTH OF DRAIN, CM.                                            * 798A
C *   HDRAIN: EQUIVALENT DEPTH FROM WATER SURFACE IN DRAIN TO IMPERMEABLE * 799A
C *           LAYER, CM.                                                     * 800A
C *   SDRAIN: DISTANCE BETWEEN TWO DRAINS, CM.                               * 801A
C *   STMAX : MAXIMUM OR AVAILABLE SURFACE DEPRESSION STORAGE, CM.           * 802A
C *   DEPTH : EFFECTIVE DEPTH TO IMPERMEABLE LAYER FROM SOIL SURFACE,CM.  * 803A
C *           EFFECTIVE DEPTH MAY BE SMALLER THAN ACTUAL DEPTH TO ACCOUNT * 804A
C *           FOR CONVERGENCE NEAR DRAIN TUBES.                              * 805A
C *   XNI   : NUMBER OF DEPTH INCREMENTS.                                    * 806A
C *   DC    : DRAINAGE COEFFICIENT;READ IN AS CM/DAY.                        *A806A
C *   ADEPTH: ACTUAL DEPTH FROM SURFACE TO IMPERMEABLE LAYER.                *B806A
C *   STORRO: SURFACE STORAGE THAT MUST BE FILLED BEFORE SURFACE W1T5R       *C806A
C *           CAN MOVE TO THE DRAIN,CM,(FIG.2-12).                           *D806A
C *   GEE   : FACTOR -G- IN KIRKHAM'S EQ. (EQ. 2-17).                        *E806A
C *   DZ(I) : DEPTH TO BOTTOM OF PROFILE LAYER I.                            * 807A
C *   CONK  : LATERAL HYDRAULIC CONDUCTIVITY, CM/HR, OF A PROFILE LAYER.  * 808A
C *           E.G. CONK(2) IS CONDUCTIVITY OF LAYER FROM DZ(1) TO DZ(2).  * 809A
C *   AMINC : MINIMUM AIR VOLUME IN PROFILE IN ORDER NOT TO HAVE CROP        * 810A
C *           DAMAGED, CM.                                                   * 811A
C *   NOPORT: AN INDICATOR TO CONTROL PRINTOUT:                              * 812A
C *           NOPORT = 0 - MONTHLY SUMMARIES                                 * 813A
C *           NOPORT .GT. 0 - DAILY SUMMARIES                                  814A
C *   DACHNG: THE DAY IN A MONTH WHEN THE WEIR DEPTH IS CHANGED TO DWIER   * 815A
C *           FOR THAT MONTH, I.E., IF DACHNG(3) = 5, THEN THE WEIR DEPTH * 816A
C *           IS CHANGED TO DWIER(3) ON 5TH DAY OF THE MONTH OF MARCH.     * 817A
C *   DWIER : WEIR DEPTH FROM SURFACE, CM., FOR GIVEN MONTH.  DWIER(2) IS * 818A
C *           DEPTH OF WEIR IN MONTH 2 (FEB).                                * 819A
C *   BWKDY1 : BEGINNING JULIAN DAY OF FIRST WORK PERIOD.                    * 820A
C *   EWKDY1: ENDING JULAIN DATE OF FIRST WORK PERIOD.                       * 821A
C *   SWKHR1: HOUR TO START WORK DURING PERIOD 1.                            * 822A
C *   EWKHR1: HOUR TO END WORK DURING WORK PERIOD 1.                         * 823A
C *   AMINI : MIMIMUM AIR VOLUME OR DRAINED VOLUME REQUIRED TO HAVE FIELD * 824A
C *           OPERATIONS DURING WORK PERIOD 1.                               * 825A
C *   ROUTA1: RAINFALL REQUIRED TO STOP FIELD OPERATIONS DURING WORK         * 826A
C *           PERIOD 1.                                                      * 827A
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C *          PERIOD 1.                                                  * 827A
C *   ROUTT1: DAYS REQUIRED TO DRAIN OR DRY FIELD SO OPERATIONS CAN CON-  * 828A
C *          TINUE DURING WORK PERIOD 1.                                * 829A
C *   BWKDY2: BEGINNING JULIAN DAY OF SECOND WORK PERIOD.                 * 830A
C *   EWKDY2: ENDING JULIAN DAY OF SECOND WORK PERIOD.                    * 831A
C *   SWKHR2: HOUR TO START WORK DURING WORK PERIOD 2.                    * 832A
C *   EWKHR2: HOUR TO END WORK DURING WORK PERIOD 2.                      * 833A
C *   AMIN2 : MINIMUM AIR VOLUME OR DRAINED VOLUME REQUIRED TO HAVE FIELD * 834A
C *          OPERATIONS DURING WORK PERIOD 2.                           * 835A
C *   ROUTA2: RAINFALL REQUIRED TO STOP FIELD OPERATIONS DURING WORK      * 836A
C *          PERIOD 2.                                                  * 837A
C *   ROUTT2: DAYS REQUIRED TO DRAIN OR DRY FIELD SO OPERATIONS CAN CON-  * 838A
C *          TINUE DURING WORK PERIOD 2.                                * 839A
C *   DITCHB: BOTTOM WIDTH OF THE DITCH, CM., WHEN OPEN DITCHS USED FOR   * 840A
C *          DRAINS.  EFFECTIVE WIDTH WHICH CONSIDERS STORAGE IN OUTLET * 841A
C *          WHEN DRAIN TUBES USED.                                     * 842A
C *   DITCHS: SIDE SLOPE OF THE DITCH.                                    * 843A
C *   CRITD : CRITICAL DEPTH OF WET ZONE, CM.                             * 844A
C *   WP    : WILTING POINT OR SOIL WATER CONTENT OF SURFACE LAYER AT     * 845A
C *          LOWER LIMIT OF AVAILABILITY TO PLANT.                      * 846A
C *   DTWT  : DEPTH TO WATER TABLE AT BEGINING OF SIMULATION.  NOT IN-    * 847A
C *          ITIALIZED AT START OF EACH YEAR.                           * 848A
C *   ISEWMS: MONTH TO START CALCULATING SEW VALUES.  05 MEANS START CAL- * 849A
C *          CULATION IN MAY.                                           * 850A
C *   ISEWDS: DAY OF MONTH TO START CALCULATING SEW.                      * 851A
C *   ISEWME: MONTH TO END SEW CALCULATION.                               * 852A
C *   ISEWDE: DAY OF MONTH TO END SEW CALCULATION.                        * 853A
C *   SEWX  : DEPTH ON WHICH SEW CALCULATION IS BASED, CM., E.G.  SEWX=30 * 854A
C *          MEANS SEW CALCULATED AS DIFFERENCE BETWEEN WATER TABLE DEPTH* 855A
C *          DEPTH AND 30 CM.  IF W.T. = 20 CM., SEW - 30 = 10 CM DAYS  * 856A
C *          FOR THAT DAY.                                              * 857A
C *   INDET : INDICATOR VARIABLE.  IF INDET.GT.0, VALUES FOR UPWARD FLUX  * 858A
C *          VS. WATER TABLE DEPTH ARE READ IN SUB. PROP TO CALCULATE   * 859A
C *          SOIL LIMITED ET.  IF INDET.LE.0, LIMITING DEPTH CONCEPT,   * 860A
C *          CRITD, IS USED FOR ET.                                     * 861A
C *   INWIER: INDICATOR TO DETERMINE IF SUBIRRIGATION IS USED.  IF INWIER * 862A
C *          .GE.0, SUBIRRIGATION IS USED AND DEPTH OF WATER IN OUTLET IS* 863A
C *          MAINTAINED AT WIER ELEVATION.  IF INWIER.LE.0 HAVE CONVENT- * 864A
C *          IONAL DRAINAGE OR CONTROLLED DRAINAGE IF DWIER IS ABOVE    * 865A
C *          BOTTOM OF DRAIN.                                           * 866A
C *   INSIRR: IF INSIRR .GT. 0,POSTPONE IRRIGATION TILL NEXT DAY WHEN     *A866A
C *          TAV .LT. REQDAR. IF INSIRR =0,SKIP IRRIGATION FOR TAV .LT. *B866A
C *          REQDAR.                                                    *C866A
C *---------------------------------------------------------------------* 867A
C *                                                                     * 868A
C *B. OTHER PROGRAM VARIABLE IN FORSUB                                    * 869A
C *   A     : CONSTANT IN GREEN-AMPT INFILTRATION EQUATION OBTAINED BY    * 870A
C *          INTERPOLATION.                                             * 871A
C *   ADRYDY: SUM OF DRY DAYS FOR A GIVEN MONTH OVER ALL PAST YEARS       * 872A
C *          SIMULATED.                                                 * 873A
C *   AET   : TOTAL DAILY ET.                                             * 874A
C *   AVOL  : AIR VOLUME OR DRAINED VOLUME IN WET ZONE.                   * 875A
C *   AVOL1 : ANOTHER VARIABLE FOR AIR VOLUME IN WET ZONE                 * 876A
C *   AWETDY: SUM OF WET DAYS FOR A GIVEN MONTH OVER ALL PAST YEARS       * 877A
C *          SIMULATED.                                                 * 878A
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C *   AWRKDY: SUM OF WORK DAYS FOR A GIVEN MONTH OVER ALL PAST YEARS      *
C *           SIMULATED.                                                 *
C *   B     : CONSTANT IN GREEN-AMPT INFILTRATION EQUATION OBTAINED BY    *
C *           INTERPOLATION.                                             *
C *   CHECK : INDEX.                                                     *
C *   CONE  : EFFECTIVE LATERAL HYDRAULIC CONDUCTIVITY, CM/HR.           *
C *   CRITAV: AIR OR DRAINED VOLUME CORRESPONDING TO CRITICAL DEPTH.      *
C *   DAYM  : NUMBER OF DAYS A MONTH, E.G., DAYM(6) = DAYS IN JUNE = 30.  *
C *   DAYMT : NUMBER OF DAYS OF THE MONTH.                               *
C *   DDT   : TIME INCREMENT.                                            *
C *   DDZ   : DEPTH OF DRY ZONE, CM.                                     *
C *   DEBT  : THE AMOUNT OF WATER IN CM THAT HAS BEEN REMOVED FROM DRY    *
C *           ZONE BY ET.                                                *
C *   DEEPET: DISTANCE FROM BOTTOM OF ROOT ZONE TO IMPERMEABLE LAYER.     *
C *   DELT  : TIME INCREMENT.                                            *
C *   DELTWK: THE FRACTION OF THE DAY WHICH IS SUITABLE FOR WORK.  IE.    *
C *           DELTWK = 0.5 MEANS THIS DAY HAS 0.5 WOKK DAYS.             *
C *   DELX  : DEPTH INCREMENT, CM.                                       *
C *   DF    : CHANGE IN INFILTRATION, CM., DURING TIME INCREMENT, DDT.    *
C *   DFLUX : DRAINAGE FLUX, CM/HR.                                      *
C *   DROOT : EFFECTIVE ROOT DEPTH FOR A JULIAN DATE; E.G. DROOT(155) IS  *
C *           ROOT DEPTH FOR DAY 155.                                    *
C *   DRYDAY: A DAY WHEN AMOUNT OF SOIL WATER SUPPLIED TO THE PLANTS IS   *
C *           LESS THAN PET FOR THAT DAY.                                *
C *   DSTOR : DIFFERENCE IN SURFACE STORAGE FROM ONE HR. TO NEXT OR FROM  *
C *           ONE DAY TO NEXT.                                           *
C *   DT    : TIME INCREMENT, HOUR.                                      *
C *   DTWT  : DEPTH TO WATER TABLE.                                      *
C *   DVOL  : DRAINAGE VOLUME, CM.  SUMMED SO = TO DAILY DRAIN VOLUME AT  *
C *           END OF DAY.                                                *
C *   DVOL1 : ESTIMATE OF DRAINAGE VOLUME, CM., FOR TIME INCREMENT DT.    *
C *   DVOL2 : ANOTHER ESTIMATE OF DRAINAGE VOLUME, CM., FOR TIME INCRE-   *
C *           MENT DT.                                                   *
C *   DVOLM : TOTAL MONTHLY DRAINAGE VOLUME, CM.                         *
C *   DWRKDY: THE FRACTION OF A WORK DAY IN A GIVEN HOUR.                 *
C *   EDTWT : EFFECTIVE DEPTH TO WATER TABLE - ASSUMING TOTAL AIR VOLUME  *
C *           WAS IN THE WETZ.                                           *
C *   ET    : EVAPOTRANSPIRATION, IN.  ET(2) = ET FOR 2ND DAY OF THE      *
C *           MONTH.                                                     *
C *   F     : INFILTRATION FOR HOUR.  F(2) MEANS INFILTRATION FOR 2ND HOUR*
C *           OF THE DAY, CM.                                            *
C *   F1    : DUMMY VARIABLE FOR F.                                      *
C *   F2    : DUMMY VARIABLE FOR F.                                      *
C *   FRATE : INFILTRATION RATE, CM/HR.  FRATE(6) MEANS INFILTRATION RATE *
C *           IN CM/HR AT THE END OF THE 6TH HOUR OF THE DAY.            *
C *   FVOL  : HOURLY OR DAILY INFILTRATION, CM.                          *
C *   FVOLM : TOTAL MONTHLY INFILTRATION, CM.                            *
C *   H     : PRESSURE HEAD, CM.                                         *
C *   HET   : CALCULATED HOURLY ET, CM.  HET(5) MEANS CALCULATED ET FOR   *
C *           THE 5TH HOUR OF THE DAY.                                   *
C *   HOUR  : HOUR OF THE DAY.                                           *
C *   HOURLY: HOURLY RAINFALL, IN.  HOURLY(54) = HOURLY RAINFALL FOR 54TH *
C *           HOUR OF THE MONTH.                                         *
C *   HSEW  : HOURLY SEW, CM-HRS.                                        *
C *   IAVOL : INTEGER VARIABLE FOR MODIFIED AIR VOLUME, CM, THAT COULD BE *
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C *          USED TO FIND WET ZONE DEPTH AS, WETZ = WTD(IAVOL).          * 934A
C *   IDTWT : INITIAL WTD, CM.                                           * 935A
C *          IND = 2 MEANS DAY FALLS WITHIN SECOND WORK PERIOD.           * 936A
C *   IND   : AN INDICATOR.  IND = 1 MEANS DAY FALLS WITHIN FIRST WORK    * 937A
C *          PERIOD.                                                     * 938A
C *   IPOST : NUMBER OF TIMES SCHEDULED SURFACE IRRIGATION IS POSTPONED.  * 939A
C *   IPOSTM: TOTAL MONTHLY TIMES POSTPONE SURFACE IRRIGATION.           * 940A
C *   IR    : CALENDAR YEAR.                                             * 941A
C *   IR1   : INDICES USED TO FIND EACH YEAR.                            * 942A
C *   IR2   : INDICES USED TO FIND EACH YEAR.                            * 943A
C *   IRAIN : FIRST HOUR RAINFALL RECORDED FOR THAT DAY.                 * 944A
C *   IRRDAY: TOTAL DAYS WHEN HAVE SURFACE IRRIGATION.                   * 945A
C *   ISICNM: TOTAL MONTHLY TIMES HAVE SURFACE IRRIGATION.               * 946A
C *   ISICNT: NUMBER OF TIMES HAVE SURFACE IRRIGATION.                   * 947A
C *   ISKIP : NUMBER OF TIMES SCHEDULED SURFACE IRRIGATION IS SKIPPED TO  * 948A
C *          NEXT DAY.                                                   * 949A
C *   ISKIPM: TOTAL MONTHLY TIMES SKIP SURFACE IRRIGATION TO NEXT DAY.    * 950A
C *   IWER  : INDEX = WETZ + 1.                                          * 951A
C *   IEDYR : END YEAR OF SIMULATION.                                    * 952A
C *   IRY   : CALENDAR YEAR.                                               953A
C *   IYEAR : NUMBER OF YEARS IN SIMULATION.                             * 954A
C *   J     : INDEX.                                                     * 955A
C *   JDAY  : JULIAN DAY OR DATE.                                        * 956A
C *   K     : INDEX.                                                     * 957A
C *   KRAIN : INDEX.                                                     * 958A
C *   L     : INDEX.                                                     * 959A
C *   LOOP  : INDEX TO SKIP THE INPUT AND INITIALIZATION AFTER FIRST TIME * 960A
C *          THROUGH THE SIMULATION.                                     * 961A
C *   LRAIN : LAST HOUR WHEN IT RAINED DURING THE DAY.                   * 962A
C *   MO    : MONTH OF THE YEAR (5 MEANS MAY, ETC.).                     * 963A
C *   NI    : (XNI + 1) NUMBER OF NODE POINTS.                           * 964A
C *   PDEBT : POTENTIAL DEBT, MAXIMUM WATER THAT CAN BE USED FROM ROOT    * 965A
C *          ZONE, CM.                                                   * 966A
C *   PET   : POTENTIAL ET.                                              * 967A
C *   PUMPV : AMOUNT OF SUBIRRIGATION, CM.                               * 968A
C *   PUMPVM: TOTAL MONTHLY SUBIRRIGATION, CM.                           * 969A
C *   R( )  : RAINFALL IN CM HAS DIMENSION 24, INDICATING RAINFALL FOR ANY* 970A
C *          HOUR DURING THAT DAY, E.G., R(4) MEANS RAINFALL BETWEEN      * 971A
C *          HOURS OF 3 TO 4 OF THAT DAY.                                * 972A
C *   RAT1  : DUMMY VARIABLE FOR INFILTRATION RATE.                      * 973A
C *   RAT2  : DUMMY VARIABLE FOR INFILTRATION RATE.                      * 974A
C *   RCATE : INDEX.                                                     * 975A
C *   RDT   : TIME BETWEEN LAST RAINFALL IN PREVIOUS DAY AND FIRST RAIN-  * 976A
C *          FALL ON PRESENT DAY, HRS.                                   * 977A
C *   RO    : DAILY RUNOFF, CM.                                          * 978A
C *   ROM   : MONTHLY RUNOFF VOLUME, CM.                                 * 979A
C *   ROOTD : ROOT DEPTH, CM.  ROOTD(125) IS ROOT DEPTH ON JULIAN DAY 125.* 980A
C *          ROOTD(I) INTERPOLATED FROM DATA READ IN SUBROUTINE ROOT.     * 981A
C *   RUNOFF: RUNOFF VOLUME, CM.                                         * 982A
C *   RVOL  : TOTAL DAILY RAINFALL.                                      * 983A
C *   RVOLM : TOTAL MONTHLY RAINFALL, CM.                                * 984A
C *   SEW   : YEARLY SUM OF EXCESS WATER.                                * 985A
C *   SEWD  : SEW VALUE FOR DAY.                                         * 986A
C *   SEWM  : TOTAL MOMTHLY SEW, CM-DAYS.                                * 987A
C *   SIRRMO: TOTAL MONTHLY SURFACE IRRIGATION, CM.                      * 988A
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C *   SPR    : TOTAL WATER AVAILABLE FOR INFILTRATION IN TIME DDT, SUM OF  *
C *            STOR + RAINFALL DURING DDT.                                  *
C *   STOR   : SURFACE STORAGE, CM.                                         *
C *   STOR1  : TEMPORARY VARIABLE FOR SURFACE STORAGE.                      *
C *   STOR2  : TEMPORARY VARIABLE FOR SURFACE STORAGE.                      *
C *   SUMAET: MONTHLY TOTAL OF ET; SUMAET(10) MEANS TOTAL ET FOR OCTOBER.  *
C *   SUMET  : TOTAL YEARLY ET, CM.                                         *
C *   TAV    : TOTAL AIR VOLUME IN SOIL PROFILE; SUM OF AVOL AND DEBT.      *
C *   TAVI   : DUMMY VARIABLE FOR TAV.                                      *
C *   TOFSIR: TIME OF SURFACE IRRIGATION,HOURS.                             *
C *   TOSIRR: TOTAL YEARLY IRRIGATION.                                      *
C *   TOTD   : TOTAL YEARLY DRAINAGE, CM.                                   *
C *   TOTDD  : TOTAL YEARLY DRY DAYS.                                       *
C *   TOTF   : TOTAL YEARLY INFILTRATION, CM.                               *
C *   TOTFD  : TOTAL YEARLY WATDAYS.                                        *
C *   TOTNT  : TOTAL YEARLY WET DAYS.                                       *
C *   TOTR   : TOTAL YEARLY RAINFALL, CM.                                   *
C *   TOTRO  : TOTAL YEARLY RUNOFF, CM.                                     *
C *   TOTWD  : TOTAL YEARLY WORK DAYS.                                      *
C *   TOTWF  : TOTAL WATER REMOVED FROM FIELD BY SURFACE AND SUBSURFACE     *
C *            DRAINAGE - DOES NOT INCLUDE WATER STORED IN DITCHES THEN     *
C *            SUBIRRIGATED.                                                *
C *   TPUMPV: TOTAL YEARLY SUBIRRIGATION, CM.                               *
C *   TVOL   : TOTAL AIR VOLUME IN SOIL.                                    *
C *   TWLOSS: TOTAL MONTHLY WATER LOST FROM SYSTEM.                         *
C *   UPQ    : MAXIMUM UPWARD FLUX CORRESPONDING TO A GIVEN WET ZONE DEPTH,*
C *            CM/HR.                                                       *
C *   UPVOL  : UPWARD FLOW IN GIVEN TIME INCREMENT, CM.                     *
C *   W      : VOLUMETRIC WATER CONTENT, DIMEMSIONLESS.                     *
C *   WATER  : VOLUMETRIC WATER CONTENT, DIMENSIONLESS.  WATER(9) MEANS     *
C *            WATER CONTENT WHEN PRESSURE HEAD IS 8 CM (FROM SOIL WATER    *
C *            CHARATERISTICS).                                             *
C *   WATDAY: A DAY WHEN WATER TABLE IS HIGH ENOUGH TO CAUSE CROP DAMAGE. *
C *   WETDAY: A DAY WHEN IT IS TOO WET TO CONDUCT TILLAGE (WETDAY).        *
C *   WETZ   : DEPTH OF WET ZONE, CM.                                       *
C *   WLO    : ANOTHER VARIABLE FOR WLOSS FOR TIME IF 1HR, 2HR, OR 1 DAY.   *
C *   WLOSS  : DAILY WATER LOSS, CM.                                        *
C *   WRKDAY: THE DAYS WHEN TILLAGE CAN BE CONDUCTED (WORKDAY).             *
C *   WTD    : WATER TABLE DEPTH, CM.  WTD(55) MEANS WTD WHEN AIR VOLUME IS*
C *            (55-1)/10 = 5.4 CM.                                          *
C *   X      : DEPTH INCREMENT, CM.                                         *
C *   XV     : REAL VARIABLE FOR IAVOL.                                     *
C *   YEARS  : NUMBER OF YEARS SIMULATED; USED TO FIND AVERAGES.            *
C *   YDEBT  : DEBT AT END OF PREVIOUS DAY, CM.                             *
C *   YESF   : YESTERDAY'S INFILTRATION, CM.                                *
C *   YSUMET: TOTAL YEARLY ET.                                              *
C ***********************************************************************
C
      SUBROUTINE PROP(WTD,VOL,WATER,AA,BB,UPFLUX)
C
C ***********************************************************************
C * THIS SUBROUTINE READS IN SOIL WATER CHARACTERISTIC, INTERPOLATES     *
C * VALUES, AND CALCULATES RELATIONSHIP BETWEEN WATER TABLE DEPTH AND    *
C * DRAINAGE VOLUME.                                                     *
C * AS AN ALTERNATIVE CAN READ IN DRAINED VOLUME - WATER TABLE DEPTH     *
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C * RELATIONSHIP WHICH MAY ALSO INCLUDE UPWARD FLUX VALUES.                   *
C * A TABLE OF CONSTANTS FOR THE GREEN - AMPT INFILTRATION EQUATION FOR       *
C * VARIOUS WATER TABLE DEPTHS IS READ IN AND INTERPOLATED.                   *
C * ALL SOIL PROPERTIES ARE STORED IN ARRAYS SO THAT THEY CAN BE EASILY       *
C * RECALLED KNOWING THE WATER TABLE DEPTH.                                   *
C ****************************************************************************
C
C READ SOIL PROPERTIES AND STORE THE INFORMATION INTO
C PROPER ARRAYS BY INTERPOLATION
      DIMENSION THETA(50),HEAD(50),H(500),WATER(500),VOL(500),WTD(1000)
      DIMENSION D(10),E(10),F(10),AA(500),BB(500)
      DIMENSION AIA(500),BIB(500)
      DIMENSION XVOL(100),X(100)
      DIMENSION UPFLUX(500),FLUX(100)
C
C |------------------------------------------------------------------------|
C | THE FOLLOWING SECTION READS IN SOIL WATER CHARACTERISTIC, AND CAL-     |
C | CULATES RELATIONSHIP BETWEEN DRAINED VOLUME AND WATER TABLE DEPTH.     |
C |------------------------------------------------------------------------|
C
      READ(1,900) NUM,IVREAD
      READ(1,905)(THETA(I),HEAD(I),I=1,NUM)
C     DATA READ IN ORDER OF DECREASING WATER CONTENT
      DO 5 I = 1,NUM
    5 HEAD(I) = -HEAD(I)+1.0
      I=1
      WATER(1)=THETA(1)
      P=WATER(1)
      VOL(1)=0
      DO 10 J = 2,500
      AJ = J
      IF(AJ.GT.HEAD(I+1))I=I+1
      AI = I
      AIM=I-1
      WATER(J) = THETA(I)+(AJ-HEAD(I))/(HEAD(I+1)-HEAD(I))*
     C(THETA(I+1)-THETA(I))
      AVG = (WATER(J)+WATER(J-1))/2
      VOL(J) = VOL(J-1) + P-AVG
   10 CONTINUE
C
C |------------------------------------------------------------------------|
C | THE FOLLOWING READS TABULAR VALUES FOR W.T. DEPTH VS. DRAINAGE VOLUME  |
C | AND UPWARD FLUX.                                                       |
C | THE NUMBER OF VALUES READ IS IVREAD.                                   |
C | IF IVREAD .LE. 0, USE ABOVE W.T.D.-VOL. RELATIONSHIP AND CRITICAL      |
C | DEPTH CONCEPT FOR UPWARD FLUX.                                         |
C |------------------------------------------------------------------------|
C
      IF(IVREAD.LE.0) GO TO 14
C      IF WATER VOL VS. WATER TAB DEPTH IS READ IN GO TO NEXT STEPS
      READ(1,930)(X(I),XVOL(I),FLUX(I),I=1,IVREAD)
      DO 12 I=1,IVREAD
   12 X(I)=X(I)+1.0
      UPFLUX(1)=FLUX(1)
      VOL(1)=XVOL(1)
```

```
      I=1
      DO 11 L=2,500
      XL=L
      IF(XL.GT.X(I+1))I=I+1
      XI=I
      XIM=XI-1.
      UPFLUX(L)=FLUX(I)+((XL-X(I))/(X(I+1)-X(I)))*(FLUX(I+1)-FLUX(I))
   11 VOL(L)=XVOL(I)+((XL-X(I))/(X(I+1)-X(I)))*(XVOL(I+1)-XVOL(I))
C
C |-----------------------------------------------------------------|
C | CONVERT TO ARRAY SO CAN DIRECTLY DETERMINE WATER TABLE DEPTH (OR WET |
C | ZONE DEPTH) IF KNOW AIR VOLUME.                                   |
C |-----------------------------------------------------------------|
C
   14 CONTINUE
      DO 15 K = 1,500
   15 VOL(K) = VOL(K)*10.0+1.0
      I = 2
      AI = I
      WTD(1) = 0
      DO 25 L = 2,500
      AL = L
      ALM = AL-1.0
      IF(VOL(L).LT.AI) GO TO 25
   20 WTD(I) = ALM + (AI-VOL(L-1))/(VOL(L)-VOL(L-1))-1.0
      I = I + 1
      AI = I
      IF(VOL(L).GT.AI) GO TO 20
   25 CONTINUE
      WRITE(6,915)
      DO 30 I=1,500
      VOL(I) = 0.1*(VOL(I)-1.0)
      XI = I
      AI = 0.1*(XI-1.0)
      BI = I-1
      AIA(I)=AI
      BIB(I)=BI
   30 CONTINUE
      DO 50 I=1,500,10
   50 WRITE(6,910)AIA(I),WTD(I),BIB(I),WATER(I),VOL(I),UPFLUX(I)
C |-------------------------------------------------------------------|
C | READ IN INFILTRATION CONSTANTS FOR GREEN-AMPT EQUATION AND INTERPOLATE|
C |-------------------------------------------------------------------|
      READ(1,900)NUMA
      READ(1,920)(D(I),E(I),F(I),I=1,NUMA)
      WRITE(6,940)
       WRITE(6,945) (D(I),E(I),F(I),I=1,NUMA)
      AA(1)=0.
      BB(1)=0.
      I=1
      J=2
      XJ=J-1
   35 IP=I+1
      RATIO=(XJ -D(I))/(D(IP)-D(I))
      AA(J)=E(I)+RATIO*(E(IP)-E(I))
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      BB(J)=F(I)+RATIO*(F(IP)-F(I))
      J=J+1
      XJ=J-1
      IF (XJ.GT.D(IP))I=I+1
      IF(I.GE.NUMA)GO TO 45
      GO TO 35
   45 CONTINUE
  900 FORMAT(2I2)
  905 FORMAT(E10.2,10X,E10.2)
  910 FORMAT(10X,6F20.4)
  915 FORMAT(1H1,40X,'SOIL WATER CHARACTERISTICS AND RELATIONSHIP'/
     $ 38X,'BETWEEN WATER TABLE DEPTH AND DRAINED(VOID) VOLUME'//
     $           18X,'VOLUME OF VOIDS',4X,'WATER TABLE DEPTH',
     $ 9X,'HEAD',12X,'WATER CONTENT',1X,'VOLUME VOIDS ABOVE W.T.',
     $ 3X,'UPFLUX')
  920 FORMAT(3E10.2)
  940 FORMAT(///10X,'GREEN AMPT INFILTRATION PARAMETERS'/12X,'W.T.D.',
     $ 9X,'A',9X,'B')
  945 FORMAT(9X,3F11.3)
  930 FORMAT(3F10.4)
      RETURN
      END
C ************************************************************************
C *                 DEFINITION OF TERMS IN SUBROUTINE PROP               *
C *                                                                      *
C *A. INPUTS TO SUBROUTINE LISTED IN  ORDER OF INPUT                     *
C *                                                                      *
C *   NUM    : NUMBER OF THETA VS. PRESSURE HEAD POINTS READ TO INPUT SOIL *
C *            WATER CHARACTERISTIC.                                     *
C *   IVREAD: THE NUMBER OF POINTS TO BE READ IN FOR THE WTD-DRAINAGE    *
C *            VOLUME-UPWARD FLUX RELATIONSHIP.  WHEN CRITICAL DEPTH CON- *
C *            CEPT IS USED, READ 0.0 FOR UPWARD FLUX.                   *
C *   THETA : WATER CONTENT VALUE ON SOIL WATER CHARATERISTIC.           *
C *   HEAD  : PRESSURE HEAD VALUE ON SOIL WATER CHARATERISTIC, CM.       *
C *   X(I)  : WATER TABLE DEPTH IN RELATION OF WTD AND DRAINAGE VOLUME,CM.*
C *   XVOL  : AIR VOLUME OR DRAINED VOL. IN RELATION OF WTD AND DRAINED, *
C *            CM.                                                       *
C *   FLUX  : UPWARD FLUX IN RELATION  TO WTD, CM/DAY.                   *
C *   NUMA  : NUMBER OF POINTS TO READ IN FOR RELATIONSHIP BETWEEN COEF- *
C *            FICIENTS OF GREEN-AMPT INFILTRATION EQUATION AND WATER TABLE*
C *            DEPTH.                                                    *
C *   D(I)  : WATER TABLE DEPTH.                                         *
C *   E(I)  : GREEN-AMPT INFILTRATION COEFFICIENT A FOR WTD D(I).        *
C *   F(I)  : GREEN-AMPT INFILTRATION COEFFICIENT B FOR WTD D(I).        *
C *----------------------------------------------------------------------*
C *B. OTHER PROGRAM VARIABLE IN PROP                                     *
C *   AA    : CONSTANT A OF INFILTRATION EQUATION INTERPOLATED FROM E AND *
C *            F VALUES READ IN AND STORED FOR INTEGER WTD FROM TO 500 CM. *
C *            STORED VALUES.                                            *
C *   BB    : CONSTANT B OF INFILTRATION EQUATION INTERPOLATED FROM E AND *
C *            F VALUES READ IN AND STORED FOR INTEGER WTD FROM TO 500 CM. *
C *            STORED VALUES.                                            *
C *   VOL   : AIR VOLUME ABOVE WTD (INTERPOLATED FROM XVOL VS X DATA READ *
C *            IN OR CALCULATED FROM SOIL WATER CHARATERISTIC.           *
C *   WATER : VOLUMETRIC WATER CONTENT, INTERPOLATED FROM SOIL WATER     *
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C *           CHARATERISTIC FOR INTEGER VALUES OF PRESSURE HEAD FROM 0 TO *
C *           500 CM.                                                     *
C *   WTD   : WATER TABLE DEPTH IN CM (FROM 0 TO 500 CM), WTD(1) = 0.0,   *
C *           WTD(51) = WATER TABLE DEPTH CORRESPONDING TO AN AIR VOLUME  *
C *           OF (51 - 1)/10 = 5.0 CM, ETC.  THEREFORE IF THE AIR VOLUME  *
C *           X CM THE CORRESPONDING WATER TABLE DEPTH WOULD BE WTD(10X+1)*
C ***********************************************************************
C
      SUBROUTINE SURIRR
C
C **********************************************************************
C * THIS SUBROUTINE DETERMINES IF CONDITIONS ARE SUITABLE FOR SURFACE    *
C * IRRIGATION FOR WASTE WATER DISPOSAL.                                 *
C * IT ALSO COUNTS THE NUMBER OF IRRIGATION DAYS, SKIPS, AND             *
C * POSTPONEMENTS.                                                       *
C **********************************************************************
C
      INTEGER FDAYSI
      COMMON/ICNT/ISICNT,ISKIP,IPOST,IK,IPCNT
      COMMON/JCNT/JSICNM,JSKIPM,JPOSTM
      COMMON/IDAY/FDAYSI,NDAYSI,INTDAY,NOIRR1,NOIRR2,NOIRR3,NOIRR4
      COMMON/IHR/IHRSTA,IHREND,INSIRR
      COMMON/PAR/TAV,REQDAR,AMTRN,AMTSI,DAMTSI
      COMMON/RAIN/R(24)
C
      IF(NDAYSI.GE.NOIRR1.AND.NDAYSI.LE.NOIRR2)GO TO 30
      IF(TAV .LT. REQDAR .AND. INSIRR .GT.0) GO TO 20
      IF(TAV .LT. REQDAR) GO TO 10
      IF(R(IHRSTA).GT.AMTRN) GO TO 20
      IHRP1=IHRSTA+1
      DO 5 I=IHRP1,IHREND
      R(I)=R(I)+AMTSI
    5 CONTINUE
      DAMTSI=AMTSI*(IHREND-IHRSTA)
      JSICNM=JSICNM+1
      ISICNT=ISICNT+1
      GO TO 15
C
   10 ISKIP=ISKIP+1
      JSKIPM=JSKIPM+1
   15 NDAYSI=FDAYSI+INTDAY*(ISICNT+ISKIP+IK)
      IPCNT=0
      GO TO 25
C
   20 NDAYSI=NDAYSI+1
      IPOST=IPOST+1
      JPOSTM=JPOSTM+1
      IPCNT=IPCNT+1
      IF(IPCNT .GE. 2) GO TO 10
   25 IF(NDAYSI.GE.NOIRR1.AND.NDAYSI.LE.NOIRR2) GO TO 30
C
      RETURN
   30 MDAYSI=NDAYSI
      DO 35 I=MDAYSI,NOIRR2,INTDAY
      IK=IK+1
```

```
      NDAYSI=I+INTDAY
   35 CONTINUE
      NOIRR1=NOIRR3
      NOIRR2=NOIRR4
      RETURN
      END
C ***********************************************************************
C *                                                                     *
C *              DEFINITION OF TERMS IN SUBROUTINE SURIRR               *
C *   FDAYSI: FIRST DAY (JULIAN) OF SURFACE IRRIGATION.                 *
C *   IHREND: ENDING HOUR OF SURFACE IRRIGATION.                        *
C *   IHRP1 : INDEX = IHREND + 1.                                       *
C *   IHRSTA: STARTING HOUR OF SURFACE IRRIGATION.                      *
C *   IK    : INDEX TO KEEP THE COUNT OF DAYS WHEN THERE ARE NO SURFACE *
C *           IRRIGATION INTERVALS (E.G., SOMETIMES NO SURFACE IRRIGATION *
C *           DURING MARCH OR APRIL).                                   *
C *   INTDAY: THE INTERVAL IN DAYS BEFORE THE NEXT DAY SURFACE IRRIGATION *
C *           COMES.                                                    *
C *   IPCNT : A COUNTER FOR THE NUMBER OF TIMES IRRIGATION POSTPONED SINCE*
C *           LAST IRRIGATION
C *   IPOST : NUMBER OF POSTPONEMENTS OF SURFACE IRRIGATION, ACCUMULATES *
C *           FOR A YEAR.                                               *
C *   IRRDAY: IRRIGATION DAY, COUNT OF TOTAL DAYS.                      *
C *   ISICNT: NUMBER OF SURFACE IRRIGATION EVENTS ACCUMULATES FOR A YEAR. *
C *   ISKIP : NUMBER OF SKIPS OF SURFACE IRRIGATION EVENTS ACCUMULATES FOR*
C *           A YEAR.                                                   *
C *   JPOSTM: NUMBER OF MONTHLY POSTPONEMENTS OF SURFACE IRRIGATION (SI). *
C *   JSICNM: NUMBER OF MONTHLY SI EVENTS.                              *
C *   JSKIPM: NUMBER OF MONTHLY SKIPS OF SI EVENTS.                     *
C *   MDAYSI: INDEX FOR NDAYSI.                                         *
C *   NDAYSI: NEXT PLANNED DAY FOR SI.                                  *
C *                  OTHER TERMS ARE DEFINED IN FORSUB                  *
C ***********************************************************************
C
      SUBROUTINE ETFLUX (AVOL,DEBT,FVOL,DVOL,UPVOL,POTET,ACTET,PDEBT)
C
C ***********************************************************************
C * THIS SUBROUTINE DETERMINES ACTUAL HOURLY OR DAILY ET BASED ON PET AND *
C * UPWARD FLUX FROM THE WATER TABLE.                                   *
C * IF UPWARD FLUX IS INSUFFICIENT TO SUPPLY ET DEMAND, WATER IS REMOVED *
C * FROM ROOT ZONE TO MAKE UP THE DIFFERENCE.                           *
C * IF ROOT ZONE WATER IS NOT AVAILABLE, ET IS LIMITED.                 *
C ***********************************************************************
C
      IF(DEBT.GT.0.0) GO TO 50
      IF(UPVOL.LT.POTET) GO TO 25
      ACTET=POTET
      DEBT=0.0
      AVOL=AVOL+DVOL+ACTET-FVOL
      RETURN
   25 DEBT=DEBT-FVOL
      XXD=DEBT+POTET-UPVOL
      IF(DEBT.GE.0.0)GO TO 28
      ACTET=POTET
      AVOL=AVOL+DVOL+DEBT+ACTET
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      DEBT=0.0
      RETURN
   28 IF(XXD.GT.PDEBT)GO TO 30
      ACTET=POTET
      DEBT=DEBT+POTET-UPVOL
      AVOL=AVOL+DVOL+UPVOL
      RETURN
   30 ACTET=PDEBT-DEBT+UPVOL
      IF(ACTET.GE.0.0) GO TO  31
      ACTET=0.0
      DEBT=DEBT-UPVOL
      AVOL=AVOL+DVOL+UPVOL
      RETURN
   31 CONTINUE
      DEBT=PDEBT
      AVOL=AVOL+DVOL+UPVOL
      RETURN
   50 IF(POTET.GT.UPVOL) GO TO 25
      EXCESS=UPVOL -POTET
      ACTET=POTET
      DEBT=DEBT-FVOL
      YDEB=DEBT
      DEBT=DEBT-EXCESS
      IF(DEBT.LT.0.0)GO TO 60
      AVOL=AVOL+DVOL+UPVOL
      GO TO 70
  60  AVOL=AVOL+DVOL+ACTET+YDEB
   70 IF(DEBT.LT.0.0)DEBT=0.0
      RETURN
      END
C
C ***********************************************************************
C *                DEFINITION OF TERMS IN SUBROUTINE ETFLUX              *
C *                                                                      *
C *   ACTET : ACTUAL ET FOR TIME PERIOD.                                 *
C *   DEBT  : AMOUNT OF WATER REMOVED FROM DRY ZONE .                    *
C *   EXCESS: DIFFERENCE BETWEEN AMOUNT OF WATER MOVING UPWARD FROM W.T. *
C *           AND POTET.                                                 *
C *   POTET : POTENTIAL ET FOR TIME PERIOD-MAY BE 1 HR OR 1 DAY.         *
C *   XXD   : TEMPORARY VALUE FOR DEBT WHICH DEPENDS ON UPWARD FLUX,      *
C *           POTET PREVIOUS DEBT.                                       *
C * ---------------------------------------------------------------------*
C *  OTHER TERMS NOT DEFINED ABOVE ARE SAME AS DEFINED IN FORSUB         *
C ***********************************************************************
C
      SUBROUTINE DRAINS(DTWT,DFLUX)
C
C ***********************************************************************
C * THIS SUBROUTINE FINDS THE EFFECTIVE LATERAL HYDRAULIC CONDUCTIVITY AND*
C * COMPUTES DRAINAGE OR SUBIRRIGATION FLUX.                              *
C ***********************************************************************
C
      COMMON/DRABLK/HDRAIN,DEPTH,CONK(5),DZ(5)
      COMMON/DLK/SDRAIN,DDRAIN,DC,ADEPTH
      COMMON/POND/STOR,GEE,STORRO
```

```
      DIMENSION W(20)                                                   11E
      Y=DTWT                                                            12E
      IF(Y .GT. ADEPTH) Y=ADEPTH                                       A12E
      ABOVE=0.0                                                         13E
      DO 10 I=1,5                                                       14E
      N=I                                                              A14E
      L=DZ(I)                                                           15E
      IF(L.EQ.0) GO TO 15                                               16E
      IF(Y.GT.DZ(I))GO TO 5                                             17E
      W(I)=DZ(I)-Y                                                      18E
      X=DZ(I)-ABOVE                                                     19E
      IF(W(I).GT.X)W(I)=X                                               20E
      GO TO 10                                                          21E
    5 W(I)=0.0                                                          22E
   10 ABOVE=DZ(I)                                                       23E
      N=6                                                               24E
   15 N=N-1                                                             25E
      SUM=0.0                                                           26E
      DEEP=0.0                                                          27E
      DO 25 I=1,N                                                       28E
      SUM=SUM+W(I)*CONK(I)                                              29E
   25 DEEP=DEEP+W(I)                                                    30E
      IF((DEEP.LE. .0001).OR.(SUM.LE. .0001)) GO TO 35                  31E
      CONE=SUM/DEEP                                                    A31E
      GO TO 45                                                         B31E
   35 CONTINUE                                                         C31E
      SUM=CONK(1)*DZ(1)                                                D31E
      DEEP=DZ(1)                                                       E31E
      DO 40 I=2,5                                                      F31E
      SUM=SUM+CONK(I)*DZ(I)                                            G31E
   40 DEEP=DEEP+DZ(I)                                                  H31E
      CONE=SUM/DEEP                                                    I31E
   45 CONTINUE                                                         J31E
      HDMIN=DEPTH-DDRAIN                                                32E
      IF(HDRAIN.LT.HDMIN) HDRAIN=HDMIN                                  33E
      IF((STOR.GT. STORRO).AND.(DTWT .LT. 0.5)) GO TO 50               A33E
C                                                                       34E
      EM=DEPTH-Y-HDRAIN                                                 35E
      IF(EM .LT. -0.1) GO TO 42                                        A35E
      DFLUX=4.0*CONE*EM*(2.0*HDRAIN+EM) /SDRAIN**2                      36E
      IF(DFLUX .GT. DC) DFLUX=DC                                        37E
      IF(DFLUX .LT. .0)DFLUX=0.0                                       A37E
      IF(EM.LT.0) DFLUX=0.0                                            B37E
      RETURN                                                           C37E
   42 DDRANP=DDRAIN-0.10                                                38E
      DOT=HDRAIN+ADEPTH-DEPTH                                          A38E
      DFLUX=4.0*CONE*EM*HDRAIN*(2.0+EM/DOT)/SDRAIN**2                  B38E
      IF((DEPTH-HDRAIN).GE.DDRANP)DFLUX=0.                              39E
      RETURN                                                            40E
   50 DFLUX=12.5663*CONE*(DEPTH-HDRAIN+STOR)/(GEE*SDRAIN)
      IF(DFLUX.GT.DC) DFLUX=DC
      RETURN                                                           B40E
      END                                                               41E
C                                                                       42E
C ************************************************************************ 43E
```

```
C *                 DEFINITION OF TERMS IN SUBROUTINE DRAINS                 *
C *                                                                          *
C *    ABOVE : DEPTH OF TOP OF LAYER CONSIDERED.                             *
C *                                                                          *
C *    CONE  : EFFECTIVE SATURATED LATERAL HYDRAULIC CONDUCTIVITY - BASED    *
C *            ON W.T. DEPTH AND K OF LAYERS.                                *
C *    DDARNP: A VARIBLE USED INDICATING DISTANCE SLIGHTLY LESS THAN         *
C *            DDRAIN, CM.   USED TO PREVENT CALCULATING SUBIRRIGATION       *
C *            WHEN WATER TABLE IS BELOW DRAIN BOTTOM AND NO WATER IN DRAIN*
C *    DEEP  : TOTAL THICKNESS OF SATURATED ZONE.                            *
C *    DEPTH : DEPTH TO IMPERMEABLE LAYER FROM SOIL SURFACE, CM.             *
C *    DFLUX : DRAINAGE FLUX, CM/HR.                                         *
C *    DOT   : ACTUAL DEPTH FROM IMPERMEABLE LAYER TO WATER LEVEL ABOVE      *
C *            DRAIN DURING SUBIRRIGATION.                                   *
C *    DTWT  : DEPTH TO WATER TABLE FROM SOIL SURFACE, CM.                   *
C *    DZ(I) : THICKNESS OF LAYER I.                                         *
C *    EM    : DISTANCE FROM WATER LEVEL IN THE DRAINS TO WATER TABLE AT     *
C *            MIDPOINT.  EM NEGATIVE DURING SUBIRRIGATION.                  *
C *    HDRAIN: DISTANCE BETWEEN THE WATER SURFACE IN THE DRAIN TO THE        *
C *            IMPERMEABLE LAYER, CM.                                        *
C *    SDRAIN: DISTANCE BETWEEN THE DRAINS, CM.                              *
C *    W     : THICKNESS OF SATURATED ZONE IN LAYER CONSIDERED.              *
C *--------------------------------------------------------------------------*
C * TERMS NOT DEFINED HERE ARE SAME AS DEFINED IN FORSUB                     *
C ****************************************************************************
C
      SUBROUTINE YDITCH(DWIEP,DVOL,YD,RO,WLOSS,B,S)
C
C ****************************************************************************
C * SUBROUTINE TO DETERMINE WATER LEVEL IN OUTLET DITCH BASED ON WIER SET-*
C * ING, DRAINAGE OR SUBIRRIGATION, AND RUNOFF.                              *
C * THE AMOUNT OF WATER LOST FROM THE SYSTEM AND THAT REMAINING IN THE       *
C * DITCH IS CALCULATED.                                                     *
C ****************************************************************************
C
C FIND WATER LOSS AND WATER DEPTH IN DRAIN
C
      COMMON/DLK/SDRAIN,DDRAIN
      COMMON/DBLK/DRNSTO
C
      V=DRNSTO+RO+DVOL
      IF(V.LT.0.)V=0.
      CV=V*SDRAIN
      YD=((B/S)**2+4.*CV/S)**0.5/2.-0.5*B/S
      IF(YD.GT.(DDRAIN-DWIEP))GO TO 10
      DDSTO=V-DRNSTO
      DRNSTO=V
      WLOSS=0.
      RETURN
C
   10 YD=DDRAIN-DWIEP
      CV=YD*(B+   S*YD)
      V=CV/SDRAIN
      DDSTO=V-DRNSTO
      DRNSTO=V
```

```
      WLOSS=RO + DVOL-DDSTO
      RETURN
      END
C
C *********************************************************************
C *               DEFINITION OF TERMS IN SUBROUTINE YDITCH            *
C *                                                                   *
C *   B      : BOTTOM WIDTH OF THE DRAIN, CM.                         *
C *   CV     : TOTAL VOLUME OF WATER COMING TO THE DRAIN, CM.         *
C *   DDSTO : AMOUNT IF WATER STORED IN DRAIN DURING PRESENT TIME INCRE-  *
C *            MENT.                                                  *
C *   DRNSTO: AMOUNT OF WATER (VOLUME PER UNIT AREA) STORED IN THE DRAIN  *
C *            AT THE END OF PREVIOUS TIME INCREMENT, CM.             *
C *            AREA).                                                 *
C *   DVOL   : WATER DRAINED THROUGH THE SYSTEM, CM.                  *
C *   DWIER : WEIR DEPTH FROM THE SOIL SURFACE, CM.                   *
C *   RO     : RUNOFF VOLUME FROM SURFACE, CM.                        *
C *   S      : SIDE SLOPE OF DRAINAGE DITCH, CM/CM.                   *
C *   V      : AMOUNT OF WATER (VOL. PER UNIT AREA) THAT COULD BE IN OUTLET*
C *            DITCH AT END OF PRESENT TIME INCREMENT.                *
C *   WLOSS : WATER LOST THROUGH THE DITCH, CM.                       *
C *   YD     : WATER HEIGHT IN THE DRAIN MEASURED FROM BOTTOM OF DITCH.   *
C *-------------------------------------------------------------------*
C * OTHER TERMS NOT DEFINED ARE SAME AS GIVEN IN FORSUB               *
C *********************************************************************
C
      SUBROUTINE ROOT(DROOT)
C
C *********************************************************************
C * SUBROUTINE TO READ IN TABULAR VALUES OF EFFECTIVE ROOT DEPTH VERSUS  *
C * TIME AND INTERPOLATE BETWEEN VALUES SO THAT ROOT DEPTH FOR ANY DAY CAN*
C * BE CALLED DIRECTLY AS A FUNCTION OF THE DAY.                      *
C *********************************************************************
C
      DIMENSION DROOT(370), INDAY(50),ROOTIN(50)
      READ(1,600) NO
  600 FORMAT(I2)
      READ(1,610)(INDAY(I),ROOTIN(I),I=1,NO)
      WRITE(6,630)
      WRITE(6,635) (INDAY(I),ROOTIN(I),I=1,NO)
      J=2
      DROOT(1)=ROOTIN(1)
      DO 10 I=2,366
      AI=I
      IF(I.GT.INDAY(J))J=J+1
      DROOT(I)=ROOTIN(J-1)+((AI-INDAY(J-1))/(INDAY(J)-INDAY(J-1)))*
     2(ROOTIN(J)-ROOTIN(J-1))
   10 CONTINUE
      WRITE(6,615)
      WRITE(6,620) (DROOT(I),I=1,360,30)
  615 FORMAT(1H0,10X,'ROOT DEPTHS AS A FUNCTION OF TIME ARE READ IN'/
     211X,'THE FOLLOWING REPRESENT MONTHLY VALUES'/4X,'MONTH    1    2
     3 3    4    5    6    7    8    9   10   11   12')
  620 FORMAT(10X,12F5.0)
  630 FORMAT(///10X,'VALUES READ IN'/12X,'DAY',8X,'ROOT DEPTH')
```

```
  635 FORMAT(13X,I3,F16.2)
  610 FORMAT(8(I3,F7.2))
      RETURN
      END
C
C ************************************************************************
C *              . DEFINITION OF TERMS IN SUBROUTINE ROOT                  *
C *                                                                        *
C *A. INPUTS TO SUBROUTINE ROOT                                            *
C *   N     : NUMBER OF POINTS TO BE READ IN FOR JULIAN DATE - ROOT DEPTH *
C *           RELATIONSHIP.                                                *
C *   INDAY : JULIAN DATE.                                                 *
C *   ROOTIN: EFFECTIVE ROOT DEPTH ON INDAY.                               *
C
C ************************************************************************
C *B. DROOT(I): STORED ROOT DEPTH FOR EVERY DAY OF YEAR, I.  DETERMINE BY *
C *           INTERPOLATION FROM ROOTIN - INDAY RELATIONSHIP.              *
C ************************************************************************
C
C
      SUBROUTINE EVAP(ET,HET,HPET1,TPET)
C
C ************************************************************************
C * THIS SUBROUTINE DISTRIBUTES DAILY PET OVER 12 HRS. FROM 0600 TO 1800. *
C * WHEN RAINFALL .GT. 0 PET FOR THAT HOUR IS SET=0.                      *
C * THEN HOURLY PET SUMMED TO GET DAILY PET.                              *
C ************************************************************************
C
C FIND DAILY EVAPOTRANSPIRATION
C
      COMMON/EVAPO/PET,DDZ,ROOTD
      COMMON/RAIN/R(24)
      DIMENSION HET(24),HPET1(24)
C
C     FIGURE ET BASED ON 12 HRS
      TPET=0.0
      HPET=PET/12.0
      DO 5 I=1,6
      HET(I)=0.0
      HPET1(I)=0.0
    5 CONTINUE
      DO 10 I=7,18
      HET(I)=HPET
      HPET1(I)=HPET
      IF(DDZ.GT.ROOTD)HET(I)=0.0
      IF(R(I).GT.0.0)HET(I)=0.0
      IF(R(I).GT.0.0)HPET1(I)=0.0
   10 CONTINUE
      DO 15 I=19,24
      HET(I)=0.0
      HPET1(I)=0.0
   15 CONTINUE
      ET=0.0
      DO 20 I=1,24
      ET=ET+HET(I)
```

```
      TPET=TPET+HPET1(I)
   20 CONTINUE
      RETURN
      END
C
C ************************************************************************
C *                    ALL TERMS DEFINED IN FORSUB AND PROP               *
C ************************************************************************
C
      SUBROUTINE WET(DTWT)
C
C ************************************************************************
C * FIND WATER CONTENT AND HEAD DISTRIBUTION IN WET ZONE                  *
C ************************************************************************
C
      COMMON/WHX/WATER(500),W(101),H(101),X(101),NN
C
      DO 5 I=1,NN
      H(I)=X(I)-DTWT
      J=-H(I)+1.
      IF(J.LT.1)J=1
      W(I)=WATER(J)
    5 CONTINUE
      RETURN
      END
C ************************************************************************
C *                    ALL TERMS DEFINED IN FORSUB AND PROP               *
C ************************************************************************
C
      SUBROUTINE SOAK
C
C ************************************************************************
C * SUBROUTINE TO FIND PARAMETERS IN GREEN-AMPT INFILTRATION EQUATION     *
C * BASED ON EFFECTIVE WATER TABLE DEPTH AT BEGINNING OF RAINFALL EVENT.  *
C ************************************************************************
C
      COMMON/ABDT/EDTWT,AA(500),BB(500),A,B
C
      I=EDTWT+1
      A=AA(I)
      B=BB(I)
      RETURN
      END
C
C ************************************************************************
C *                    ALL TERMS DEFINED IN FORSUB AND PROP               *
C ************************************************************************
C
      SUBROUTINE WORK(IND,J,TAV,DWRK,ACC,DDAY,YTAV)
C
C ***********************************************************************
C * THIS SUBROUTINE DETERMINES IF ALL OR ANY PART OF THIS DAY MAY BE      *
C * CONSIDERED A WORK DAY.                                                *
C ************************************************************************
      INTEGER SWKHR1,SWKHR2,EWKHR1,EWKHR2
```

```
      COMMON /RAIN/ R(24)
      COMMON /IWK/ SWKHR1,EWKHR1,SWKHR2,EWKHR2
      COMMON /WRK/ AMIN1,ROUTA1,ROUTT1,AMIN2,ROUTA2,ROUTT2
      IF(J.LT.0) GO TO 50
      IF(IND.GT. 1) GO TO 25
      IF((ACC.GT.ROUTA1).AND. (R(J) .GT. 0.005)) DDAY=0.0
      IF((J .LE. SWKHR1) .OR. (J .GT. EWKHR1)) GO TO 60
      IF(TAV.LT. AMIN1) GO TO 60
      IF(DDAY .LT. ROUTT1) GO TO 60
      DWRK=1.0/(EWKHR1-SWKHR1)
      RETURN
   25 IF((ACC .GT. ROUTA2) .AND. (R(J) .GT. 0.005)) DDAY=0.0
      IF((J .LE. SWKHR2) .OR. (J .GT. EWKHR2)) GO TO 60
      IF(TAV .LT. AMIN2) GO TO 60
      IF(DDAY .LT. ROUTT2) GO TO 60
      DWRK=1.0/(EWKHR2-SWKHR2)
      RETURN
   60 DWRK=0.0
      RETURN
   50 IF(IND .GT. 1) GO TO 55
      IF(TAV.LT. AMIN1) GO TO 60
      IF(DDAY .LT. ROUTT1) GO TO 60
      DWRK=1.0
      IF(YTAV .LT. AMIN1) DWRK=(TAV-AMIN1)/(TAV-YTAV)
      RETURN
   55 IF(TAV .LT. AMIN2) GO TO 60
      IF(DDAY .LT. ROUTT2) GO TO 60
      DWRK=1.0
      IF(YTAV .LT. AMIN2) DWRK=(TAV-AMIN2)/(TAV-YTAV)
      RETURN
      END
C ***************************************************************************
C * ALL TERMS ARE DEFINED IN SUBROUTINE FORSUB                              *
C ***************************************************************************
C
      SUBROUTINE ORDER(IYEAR)
C
C ***************************************************************************
C * THIS SUBROUTINE DETERMINES THE RANK OF TOTDD, TOTWD, SEW, AND TOSIRR    *
C * AND THEIR AVERAGES DURING THE SIMULATED YEARS.                          *
C ***************************************************************************
C
      COMMON/ORDR/TOSIRR(50),TOTDD(50),TOTWD(50),SEW(50),IRY(50)
      DIMENSION NRANK1(50),NRANK2(50),NRANK3(50),NRANK4(50)
      DATA SUMWKY,SUMSEW,SUMDDY,SUMIRR/4*0.0/
      CALL RANK(TOTWD,NRANK1,IYEAR,IRY)
      CALL RANK(SEW,NRANK2,IYEAR,IRY)
      CALL RANK(TOTDD,NRANK3,IYEAR,IRY)
      CALL RANK(TOSIRR,NRANK4,IYEAR,IRY)
      WRITE(6,10)
      DO 20 I=1,IYEAR
      WRITE(6,30)I,TOTWD(I),NRANK1(I),SEW(I),NRANK2(I),TOTDD(I),
     1 NRANK3(I),TOSIRR(I),NRANK4(I)
      SUMWKY=SUMWKY+TOTWD(I)
      SUMSEW=SUMSEW+SEW(I)
```