

```

8470 PRINT:INPUT"PLEASE ENTER NUMBER OF TIMESTEPS FOR GATE OPERATION: ";NOSTEP
8480 IF Q4=2 THEN GOTO 8600
8490 CLS:PRINT"YOU HAVE SELECTED TO DETERMINE A % OUTLET OPENING FOR EACH OUTLET
      AT EACH TIME STEP"
8500 INPUT"IS THIS CORRECT (Y/N) ";Q$
8510 IF Q$="N" THEN GOTO 8430
8520 DIM HGATEOP(NOSTEP+1,GATEHNO)
8530 FOR J2=0 TO NOSTEP
8540 PRINT"TIME STEP ";J2:PRINT
8550 FOR J3=1 TO GATEHNO
8560 PRINT"GATE OPENING FOR GATE ";J3:INPUT"Z ";HGATEOP(J2,J3)
8570 NEXT J3
8580 NEXT J2
8590 RETURN
8600 CLS:PRINT"YOU HAVE SELECTED TO DETERMINE THE NUMBER OF OUTLETS TO BE OPENED
      AT EACH TIME INTERVAL":PRINT
8610 INPUT"IS THIS CORRECT (Y/N) ";Q$
8620 IF Q$="N" THEN GOTO 8430
8630 DIM HGATEOP(NOSTEP+1)
8640 FOR J2=0 TO NOSTEP
8650 PRINT"NUMBER OF OUTLETS OPEN AT TIME STEP NUMBER ";J2:INPUT HGATEOP(J2)
8660 NEXT J2
8670 RETURN
8680 ":DISPLAY OF DATA FILE-----
-
8690 FOR Z1=1 TO NZ
8700 ON DPT(Z1) GOSUB 8730,8830,9820,9920
8710 NEXT Z1
8720 RETURN
8730 ":DISPLAY RESERVOIR CHARACTERISTICS-----
-
8740 CLS:PRINT"THE RESEVOIR BASIN CHARACTERISTIC IS DESCRIBED BY";NOSTEL;" POINTS
      AS FOLLOWS:"
8750 PRINT:PRINT"                ELEVATION                STORAGE":QUES=17
8760 FOR I=1 TO NOSTEL
8770 PRINT TAB(20);ELEV(I);TAB(40);STOR(I)
8780 IF I=QUES THEN INPUT"PRESS ANY KEY TO CONTINUE: ";Q$:GOTO 8810
8790 NEXT I
8800 PRINT:INPUT"PRESS ANY KEY TO CONTINUE: ";Q$:RETURN
8810 QUES=QUES+19
8820 CLS:PRINT"                ELEVATION                STORAGE":GOTO 8790
8830 ":DISPLAY SPILLWAY DATA-----
-
8840 FOR I=1 TO SPILLNO
8850 ON SPILLWAY(I) GOSUB 8890,9040,9100,9220,9420,9630,9720
8860 NEXT I
8870 RETURN
8880 ":BOX CULVERTS-----
-
8890 CLS:PRINT A$:PRINT:QUES=16
8900 PRINT"THIS SPILLWAY COMPONENT CONSISTS OF";CULNO;" CULVERTS WITH THE FOLLOW
      ING PROPERTIES:"
8910 PRINT"  NUMBER    WIDTH    HEIGHT    INVERT UNSUBCOEF    SUBCOEF"
8920 FOR I=1 TO CULNO
8930 PRINT I;:PRINT TAB(11);:PRINT USING "EEEE.EEE";CULWIDTH(I);
8940 PRINT TAB(21);:PRINT USING "EEEE.EEE";CULHEIGHT(I);
8950 PRINT TAB(31);:PRINT USING "EEEE.EEE";CULINVERT(I);
8960 PRINT TAB(41);:PRINT USING "EE.EEEE";CULUNCOEF(I);
8970 PRINT TAB(51);:PRINT USING "EE.EEEE";CULSUBCOEF(I)
8980 IF I=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE: ";Q$:GOTO 9010
8990 NEXT I

```

```

9000 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9010 QUES=QUES+19
9020 CLS:PRINT"    NUMBER    WIDTH    HEIGHT    INVERT UNSUBCOEF    SUBCOEF":GOT
0 8990
9030 ':FREE OVERFLOW WIER-----
-
9040 CLS:PRINT B$:PRINT
9050 PRINT"WEIR LENGTH=";WIERLENGTH
9060 PRINT"WEIR INVERT LEVEL=";WIERINVERT
9070 PRINT"WEIR DISCHARGE COEFFICIENT=";WIERCOEF
9080 INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9090 ':AUTOMATIC GATES-----
-
9100 CLS:PRINT C$:PRINT:QUES=16
9110 PRINT"THIS SPILLWAY COMPONENT CONSISTS OF";GATELND;" GATES WITH THE FOLLOWI
NG PROPERTIES":PRINT
9120 PRINT"NO    INVERT    COEFFICIENT WIDTH    HEIGHT    START EL    END
EL"
9130 FOR J=1 TO GATELND
9140 PRINT J;TAB(5);GATELINVERT(J);TAB(17);GATELCOEF(J);TAB(29);GATELWIDTH(J);
9150 PRINT TAB(41);GATELHEIGHT(J);TAB(53);GATELS(J);TAB(65);GATELE(J)
9160 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 9190
9170 NEXT J
9180 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9190 QUES=Q$
9200 CLS:PRINT"    COEFFICIENT WIDTH    HEIGHT    START EL
END EL":GOTO 9210
9210 ':MANUAL GATES-----
-
9220 CLS:PRINT D$:PRINT:QUES=16
9230 PRINT"THIS SPILLWAY COMPONENT CONSISTS OF";GATEMND;" GATES WITH THE FOLLOWI
NG PROPERTIES":PRINT
9240 PRINT"NO    INVERT    COEFFICIENT WIDTH    HEIGHT    TRAVEL    SPILL CO
EF."
9250 FOR J=1 TO GATEMND
9260 PRINT J;TAB(5);GATEMINVERT(J);TAB(17);GATEMCOEF(J);TAB(29);GATEMWIDTH(J);
9270 PRINT TAB(41);GATEMSIZE(J);TAB(51);GATEMHEIGHT(J);TAB(61);GATESPILL(J)
9280 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 9310
9290 NEXT J
9300 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 9330
9310 QUES=QUES+19
9320 CLS:PRINT"NO    INVERT    COEFFICIENT WIDTH    HEIGHT    TRAVEL    SPIL
L COEF.":GOTO 9240
9330 IF Q$="U" THEN GOTO 9400
9340 CLS:PRINT"THESE GATES ARE OPERATED BY THE PROGRAM SUBJECT TO THE FOLLOWING
CONSTRAINTS":PRINT
9350 PRINT"DELAY TIME TO FIRST OPERATION=";GATEMSTART;" HOURS"
9360 PRINT"MAXIMUM NUMBER OF GATES OPERABLE AT ANY ONE TIME=";GATEMSUM
9370 PRINT"MAXIMUM DESIRABLE OUTFLOW RATE=";GATEMFLOW;" #3/s"
9380 PRINT"MAXIMUM ALLOWABLE OUTFLOW RATE INCREASE=";FLOWMESC;" #3/s/h"
9390 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9400 CLS:PRINT"THESE GATES ARE OPERATED BY THE USER. USER GATE REVISION IS DONE
AS A RERUN    OPTION IN THE CALC BLOCK"
9410 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9420 ':MANUAL HIGH PRESSURE OUTLET-----
-
9430 CLS:PRINT E$:PRINT:QUES=16
9440 PRINT"THIS SPILLWAY COMPONENT CONSISTS OF";GATEHND;" OUTLETS WITH THE FOLLO
WING PROPERTIES":PRINT
9450 PRINT"NO    INVERT    COEFFICIENT WIDTH    HEIGHT"
9460 FOR J=1 TO GATEHND
9470 PRINT J;TAB(5);GATEHINVERT(J);TAB(17);GATEHCOEF(J);TAB(29);GATEHWIDTH(J);

```

```

9480 PRINT TAB(41);GATEHEIGHT(J)
9490 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 9520
9500 NEXT J
9510 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 9100
9520 QUES=QUES+19
9530 CLS:PRINT"NO INVERT COEFFICIENT WIDTH HEIGHT":GOTO 9500
9540 IF Q1$="U" THEN GOTO 9610
9550 CLS:PRINT"THESE GATES ARE OPERATED BY THE PROGRAM SUBJECT TO THE FOLLOWING
CONSTRAINTS:~":PRINT
9560 PRINT"DELAY TIME TO FIRST OPERATION=";GATEHSTART;" HOURS"
9570 PRINT"MAXIMUM NUMBER OF OUTLETS OPERABLE AT ANY ONE TIME=";GATEHSUM
9580 PRINT"MAXIMUM DESIRABLE OUTFLOW RATE=";GATEHFLOW;" m3/s"
9590 PRINT"MAXIMUM ALLOWABLE OUTFLOW RATE INCREASE=";FLOWHESC;" m3/s/h"
9600 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9610 CLS:PRINT"THESE OUTLETS ARE OPERATED BY THE USER. USER REVISION IS DONE AS
A RERUN OPTION IN THE CALC BLOCK"
9620 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9630 '~:FUSE PLUG-----
-
9640 CLS:PRINT F$:PRINT
9650 PRINT"THIS SPILLWAY COMPONENT HAS THE FOLLOWING PROPERTIES:~":PRINT
9660 PRINT"ELEVATION AT START OF WASH=";FUSESTART
9670 PRINT"ELEVATION OF SPILLWAY CREST=";FUSECREST
9680 PRINT"LENGTH OF SPILLWAY=";FUSELENGTH
9690 PRINT"WFIR DISCHARGE COEFFICIENT=";FUSECOEF
9700 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9710 '~:USER SPILLWAY-----
-
9720 CLS:PRINT G$:PRINT:QUES=16
9730 PRINT"THIS SPILLWAY COMPONENT IS DEFINED BY";PTNOU;" POINTS AS FOLLOWS:~":PR
INT
9740 PRINT"ELEVATION DISCHARGE"
9750 FOR J=1 TO PTNOU
9760 PRINT ELEV(J);TAB(20);DISCHU(J)
9770 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 9800
9780 NEXT J
9790 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9800 QUES=QUES+19
9810 CLS:PRINT"ELEVATION DISCHARGE":GOTO 9780
9820 '~:DISPLAY RESERVOIR FLOOD STATUS-----
-
9830 CLS:PRINT"THE FOLLOWING CONDITIONS APPLY TO THE RESERVOIR DURING SIMULATION
~":PRINT
9840 PRINT"WATER LEVEL IN RESERVOIR AT START=";RESSTA
9850 PRINT"FINAL WATER LEVEL REQUIRED=";RESLEV
9860 PRINT"MAXIMUM WATER LEVEL ALLOWED DURING FLOOD=";RESMAX
9870 PRINT"ANALYSIS SENSITIVITY=";LEVSENSE
9880 PRINT"TIME AT START OF ANALYSIS=";STATIME
9890 PRINT"COMPUTATIONAL TIME STEP=";CSTEP
9900 PRINT"NUMBER OF TIME STEPS IN ANALYSIS=";NOSTEP
9910 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
9920 '~:DISPLAY INFLOW HYDROGRAPH-----
-
9930 CLS:PRINT"THE INFLOW HYDROGRAPH IS DEFINED BY";NOHYD;" POINTS AT";ISTEP;" H
OUR INTERVALS AS FOLLOWS:~":QUES=17
9940 PRINT"INTERVAL INFLOW"
9950 FOR J=1 TO NOHYD
9960 PRINT J;TAB(20);INFLOW(J)
9970 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 10000
9980 NEXT J
9990 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:RETURN
10000 QUES=QUES+19
10010 CLS:PRINT"INTERVAL INFLOW":GOTO 9980

```

LISTING FOR CALC PROGRAM BLOCK

```

10 CLEAR:CLS
20 ':GENERAL DEFINITIONS -----
30 A$="BOX CULVERTS":B$="FREE OVERFLOW WIER"
40 C$="AUTOMATICALLY CONTROLLED OVERFLOW WEIR"
50 D$="MANUALLY CONTROLLED OVERFLOW WIER"
60 E$="MANUALLY CONTROLLED HIGH PRESSURE OUTLET"
70 F$="FUSEPLUG EMERGENCY SPILLWAY"
80 G$="USER DEFINED SPILLWAY"
90 H$="PLEASE ENTER CORRECT DATA DISK IN DRIVE A"
100 I$="PLEASE REVISE SENSITIVITY AS MODELLING MATRIX TOO LARGE"
110 J$="USER DEFINED SPILLWAY CAPACITY EXCEEDED"
120 K$="JOB ABANDONED****"
130 L$="*****"
140 M$="RESERVOIR LEVEL EXCEEDS STORAGE/ELEVATION DATA"
150 N$="RESERVOIR LEVEL EXCEEDS MAXIMUM ALLOWABLE LEVEL"
160 O$="STORAGE-INDICATION CURVE EXCEEDED"
170 P$="DATA SET INCONSISTENT"
180 R$="MAXIMUM DESIRABLE OUTFLOW RATE EXCEEDED"
190 S$="MAXIMUM ALLOWABLE OUTFLOW RATE INCREASE EXCEEDED"
200 ':PROGRAM HEADING -----
210 PRINT L$:PRINT
220 PRINT "          FLOOD ROUTING THROUGH DAM WITH MULTIPLE SPILLWAY SYSTEM"
230 PRINT:PRINT "          L. FURSTENBURG (011-683-1663)
    1985"
240 PRINT:PRINT"          CALCULATION BLOCK":PRINT:PRINT L$:PRINT
250 PRINT"          THE FOLLOWING OPTIONS ARE PROVIDED:-":PRINT
260 PRINT"          1.RUN SIMULATION"
270 PRINT"          2.CHAIN TO DATA"
280 PRINT"          3.CHAIN TO PRES"
290 PRINT"          4.FINISH USING PROGRAM"
300 PRINT:INPUT"          PLEASE SELECT OPTION:-",OPT
310 ON OPT GOSUB 370,330,340,350
320 GOTO 10
330 CHAIN "A:DATA"
340 CHAIN "A:PRES"
350 CLS:END
360 ': ANALYSIS/OUTPUT MODE FIXED -----
370 CLS:PRINT L$
380 INPUT"PLEASE ENTER NAME OF DATA FILE TO BE RUN:-";X$:IF X$="" THEN PRINT CHR
$(7);"A NAME IS REQUIRED":GOTO 380
390 ON ERROR GOTO 440
400 OPEN X$ FOR INPUT AS #1
410 ON ERROR GOTO 0
420 GOSUB 4950
430 CLOSE #1:GOTO 460
440 PRINT"THIS FILE DOES NOT EXIST"
450 RESUME 380
460 FOR I=1 TO SPILLNO
470 IF SPILLWAY (I)=4 THEN GOTO 660
480 IF SPILLWAY (I)=5 THEN GOTO 660
490 NEXT I
500 CLS:PRINT L$:PRINT:PRINT TITLE1$:PRINT TITLE2$:PRINT
510 PRINT "THE SPILLWAY SYSTEM CONTAINS NO MANUAL COMPONENT"
520 PRINT "FLOOD ROUTING SHALL PROCEED NORMALLY"
530 PRINT:PRINT L$:PRINT
540 PRINT "OUTPUT CAN BE PRESENTED ON TWO LEVELS:-"
550 PRINT:PRINT "    1.BASIC OUTPUT"
560 PRINT "    2.EXTENDED OUTPUT"
570 PRINT:INPUT "WHICH LEVEL DO YOU REQUIRE (1/2)";OTL
580 IF STORIND=0 THEN GOTO 620

```

```

590 GOSUB 980
600 GOSUB 6130
610 RETURN
620 GOSUB 1730
630 GOSUB 2130
640 GOSUB 6130
650 RETURN
660 CLS:PRINT L$:PRINT:PRINT TITLE1$:PRINT TITLE2$:PRINT:PRINT L$:PRINT
670 PRINT "THE SPILLWAY SYSTEM CONTAINS MANUAL COMPONENTS AS FOLLOWS:";PRINT
680 FOR I=1 TO SPILLNO
690 IF SPILLWAY(I)=4 THEN GOSUB 730
700 IF SPILLWAY(I)=5 THEN GOSUB 780
710 NEXT I
720 GOTO 830
730 IF Q1$="U" THEN GOTO 760
740 PRINT D$;" WHICH WILL BE OPERATED BY THE PROGRAM"
750 RETURN
760 PRINT D$;" WHICH WILL BE OPERATED BY THE USER"
770 RETURN
780 IF Q2$="U" THEN GOTO 810
790 PRINT E$;" WHICH WILL BE OPERATED BY THE PROGRAM"
800 RETURN
810 PRINT E$;" WHICH WILL BE OPERATED BY THE USER"
820 RETURN
830 PRINT:INPUT "IS THIS CORRECT (Y/N)";Q$
840 IF Q$="N" THEN PRINT P$:PRINT K$:INPUT "PRESS ANY KEY TO CONTINUE:~",Q$:GOTO
10
850 IF Q1$="P" THEN GOTO 7270
860 IF Q2$="P" THEN GOTO 7270
870 FOR J1=1 TO SPILLNO
880 IF SPILLWAY(J1)>=1 AND SPILLWAY(J1)<=3 THEN GOTO 940
890 IF SPILLWAY(J1)=7 THEN GOTO 940
900 NEXT J1
910 CLS:PRINT L$:PRINT
920 PRINT "THE SPILLWAY CONTAINS MANUAL COMPONENTS OPERATED BY THE USER"
930 STORIND=1:GOTO 520
940 CLS:PRINT L$:PRINT
950 PRINT "THE SPILLWAY CONTAINS MANUAL COMPONENTS OPERATED BY THE USER"
960 STORIND=0:GOTO 520
970 ":VOLUME BALANCE WITHOUT STORAGE INDICATION CURVE-----
~
980 CLS:PRINT "ITERATIVE SEARCH TECHNIQUE EMPLOYED"
990 DIM INFL(NOSTEP+1),OUTFL(NOSTEP+1),STO(NOSTEP+1)
1000 DIM HT(NOSTEP+1),TIME(NOSTEP+1),BAL(NOSTEP+1)
1010 FOR J1=1 TO SPILLNO
1020 IF SPILLWAY(J1)=4 THEN DIM MGATE(NOSTEP+1),SPILL(NOSTEP+1)
1030 IF SPILLWAY(J1)=5 THEN DIM HGATE(NOSTEP+1)
1040 IF SPILLWAY(J1)=6 THEN DIM FUSE(NOSTEP+1)
1050 NEXT J1
1060 T=-CSTEP
1070 FOR J=0 TO NOSTEP+1
1080 T=T+CSTEP:TIME(J)=T+STATIME
1090 COUNT=INT(T/ISTEP)
1100 IF COUNT=0 THEN INFL(J)=0:GOTO 1120
1110 INFL(J)=INFL(COUNT)+(INFL(COUNT+1)-INFL(COUNT))*(T/ISTEP-COUNT)
1120 NEXT J
1130 HT(0)=RESSTA:ISTEP=3600*ISTEP:CSTEP=3600*CSTEP:STATIME=3600*STATIME
1140 ":CALCULATE VOLUME BALANCE-----
~
1150 PRINT:PRINT "CALCULATING VOLUME BALANCE"
1160 FOR K=0 TO NOSTEP

```

```

1170 PRINT K
1180 FOR I=1 TO NOSTEL
1190 IF HT(K)<=ELEV(I) THEN GOTO 1220
1200 NEXT I
1210 PRINT M$:PRINT K$:END
1220 STD(K)=STOR(I-1)+(STOR(I)-STOR(I-1))*(HT(K)-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
1230 OUTFL(K)=0
1240 FOR I=1 TO SPILLNO
1250 IF SPILLWAY(I)=4 THEN GOSUB 3810:OUTFL(K)=OUTFL(K)+MGATE(K)
1260 IF SPILLWAY(I)=5 THEN GOSUB 4230:OUTFL(K)=OUTFL(K)+HGATE(K)
1270 IF SPILLWAY(I)=6 THEN GOSUB 1590:OUTFL(K)=OUTFL(K)+FUSE(K)
1280 NEXT I
1290 INFLOW=(INFL(K)+INFL(K+1))*CSTEP/2+STD(K)
1300 INCREMENT=1:IF K=0 THEN GOTO 1330
1310 IF HT(K)>HT(K-1) THEN GOTO 1330
1320 HT(K+1)=HT(K)-INCREMENT:GOTO 1340
1330 HT(K+1)=HT(K)+INCREMENT
1340 FOR I=1 TO NOSTEL
1350 IF HT(K+1)<=ELEV(I) THEN GOTO 1380
1360 NEXT I
1370 PRINT M$:PRINT K$:END
1380 STD(K+1)=STOR(I-1)+(STOR(I)-STOR(I-1))*(HT(K+1)-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
1390 OUTFL(K+1)=0
1400 FOR I=1 TO SPILLNO
1410 IF SPILLWAY(I)=4 THEN GOSUB 4340:OUTFL(K+1)=OUTFL(K+1)+MGATE(K+1)
1420 IF SPILLWAY(I)=5 THEN GOSUB 4740:OUTFL(K+1)=OUTFL(K+1)+HGATE(K+1)
1430 IF SPILLWAY(I)=6 THEN GOSUB 1670:OUTFL(K+1)=OUTFL(K+1)+FUSE(K+1)
1440 NEXT I
1450 OUTFLOW=(OUTFL(K+1)+OUTFL(K))*CSTEP/2+STD(K+1)
1460 A=INFLOW:B=OUTFLOW
1470 IF A<10000 AND B<10000 THEN GOTO 1500
1480 A=A/10:B=B/10
1490 GOTO 1470
1500 IF INT(A)>INT(B) THEN INCREMENT=.8*INCREMENT:HT(K+1)=HT(K+1)+INCREMENT:GOTO 1340
1510 IF INT(A)<INT(B) THEN INCREMENT=.8*INCREMENT:HT(K+1)=HT(K+1)-INCREMENT:GOTO 1340
1520 FOR I=1 TO SPILLNO
1530 IF SPILLWAY(I)=4 THEN MGATE(K+1)=0:SPILL(K+1)=0
1540 IF SPILLWAY(I)=5 THEN HGATE(K+1)=0
1550 IF SPILLWAY(I)=6 THEN FUSE(K+1)=0
1560 NEXT I
1570 NEXT K
1580 RETURN
1590 'FLOW THROUGH FUSEPLUG ADDED-----
--
1600 IF HT(K)<=FUSECREST THEN FUSE(K)=0:RETURN
1610 IF FUSECHECK>0 THEN GOTO 1640
1620 IF HT(K)<=FUSESTART THEN FUSE(K)=0:RETURN
1630 FUSECHECK=1
1640 FUSE(K)=FUSECOEF*FUSELENGTH*(HT(K)-FUSECREST)^1.5
1650 RETURN
1660 'FLOW THROUGH FUSEPLUG CHECKED-----
--
1670 IF HT(K+1)<=FUSECREST THEN FUSE(K+1)=0:RETURN
1680 IF FUSECHECK>0 THEN GOTO 1710
1690 IF HT(K+1)<=FUSESTART THEN FUSE(K+1)=0:RETURN
1700 FUSECHECK=1
1710 FUSE(K+1)=FUSECOEF*FUSELENGTH*(HT(K+1)-FUSECREST)^1.5
1720 RETURN

```

1730 ': CONSTRUCTION OF STORAGE - INDICATION CURVE -----

```
1740 CLS:PRINT*CONSTRUCTING STORAGE - INDICATION CURVE*
1750 A=RESMAX-RESLEV: B=RESMAX-RESSTA
1760 IF A<B THEN A=B
1770 C=A/LEVSENSE
1780 IF C>5000 THEN PRINT I$:GOTO 1800
1790 GOTO 1820
1800 INPUT "REVISED ANALYSIS SENSITIVITY REQUIRED:"; LEVSENSE
1810 GOTO 1750
1820 J=1:DIM HEIGHT(C+1),OUTFLOW(C+1)
1830 FOR I=1 TO SPILLNO
1840 ON SPILLWAY(I) GOSUB 1870,1880,1890,1900,1910,1920,1930
1850 NEXT I
1860 GOTO 1940
1870 DIM BOXFLOW(C+1):RETURN
1880 DIM DBEEFLOW(C+1):RETURN
1890 DIM LGATEFLOW(C+1),LGATEOP(NCSTEP+1,GATELNO):RETURN
1900 RETURN
1910 RETURN
1920 DIM FUSEFLOW(C+1):RETURN
1930 DIM USERFLOW(C+1):RETURN
1940 HEIGHT(J-1)=RESMAX-A-LEVSENSE:DIM STORIND(C+1)
1950 HEIGHT(J)=HEIGHT(J-1)+LEVSENSE
1960 OUTFLOW(J)=0
1970 FOR I=1 TO SPILLNO
1980 ON SPILLWAY(I) GOSUB 2930,3050,3100,3330,3350,3370,3410
1990 NEXT I
2000 PRINT J
2010 J=J+1
2020 IF J=(C+1) THEN GOTO 2040
2030 GOTO 1950
2040 FOR J=1 TO C
2050 FOR I=1 TO NOSTEL
2060 IF HEIGHT(J) < ELEV(I) THEN GOTO 2090
2070 NEXT I
2080 PRINT M$: PRINT K$: END
2090 STOR=STOR(I)-(STOR(I)-STOR(I-1))*(ELEV(I)-HEIGHT(J))/(ELEV(I)-ELEV(I-1))
2100 STORIND(J)=STOR+(CSTEP*OUTFLOW(J)/2)*3600
2110 NEXT J
2120 RETURN
2130 ': VOLUME BALANCE -----
```

```
2140 PRINT:PRINT*CALCULATING VOLUME BALANCE*
2150 DIM INFL(NOSTEP+1),OUTFL(NOSTEP+1),STO(NOSTEP+1),HT(NOSTEP+1)
2160 DIM TIME(NOSTEP+1),BAL(NOSTEP+1)
2170 FOR J1=1 TO SPILLNO
2180 IF SPILLWAY(J1)=3 THEN DIM LGATE(NOSTEP+1)
2190 IF SPILLWAY(J1)=4 THEN DIM MGATE(NOSTEP+1),SPILL(NOSTEP+1)
2200 IF SPILLWAY(J1)=5 THEN DIM HGATE(NOSTEP+1)
2210 IF SPILLWAY(J1)=6 THEN DIM FUSE(NOSTEP+1)
2220 NEXT J1
2230 T=-CSTEP
2240 FOR J=0 TO NOSTEP +1
2250 T=T+CSTEP:TIME(J)=T+STATIME
2260 COUNT=INT(T/ISTEP)
2270 IF COUNT>NOHYD THEN INFL(J)=0:GOTO 2290
2280 INFL(J)=INFLOW(COUNT)+(INFLOW(COUNT+1)-INFLOW(COUNT))*(T/ISTEP-COUNT)
2290 NEXT J
2300 ISTEP=ISTEP*3600:CSTEP=CSTEP*3600:HT(0)=RESSTA
```

```

2310 FOR K=0 TO NOSTEP
2320 PRINT K
2330 FOR I=1 TO NOSTEL
2340 IF HT(K)<=ELEV(I) THEN GOTO 2370
2350 NEXT I
2360 PRINT M$:PRINT K$:END
2370 STO(K)=STOR(I-1)+(STOR(I)-STOR(I-1))*(HT(K)-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
2380 FOR I=1 TO C
2390 IF HT(K)<=HEIGHT(I) THEN GOTO 2420
2400 NEXT I
2410 PRINT N$:PRINT K$:END
2420 OUTFL(K)=OUTFLOW(I-1)+(OUTFLOW(I)-OUTFLOW(I-1))*(HT(K)-HEIGHT(I-1))/(HEIGHT(I)-HEIGHT(I-1))
2430 FOR J1=1 TO SPILLNO
2440 IF SPILLWAY(J1)=3 THEN GOTO 2470
2450 NEXT J1
2460 GOTO 2480
2470 LGATE(K)=LGATEFLOW(I-1)+(LGATEFLOW(I)-LGATEFLOW(I-1))*(HT(K)-HEIGHT(I-1))/(HEIGHT(I)-HEIGHT(I-1))
2480 FOR J1=1 TO SPILLNO
2490 IF SPILLWAY(J1)=4 THEN GOSUB 3810:OUTFL(K)=OUTFL(K)+MGATE(K)
2500 IF SPILLWAY(J1)=5 THEN GOSUB 4230:OUTFL(K)=OUTFL(K)+HGATE(K)
2510 IF SPILLWAY(J1)=6 THEN GOSUB 3700:OUTFL(K)=OUTFL(K)+FUSE(K)
2520 NEXT J1
2530 BAL=0
2540 FOR J1=1 TO SPILLNO
2550 IF SPILLWAY(J1)=4 THEN BAL=BAL+MGATE(K)*CSTEP/2
2560 IF SPILLWAY(J1)=5 THEN BAL=BAL+HGATE(K)*CSTEP/2
2570 IF SPILLWAY(J1)=6 THEN BAL=BAL+FUSE(K)*CSTEP/2
2580 NEXT J1
2590 BAL(K)=STO(K)-OUTFL(K)*CSTEP/2+(INFL(K)+INFL(K+1))*CSTEP/2
2600 FOR J=1 TO C
2610 IF BAL(K)<=STORIND(J)+BAL THEN GOTO 2650
2620 NEXT J
2630 PRINT O$:GOSUB 6130
2640 PRINT K$:PRINT:INPUT"PRESS ANY KEY TO CONTINUE: ",Q$:GOTO 10
2650 HT(K+1)=HEIGHT(J-1)+(HEIGHT(J)-HEIGHT(J-1))*(BAL(K)-STORIND(J-1)-BAL)/(STORIND(J)-STORIND(J-1))
2660 BALA=0
2670 FOR J1=1 TO SPILLNO
2680 IF SPILLWAY(J1)=4 THEN GOSUB 4340:BALA=BALA+MGATE(K+1)*CSTEP/2
2690 IF SPILLWAY(J1)=5 THEN GOSUB 4740:BALA=BALA+HGATE(K+1)*CSTEP/2
2700 IF SPILLWAY(J1)=6 THEN GOSUB 4850:BALA=BALA+FUSE(K+1)*CSTEP/2
2710 NEXT J1
2720 FOR J1=1 TO SPILLNO
2730 IF SPILLWAY(J1)>=4 AND SPILLWAY(J1)<=6 THEN GOTO 2770
2740 NEXT J1
2750 NEXT K
2760 RETURN
2770 IF INT(BALA)=INT(BAL) THEN GOTO 2850
2780 BAL=BALA
2790 FOR J1=1 TO SPILLNO
2800 IF SPILLWAY(J1)=4 THEN MGATE(K+1)=0
2810 IF SPILLWAY(J1)=5 THEN HGATE(K+1)=0
2820 IF SPILLWAY(J1)=6 THEN FUSE(K+1)=0
2830 NEXT J1
2840 GOTO 2600
2850 FOR J1=1 TO SPILLNO
2860 IF SPILLWAY(J1)=4 THEN MGATE(K+1)=0
2870 IF SPILLWAY(J1)=5 THEN HGATE(K+1)=0
2880 IF SPILLWAY(J1)=6 THEN FUSE(K+1)=0

```

```

2890 NEXT J1
2900 NEXT K
2910 RETURN
2920 ': BOX CULVERT FLOW -----

2930 FOR K=1 TO CULNO
2940 IF HEIGHT(J)>CULINVERT(K) THEN GOSUB 2980
2950 NEXT K
2960 OUTFLOW(J)=OUTFLOW(J)+BOXFLOW(J)
2970 RETURN
2980 H=HEIGHT(J)-CULINVERT(K)
2990 IF H=1.2*CULHEIGHT(K) GOTO 3020
3000 BOXFLOW(J)=(2/3)*CULCOEF(K)*CULWIDTH(K)*H*SQR(6.54*H)+BOXFLOW(J)
3010 RETURN
3020 BOXFLOW(J)=CULSUBCOEF(K)*CULWIDTH(K)*CULHEIGHT(K)*SQR(19.62*(H-CULSUBCOEF(K)*CULHEIGHT(K))+BOXFLOW(J)
3030 RETURN
3040 ': WIER FLOW -----

3050 IF HEIGHT(J)<=WIERINVERT THEN RETURN
3060 OGEEFLOW(J)=WIERCOEF*WIERLENGTH*((HEIGHT(J)-WIERINVERT)^1.5)
3070 OUTFLOW(J)=OUTFLOW(J)+OGEEFLOW(J)
3080 RETURN
3090 ': AUTOMATIC GATE FLOW -----

3100 FOR J1=1 TO GATELNO
3110 IF HEIGHT(J)>GATELS(J1) THEN GOSUB 3150
3120 NEXT J1
3130 OUTFLOW(J)=OUTFLOW(J)+LGATEFLOW(J)
3140 RETURN
3150 H=HEIGHT(J)-GATELS(J1)
3160 D=(H/(GATEL(J1)-GATELS(J1)))*GATELHEIGHT(J1)
3170 IF D>GATELHEIGHT(J1) THEN D=GATELHEIGHT(J1)
3180 IF D<=.7*(HEIGHT(J)-GATELINVERT(J1)) THEN GOTO 3220
3190 F=GATELCOEF(J1)*GATELWIDTH(J1)*(HEIGHT(J)-GATELINVERT(J1))^1.5
3200 LGATEFLOW(J)=LGATEFLOW(J)+F
3210 RETURN
3220 H1=HEIGHT(J)-GATELINVERT(J1)
3230 H2=H1-D:R=D/H1
3240 IF R<=.05 THEN C1=.73:GOTO 3290
3250 IF R<=.075 THEN C1=.73-((R-.05)/.025)*.01:GOTO 3290
3260 IF R<=.12 THEN C1=.72-((R-.075)/.045)*.01:GOTO 3290
3270 IF R<=.175 THEN C1=.71-((R-.12)/.055)*.01:GOTO 3290
3280 IF R<.175 THEN C1=.701-((R-.175)/.525)*.056
3290 F=2.48*C1*GATELWIDTH(J1)*(H1^1.5-H2^1.5)
3300 LGATEFLOW(J)=LGATEFLOW(J)+F
3310 RETURN
3320 ': MANUAL GATE FLOW -----
3330 RETURN
3340 ': MANUAL HIGH PRESSURE GATE FLOW -----
3350 RETURN
3360 ': FUSEPLUG FLOW -----
3370 IF HEIGHT(J)<=FUSECREST THEN RETURN
3380 FUSEFLOW(J)=FUSECOEF*FUSELENGTH*(HEIGHT(J)-FUSECREST)^1.5
3390 RETURN
3400 ': USER SPILLWAY FLOW -----
3410 IF HEIGHT(J)>ELEVU(PTNOU) THEN PRINT J$:GOTO 3430
3420 GOTO 3630
3430 SOUND 640,20
3440 PRINT"DO YOU WISH TO EXTEND YOUR SPILLWAY"
3450 INPUT "CAPACITY (Y/N):";Q$

```

```

3460 IF Q$="N" THEN PRINT K$:END
3470 PRINT:INPUT "NUMBER OF DISCHARGE ELEVATION POINTS ADDED :- ",J1
3480 DIM ELEVE(PTNOU+J1), DISCH(PTNOU+J1)
3490 FOR L=1 TO PTNOU
3500 ELEVE(L)=ELEVU(L):DISCH(L)=DISCHU(L)
3510 NEXT L
3520 FOR L=PTNOU+1 TO PTNOU+J1
3530 INPUT "ELEVATION :- ",ELEVE(L)
3540 INPUT "DISCHARGE :- ",DISCH(L)
3550 NEXT L
3560 PTNOU=PTNOU+J1
3570 ERASE ELEVE,DISCHU
3580 DIM ELEVE(PTNOU),DISCHU(PTNOU)
3590 FOR I=1 TO PTNOU
3600 ELEVE(I)=ELEVE(I):DISCHU(I)=DISCH(I)
3610 NEXT I
3620 ERASE ELEVE,DISCH
3630 FOR I=1 TO PTNOU
3640 IF HEIGHT(J)<ELEVE(I) THEN GOTO 3670
3650 NEXT I
3660 RETURN
3670 USERFLOW(J)=DISCHU(I-1)+(DISCHU(I)-DISCHU(I-1))*(HEIGHT(J)-ELEVE(I-1))/(ELE
VU(I)-ELEVE(I-1))
3680 OUTFLOW(J)=OUTFLOW(J)+USERFLOW(J)
3690 RETURN
3700 ': FUSEPLUS FLOW ADDED TO EQUATION -----

3710 IF HT(K)<=FUSECREST THEN FUSE(K)=0:RETURN
3720 IF FUSECHECK>0 THEN GOTO 3750
3730 IF HT(K)<=FUSESTART THEN FUSE(K)=0:RETURN
3740 FUSECHECK=1
3750 FOR I=1 TO C
3760 IF HT(K)<=HEIGHT(I) THEN GOTO 3790
3770 NEXT I
3780 PRINT N$:PRINT K$:END
3790 FUSE(K)=FUSEFLOW(I-1)+(FUSEFLOW(I)-FUSEFLOW(I-1))*(HT(K)-HEIGHT(I-1))/(HEIG
HT(I)-HEIGHT(I-1)):RETURN
3800 ': MANUAL WIER FLOW ADDED TO EQUATION -----

3810 IF Q1$="P" THEN RETURN
3820 IF Q3=1 THEN GOTO 3930
3830 IF HT(K)>GATEMINVERT(1) THEN GOTO 3850
3840 RETURN
3850 F=GATEMCOEF(1)*GATEMWIDTH(1)*(HT(K)-GATEMINVERT(1))^1.5
3860 MGATE(K)=F*MGATEDP(K)
3870 IF HT(K)>GATEMINVERT(1)+GATEMSIZE(1) THEN GOTO 3890
3880 RETURN
3890 NOSPIL=GATEMNO-MGATEDP(K)
3900 SPILL(K)=GATESPILL(1)*GATEMWIDTH(1)*NOSPIL*(HT(K)-GATEMINVERT(1)-GATEMSIZE(
1))^1.5
3910 MGATE(K)=MGATE(K)+SPILL(K)
3920 RETURN
3930 FOR J2=1 TO GATEMNO
3940 IF HT(K)>GATEMINVERT(J2) THEN GOSUB 3980
3950 IF HT(K)>GATEMINVERT(J2)+GATEMSIZE(J2) THEN GOSUB 4160
3960 NEXT J2
3970 RETURN
3980 H=HT(K)-GATEMINVERT(J2)
3990 D=MGATEDP(K,J2)*GATEMHEIGHT(J2)/100
4000 IF D=0 THEN RETURN
4010 IF D>GATEMHEIGHT(J2) THEN D=GATEMHEIGHT(J2)

```

```

4020 IF D<=.7*(HT(K)-GATEMINVERT(J2)) THEN GOTO 4060
4030 F=GATEMCOEF(J2)*GATEMWIDTH(J2)*(HT(K)-GATEMINVERT(J2))^1.5
4040 MGATE(K)=MGATE(K)+F
4050 RETURN
4060 H1=HT(K)-GATEMINVERT(J2)
4070 H2=H1-D:R=D/H1
4080 IF R<=.05 THEN C1=.73:GOTO 4130
4090 IF R<=.075 THEN C1=.73-((R-.05)/.025)*.01:GOTO 4130
4100 IF R<=.12 THEN C1=.72-((R-.075)/.045)*.01:GOTO 4130
4110 IF R<=.175 THEN C1=.71-((R-.12)/.055)*.01:GOTO 4130
4120 IF R<=.7 THEN C1=.701-((R-.175)/.525)*.056
4130 F=2.953*C1*GATEMWIDTH(J2)*(H1^1.5-H2^1.5)
4140 MGATE(K)=MGATE(K)+F
4150 RETURN
4160 IF MGATEOP(K,J2)>0 THEN RETURN
4170 IF (HT(K)-GATEMINVERT(J2)-GATEMSIZE(J2))<=0 THEN SPILL=0:RETURN
4180 SPILL=GATESPILL(J2)*GATEMWIDTH(J2)*(HT(K)-GATEMINVERT(J2)-GATEMSIZE(J2))^1.5
5
4190 MGATE(K)=MGATE(K)+SPILL
4200 SPILL(K)=SPILL(K)+SPILL
4210 RETURN
4220 'MANUAL HIGH PRESSURE GATE ADDED TO EQUATION -----
4230 IF Q2$="P" THEN RETURN
4240 IF Q4=1 THEN GOTO 4280
4250 F=GATEMCOEF(1)*GATEMWIDTH(1)*GATEMHEIGHT(1)*SQR(ABS(2*9.810001*(HT(K)-GATEMINVERT(1)+GATEMHEIGHT(1)/2)))
4260 HGATE(K)=HGATE(K)+F*HGATEOP(K)
4270 RETURN
4280 FOR J2=1 TO GATEMNO
4290 F=GATEMCOEF(J2)*GATEMWIDTH(J2)*GATEMHEIGHT(J2)*SQR(2*9.810001*(HT(K)-GATEMINVERT(J2)+GATEMHEIGHT(J2)/2))
4300 HGATE(K)=HGATE(K)+F*HGATEOP(K,J2)/100
4310 NEXT J2
4320 RETURN
4330 'MANUAL WIER FLOW CHECKED -----
4340 IF Q1$="P" THEN RETURN
4350 IF Q3=1 THEN GOTO 4460
4360 IF HT(K+1)>GATEMINVERT(1) THEN GOTO 4380
4370 RETURN
4380 F=GATEMCOEF(1)*GATEMWIDTH(1)*(HT(K+1)-GATEMINVERT(1))^1.5
4390 MGATE(K+1)=F*HGATEOP(K+1)
4400 IF HT(K+1)>GATEMINVERT(1)+GATEMSIZE(1) THEN GOTO 4420
4410 RETURN
4420 NOSPIL=GATEMNO-MGATEOP(K+1)
4430 SPILL(K+1)=GATESPILL(1)*GATEMWIDTH(1)*NOSPIL*(HT(K+1)-GATEMINVERT(1)-GATEMSIZE(1))^1.5
4440 MGATE(K+1)=MGATE(K+1)+SPILL(K+1)
4450 RETURN
4460 FOR J2=1 TO GATEMNO
4470 IF HT(K+1)>GATEMINVERT(J2) THEN GOSUB 4510
4480 IF HT(K+1)>GATEMINVERT(J2)+GATEMSIZE(J2) THEN GOSUB 4680
4490 NEXT J2
4500 RETURN
4510 H=HT(K+1)-GATEMINVERT(J2)
4520 D=MGATEOP(K+1,J2)*GATEMHEIGHT(J2)/100
4530 IF D=0 THEN RETURN
4540 IF D<=.7*(HT(K+1)-GATEMINVERT(J2)) THEN GOTO 4580
4550 F=GATEMCOEF(J2)*GATEMWIDTH(J2)*(HT(K+1)-GATEMINVERT(J2))^1.5
4560 MGATE(K+1)=MGATE(K+1)+F
4570 RETURN
4580 H1=HT(K+1)-GATEMINVERT(J2)

```

```

4590 H2=H1-D:R=D/H1
4600 IF R<=.05 THEN C1=.73:GOTO 4650
4610 IF R<=.075 THEN C1=.73-((R-.05)/.025)*.01:GOTO 4650
4620 IF R<=.12 THEN C1=.72-((R-.075)/.045)*.01:GOTO 4650
4630 IF R<=.175 THEN C1=.71-((R-.12)/.055)*.01:GOTO 4650
4640 IF R<=.7 THEN C1=.701-((R-.175)/.525)*.056
4650 F=2.953*C1*GATEWIDTH(J2)*(H1^1.5-H2^1.5)
4660 MGATE(K+1)=MGATE(K+1)+F
4670 RETURN
4680 IF MGATEOP(K+1,J2)>0 THEN RETURN
4690 IF (HT(K+1)-GATEMINVERT(J2)-GATEMSIZE(J2))<=0 THEN SPILL=0:RETURN
4700 SPILL=GATESPILL(J2)*GATEWIDTH(J2)*(HT(K+1)-GATEMINVERT(J2)-GATEMSIZE(J2))^
1.5
4710 MGATE(K+1)=MGATE(K+1)+SPILL
4720 RETURN
4730 'HIGH PRESSURE GATE FLOW CHECKED-----
4740 IF Q2$="P" THEN RETURN
4750 IF Q4=1 THEN GOTO 4790
4760 F=GATEHCOEF(I)*GATEWIDTH(I)*GATEHEIGHT(I)*SQRT(2*9.810001*(HT(K+1)-GATEMINVERT(I)+GATEHEIGHT(I)/2))
4770 MGATE(K+1)=MGATE(K+1)+F*HGATEOP(K+1)
4780 RETURN
4790 FOR J2=1 TO GATEHND
4800 F=GATEHCOEF(J2)*GATEWIDTH(J2)*GATEHEIGHT(J2)*SQRT(2*9.810001*(HT(K+1)-GATEMINVERT(J2)+GATEHEIGHT(J2)/2))
4810 MGATE(K+1)=MGATE(K+1)+F*HGATEOP(K+1,J2)/100
4820 NEXT J2
4830 RETURN
4840 'FUSEPLUS FLOW CHECKED-----
4850 IF HT(K+1)<=FUSECREST THEN FUSE(K+1)=0:RETURN
4860 IF FUSECHECK>0 THEN GOTO 4890
4870 IF HT(K+1)<=FUSESTART THEN FUSE(K+1)=0:RETURN
4880 FUSECHECK=1
4890 FOR I=1 TO C
4900 IF HT(K+1)<=HEIGHT(I) THEN GOTO 4930
4910 NEXT I
4920 PRINT N$:PRINT K$:END
4930 FUSE(K+1)=FUSEFLOW(I-1)+(FUSEFLOW(I)-FUSEFLOW(I-1))*(HT(K+1)-HEIGHT(I-1))/(HEIGHT(I)-HEIGHT(I-1))
4940 RETURN
4950 'STORAGE - ELEVATION POINTS FROM DISK -----
-
4960 CLS:PRINT L$:PRINT
4970 PRINT:PRINT"READING STORAGE/ELEVATION DATA FROM DISK."
4980 INPUT E1,NOSTEL
4990 DIM ELEV(NOSTEL),STOR(NOSTEL)
5000 FOR I=1 TO NOSTEL
5010 INPUT E1,ELEV(I),STOR(I)
5020 NEXT I
5030 INPUT E1,NOSTEP
5040 ' SPILLWAY DATA FROM DISK -----
5050 PRINT:PRINT"READING SPILLWAY DATA FROM DISK."
5060 INPUT E1,SPILLND
5070 DIM SPILLWAY(SPILLND)
5080 FOR I=1 TO SPILLND
5090 INPUT E1,SPILLWAY(I)
5100 NEXT I
5110 FOR I=1 TO SPILLND
5120 ON SPILLWAY(I) GOSUB 5150,5240,5270,5360,5620,5890,5930
5130 NEXT I

```

```

5140 GOTO 6010
5150 ': BOX CULVERT DATA -----

5160 INPUT L1,CULNO
5170 DIM CULHEIGHT(CULNO),CULWIDTH(CULNO),CULINVERT(CULNO)
5180 DIM CULUNCOEF(CULNO),CULSUBCOEF(CULNO)
5190 FOR J=1 TO CULNO
5200 INPUT L1,CULWIDTH(J),CULHEIGHT(J),CULINVERT(J)
5210 INPUT L1,CULUNCOEF(J),CULSUBCOEF(J)
5220 NEXT J
5230 RETURN
5240 ': FREE OVERFLOW WIER DATA -----

5250 INPUT L1,WIERLENGTH,WIERINVERT,WIERCOEF
5260 RETURN
5270 ': AUTOMATIC GATE DATA -----

5280 INPUT L1,GATELNO
5290 DIM GATELS(GATELNO),GATELF(GATELNO),GATELCOEF(GATELNO)
5300 DIM GATELIVERT(GATELNO),GATELWIDTH(GATELNO),GATELHEIGHT(GATELNO),GATELTIME(GATELNO)
5310 FOR J=1 TO GATELNO
5320 INPUT L1,GATELS(J),GATEL(J)
5330 INPUT L1,GATELINVERT(J),GATELCOEF(J),GATELWIDTH(J),GATELHEIGHT(J)
5340 NEXT J
5350 RETURN
5360 ': MANUAL GATE DATA -----

5370 INPUT L1,GATEMNO
5380 DIM GATEMCOEF(GATEMNO),GATEMINVERT(GATEMNO),GATESPILL(GATEMNO)
5390 DIM GATEMWIDTH(GATEMNO),GATEMHEIGHT(GATEMNO),GATEMSIZE(GATEMNO)
5400 FOR J=1 TO GATEMNO
5410 INPUT L1,GATEMINVERT(J),GATESPILL(J),GATEMCOEF(J),GATEMWIDTH(J)
5420 INPUT L1,GATEMHEIGHT(J),GATEMSIZE(J)
5430 NEXT J
5440 INPUT L1,Q1$
5450 IF Q1$ = "J" THEN GOTO 5480
5460 INPUT L1,GATEMSTART,GATEMSUM,GATEMFLOW,FLOWMESC
5470 RETURN
5480 INPUT L1,Q3
5490 IF Q3=2 THEN GOTO 5570
5500 DIM MGATEOP(NOSTEP+1,GATEMNO)
5510 FOR I=0 TO NOSTEP
5520 FOR J=1 TO GATEMNO
5530 INPUT L1,MGATEOP(I,J)
5540 NEXT J
5550 NEXT I
5560 RETURN
5570 DIM MGATEOP(NOSTEP+1)
5580 FOR I=0 TO NOSTEP
5590 INPUT L1,MGATEOP(I)
5600 NEXT I
5610 RETURN
5620 ': MANUAL HIGH PRESSURE GATE DATA -----

5630 INPUT L1,GATEHNO
5640 DIM GATEHCOEF(GATEHNO),GATEHINVERT(GATEHNO)
5650 DIM GATEHWIDTH(GATEHNO),GATEHHEIGHT(GATEHNO)
5660 FOR J=1 TO GATEHNO
5670 INPUT L1,GATEHINVERT(J),GATEHCOEF(J)
5680 INPUT L1,GATEHWIDTH(J),GATEHHEIGHT(J)

```

```

5690 NEXT J
5700 INPUT £1,Q2$
5710 IF Q2$ = "U" THEN GOTO 5750
5720 INPUT £1,GATEHSTART,GATEHSUM
5730 INPUT £1,GATEHFLOW,FLOWHESC
5740 RETURN
5750 INPUT £1,Q4
5760 IF Q4=2 THEN GOTO 5840
5770 DIM HGATEOP(NOSTEP+1,GATEHNO)
5780 FOR I=0 TO NOSTEP
5790 FOR J=1 TO GATEHNO
5800 INPUT £1,HGATEOP(I,J)
5810 NEXT J
5820 NEXT I
5830 RETURN
5840 DIM HGATEOP(NOSTEP+1)
5850 FOR I=0 TO NOSTEP
5860 PRINT £1,HGATEOP(I)
5870 NEXT I
5880 RETURN
5890 ': FUSEPLUG DATA -----

5900 INPUT £1,FUSESTART,FUSECREST
5910 INPUT £1,FUSELENGTH,FUSECDEF
5920 RETURN
5930 ': USER SPILLWAY DATA -----

5940 INPUT £1,PTNOU
5950 DIM ELEVU(PTNOU),DISCHU(PTNOU)
5960 FOR J=1 TO PTNOU
5970 INPUT £1,ELEVU(J),DISCHU(J)
5980 NEXT J
5990 RETURN
6000 ':FLOOD DATA READ FROM DISK-----

6010 PRINT:PRINT"READING INFLOW HYDROGRAPH FROM DISK."
6020 INPUT £1,NOHYD,ISTEP
6030 DIM INFLOW(NOHYD+2)
6040 FOR I=0 TO NOHYD
6050 INPUT £1,INFLOW(I)
6060 NEXT I
6070 ':RESERVOIR FLOOD STATUS FROM DISK-----
-
6080 PRINT:PRINT"READING RESERVOIR STATUS FROM DISK."
6090 INPUT £1,TITLE1$,TITLE2$
6100 INPUT £1,RESSTA,RESLEV,RESMAX,LEVSENSE,STATIME,CSTEP,NOSTEP
6110 CLOSE £1:RETURN
6120 ': STORE RESULTS ON DISK-----
-
6130 X$=X$+".RES"
6140 PRINT:PRINT"WRITING RESULTS TO DISK"
6150 OPEN X$ FOR OUTPUT AS £1
6160 PRINT £1,TITLE1$
6170 PRINT £1,TITLE2$
6180 PRINT £1,OTL,NOSTEP,SPILLNO
6190 IF OTL=2 THEN GOSUB 6520
6200 GOSUB 6230
6210 CLOSE £1
6220 RETURN
6230 ':STORE CALCULATION RESULTS-----
-

```

```

6240 FOR I=1 TO SPILLNO
6250 PRINT #1,SPILLWAY(I)
6260 NEXT I
6270 PRINT #1,Q3,Q4
6280 PRINT #1,Q1$
6290 PRINT #1,Q2$
6300 IF Q1$="P" THEN Q3=2
6310 IF Q2$="P" THEN Q4=2
6320 FOR J=0 TO NOSTEP
6330 PRINT #1,TIME(J),INFL(J),OUTFL(J),HT(J),STD(J)
6340 FOR J2=1 TO SPILLNO
6350 IF SPILLWAY(J2)=3 THEN PRINT #1,LGATE(J)
6360 IF SPILLWAY(J2)=4 AND Q3=2 THEN PRINT #1,HGATE(J),SPILL(J),HGATEOP(J)
6370 IF SPILLWAY(J2)=4 AND Q3=1 THEN PRINT #1,HGATE(J),SPILL(J):GOSUB 6470
6380 IF SPILLWAY(J2)=5 AND Q4=2 THEN PRINT #1,HGATE(J),HGATEOP(J)
6390 IF SPILLWAY(J2)=5 AND Q4=1 THEN PRINT #1,HGATE(J):GOSUB 6430
6400 NEXT J2
6410 NEXT J
6420 RETURN
6430 FOR K2=1 TO GATEMNO
6440 PRINT #1,HGATEOP(J,K2)
6450 NEXT K2
6460 RETURN
6470 FOR K2=1 TO GATEMNO
6480 PRINT #1,HGATEOP(J,K2)
6490 NEXT K2
6500 RETURN
6510 'STORE ADDITIONAL DATA-----
-
6520 PRINT #1,NOSTEL,SPILLNO
6530 FOR I=1 TO NOSTEL
6540 PRINT #1,ELEV(I),STOR(I)
6550 NEXT I
6560 FOR I=1 TO SPILLNO
6570 PRINT #1,SPILLWAY(I)
6580 ON SPILLWAY(I) GOSUB 6610,6700,6740,6840,7000,7140,7190
6590 NEXT I
6600 RETURN
6610 PRINT #1,CULNO
6620 FOR J=1 TO CULNO
6630 PRINT #1,CULWIDTH(J)
6640 PRINT #1,CULHEIGHT(J)
6650 PRINT #1,CULINVERT(J)
6660 PRINT #1,CULNCOEF(J)
6670 PRINT #1,CULSUBCOEF(J)
6680 NEXT J
6690 RETURN
6700 PRINT #1,WIERLENGTH
6710 PRINT #1,WIERINVERT
6720 PRINT #1,WIERCOEF
6730 RETURN
6740 PRINT #1,GATELNO
6750 FOR J=1 TO GATELNO
6760 PRINT #1,GATELINVERT(J)
6770 PRINT #1,GATELCOEF(J)
6780 PRINT #1,GATELWIDTH(J)
6790 PRINT #1,GATELHEIGHT(J)
6800 PRINT #1,GATELS(J)
6810 PRINT #1,GATELE(J)
6820 NEXT J
6830 RETURN

```

```

6840 PRINT E1,GATEMNO
6850 FOR J=1 TO GATEMNO
6860 PRINT E1,GATEMINVERT(J)
6870 PRINT E1,GATEMCOEF(J)
6880 PRINT E1,GATEMWIDTH(J)
6890 PRINT E1,GATEMHEIGHT(J)
6900 PRINT E1,GATEMSIZE(J)
6910 PRINT E1,GATESPILL(J)
6920 NEXT J
6930 PRINT E1,Q1$
6940 IF Q1$="U" THEN RETURN
6950 PRINT E1,GATEMSTART
6960 PRINT E1,GATEMSUM
6970 PRINT E1,GATEMFLOW
6980 PRINT E1,FLOWMESC
6990 RETURN
7000 PRINT E1,GATEHNO
7010 FOR J=1 TO GATEHNO
7020 PRINT E1,GATEHINVERT(J)
7030 PRINT E1,GATEHCOEF(J)
7040 PRINT E1,GATEHWIDTH(J)
7050 PRINT E1,GATEHHEIGHT(J)
7060 NEXT J
7070 PRINT E1,Q2$
7080 IF Q2$="U" THEN RETURN
7090 PRINT E1,GATEHSTART
7100 PRINT E1,GATEHSUM
7110 PRINT E1,GATEHFLOW
7120 PRINT E1,FLOWHESC
7130 RETURN
7140 PRINT E1,FUSESTART
7150 PRINT E1,FUSECREST
7160 PRINT E1,FUSELENGTH
7170 PRINT E1,FUSECOEF
7180 RETURN
7190 PRINT E1,PTNOU
7200 FOR J=1 TO PTNOU
7210 PRINT E1,ELEVU(J)
7220 PRINT E1,DISCHU(J)
7230 NEXT J
7240 RETURN
7250 :PROGRAM CONTROLLED GATES-----
-
7260 :CALCULATION OF INITIAL VOLUMES-----

7270 CLS:PRINT L$:PRINT:PRINT TITLE1$:PRINT TITLE2$:PRINT
7280 PRINT"THE SPILLWAY CONTAINS MANUAL COMPONENTS OPERATED BY THE PROGRAM"
7290 PRINT"GATE OPERATION SHALL BE OPTIMIZED"
7300 PRINT:PRINT L$:PRINT
7310 I=0
7320 FOR J=1 TO SPILLNO
7330 IF SPILLWAY(J)=4 THEN I=I+1
7340 IF SPILLWAY(J)=5 THEN I=I+1
7350 NEXT J
7360 IF I=1 THEN GOTO 7390
7370 PRINT"THE SPILLWAY CONTAINS TWO MANUAL COMPONENTS. OPTIMIZATION CAN ONLY BE
DONE ON ONE MANUAL COMPONENT AT A TIME"
7380 PRINT K$:INPUT"PRESS ANY KEY TO CONTINUE:~",Q$:GOTO 10
7390 PRINT"OUTPUT CAN BE PRESENTED ON TWO LEVELS:~":PRINT
7400 PRINT" 1.BASIC OUTPUT"
7410 PRINT" 2.EXTENDED OUTPUT"

```

```

7420 PRINT:INPUT"WHICH LEVEL DO YOU REQUIRE (1/2)";OTL
7430 INVOL=0
7440 FOR I=1 TO NOHYD
7450 INVOL=INVOL+(INFLOW(I)+INFLOW(I-1))*ISTEP*1800
7460 NEXT I
7470 FOR I=1 TO NOSTEL
7480 IF RESSTA<=ELEV(I) THEN GOTO 7510
7490 NEXT I
7500 PRINT:PRINT M$:PRINT K$:END
7510 STOR1=STOR(I-1)+(STOR(I)-STOR(I-1))*(RESSTA-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
7520 FOR I=1 TO NOSTEL
7530 IF RESLEV<=ELEV(I) THEN GOTO 7560
7540 NEXT I
7550 PRINT:PRINT M$:PRINT K$:END
7560 STOR2=STOR(I-1)+(STOR(I)-STOR(I-1))*(RESLEV-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
7570 FOR I=1 TO NOSTEL
7580 IF RESMAX<=ELEV(I) THEN GOTO 7610
7590 NEXT I
7600 PRINT:PRINT M$:PRINT K$:END
7610 STOR3=STOR(I-1)+(STOR(I)-STOR(I-1))*(RESMAX-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
7620 TEMPSTOR=STOR3-STOR2
7630 PERMSTOR=STOR2-STOR1
7640 EXVOL=INVOL-PERMSTOR
7650 IF EXVOL<=0 THEN PRINT"INFLOW VOLUME IS LESS THAN PERMANENT STORAGE AVAILAB
LE":GOTO 7670
7660 GOTO 7680
7670 PRINT"NO FLOODROUTING REQUIRED":PRINT K$:END
7680 FOR J1=1 TO SPILLNO
7690 IF SPILLWAY(J1)>=1 AND SPILLWAY(J1)<=3 THEN
7700 IF SPILLWAY(J1)=7 THEN GOTO 7730
7710 NEXT J1
7720 STORIND=1:CLS:PRINT"ITERATIVE SEARCH TECHNIQUE EMPLOYED":GOTO 7740
7730 STORIND=0:GOSUB 1740
7740 T=-CSTEP:DIM TIME(NOSTEP+1),INFL(NOSTEP+1),OUTFL(NOSTEP+1)
7750 DIM STO(NOSTEP+1),HT(NOSTEP+1),BAL(NOSTEP+1)
7760 FOR J1=1 TO SPILLNO
7770 IF SPILLWAY(J1)=4 THEN DIM MGATE(NOSTEP+1),MGATEOP(NOSTEP+1),SPILL(NOSTEP+1)
7780 IF SPILLWAY(J1)=5 THEN DIM HGATE(NOSTEP+1),HGATEOP(NOSTEP+1)
7790 IF SPILLWAY(J1)=6 THEN DIM FUSE(NOSTEP+1)
7800 NEXT J1
7810 FOR J=0 TO NOSTEP+1
7820 T=T+CSTEP:TIME(J)=T+STATIME
7830 COUNT=INT(T/ISTEP)
7840 IF COUNT>NOHYD THEN INFL(J)=0:GOTO 7860
7850 INFL(J)=INFLOW(COUNT)+(INFLOW(COUNT+1)-INFLOW(COUNT))*(T/ISTEP-COUNT)
7860 NEXT J
7870 HT(0)=RESSTA:ISTEP=3600*ISTEP:CSTEP=3600/CSTEP:STATIME=3600*STATIME
7880 :CALCULATE VOLUME BALANCE-----

7890 PRINT:PRINT"CALCULATING VOLUME BALANCE"
7900 OUTVOL=0:TARCHECK=0
7910 FOR J1=1 TO SPILLNO
7920 IF SPILLWAY(J1)=4 THEN T=STATIME+GATESTART+3600:T1=T-STATIME
7930 IF SPILLWAY(J1)=5 THEN T=STATIME+GATESTART+3600:T1=T-STATIME
7940 NEXT J1
7950 FOR I=0 TO NOHYD
7960 IF PEAKA<INFLOW(I) THEN PEAKA=INFLOW(I):PEAK=I
7970 NEXT I
7980 FOR K=0 TO NOSTEP
7990 PRINT K

```

```

8000 IF TARCHCK=1 THEN GOTO 8160
8010 ':CALCULATE TARGET DISCHARGE-----

8020 I=NOHYD:DISCHVOL=0:REMAIN=0
8030 IF T1<3600*TIME(K)-STATIME THEN T1=3600*TIME(K)-STATIME
8040 IF I*ISTEP<=T1 THEN TARCHCK=1:GOTO 8160
8050 DISCHVOL=INFLOW(I)*(I*ISTEP-T1)
8060 IF I=NOHYD THEN GOTO 8080
8070 REMAIN=REMAIN+(INFLOW(I)+INFLOW(I+1))*ISTEP/2
8080 IF DISCHVOL>=INVOL-REMAIN-PERMSTOR-TEMPSTOR-OUTVOL THEN GOTO 8140
8090 I=I-1:IF I<PEAK THEN GOTO 8110
8100 GOTO 8040
8110 PRINT"TARGET OUTFLOW EXCEEDS INFLOW"
8120 PRINT"GATE CONSTRAINT' TO STRINGENT":GOSUB 6120:PRINT K$
8130 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:GOTO 10
8140 EXCESS=INVOL-REMAIN-PERMSTOR-TEMPSTOR-OUTVOL
8150 TARGET=EXCESS/(I*ISTEP-T1)
8160 FOR I=1 TO NOSTEL
8170 IF HT(K)<=ELEV(I) THEN GOTO 8200
8180 NEXT I
8190 PRINT M$:GOSUB 6120:PRINT K$:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:GOTO 10
8200 STOR(K)=STOR(I-1)+(STOR(I)-STOR(I-1))*(HT(K)-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
8210 IF STORIND=0 THEN GOTO 8440
8220 GOSUB 10170
8230 TEST=0
8240 IF K=0 THEN GOTO 8350
8250 OUTVOL=OUTVOL+(OUTFL(K)+OUTFL(K-1))*CSTEP/2
8260 FOR I=1 TO SPILLNO
8270 IF SPILLWAY(I)=4 THEN GOTO 8310
8280 IF SPILLWAY(I)=5 THEN GOTO 8350
8290 NEXT I
8300 GOTO 8410
8310 IF OUTFL(K)>GATEFLOW THEN GOTO 8390
8320 IF K=0 THEN GOTO 8410
8330 IF OUTFL(K)-OUTFL(K-1)>FLOWMESC THEN GOTO 8400
8340 GOTO 8410
8350 IF OUTFL(K)>GATEFLOW THEN GOTO 8390
8360 IF K=0 THEN GOTO 8410
8370 IF OUTFL(K)-OUTFL(K-1)>FLOWHESC THEN GOTO 8400
8380 GOTO 8410
8390 PRINT R$:GOTO 8410
8400 PRINT S$
8410 NEXT K
8420 GOSUB 6120
8430 RETURN
8440 FOR I=1 TO C
8450 IF HT(K)<=HEIGHT(I) THEN GOTO 8480
8460 NEXT I
8470 PRINT N$:PRINT K$:END
8480 OUTFL(K)=OUTFLOW(I-1)+(OUTFLOW(I)-OUTFLOW(I-1))*(HT(K)-HEIGHT(I-1))/(HEIGHT(I)-HEIGHT(I-1))
8490 FOR J=1 TO SPILLNO
8500 IF SPILLWAY(J)=4 THEN GOSUB 9860:OUTFL(K)=OUTFL(K)+MGATE(K)
8510 IF SPILLWAY(J)=5 THEN GOSUB 9970:OUTFL(K)=OUTFL(K)+HGATE(K)
8520 IF SPILLWAY(J)=6 THEN GOSUB 3710:OUTFL(K)=OUTFL(K)+FUSE(K)
8530 NEXT J
8540 HT(K+1)=2*HT(K)-HT(K-1)
8550 FOR J=1 TO C
8560 IF HT(K+1)<=HEIGHT(J) THEN GOTO 8590
8570 NEXT J
8580 PRINT N$:PRINT K$:END

```

```

8590 OUTFL(K+1)=OUTFLOW(I-1)+(OUTFLOW(I)-OUTFLOW(I-1))*(HT(K+1)-HEIGHT(I-1))/(HE
      IHT(I)-HEIGHT(I-1))
8600 IF TARCHCK=0 THEN GOTO 8670
8610 FOR J1=1 TO SPILLNO
8620 IF SPILLWAY(J1)=4 THEN GOSUB 10020:OUTFL(K+1)=OUTFL(K+1)+MGATE(K+1)
8630 IF SPILLWAY(J1)=5 THEN GOSUB 10120:OUTFL(K+1)=OUTFL(K+1)+HGATE(K+1)
8640 IF SPILLWAY(J1)=6 THEN GOSUB 4850:OUTFL(K+1)=OUTFL(K+1)+FUSE(K+1)
8650 NEXT J1
8660 GOTO 9370
8670 FOR J1=1 TO SPILLNO
8680 IF SPILLWAY(J1)=4 THEN GOSUB 10020:OUTFL(K+1)=OUTFL(K+1)+MGATE(K+1)
8690 IF SPILLWAY(J1)=5 THEN GOSUB 10120:OUTFL(K+1)=OUTFL(K+1)+HGATE(K+1)
8700 IF SPILLWAY(J1)=6 THEN GOSUB 4850:OUTFL(K+1)=OUTFL(K+1)+FUSE(K+1)
8710 NEXT J1
8720 IF TARCHCK=1 THEN GOSUB 10710:GOTO 9370
8730 IF INT(OUTFL(K+1))=INT(TARGET) THEN GOTO 9370
8740 IF OUTFL(K+1)<TARGET THEN GOTO 9080
8750 ':REDUCE FLOW TO ACHIEVE TARGET-----
-
8760 FOR I=1 TO SPILLNO
8770 IF SPILLWAY(I)=4 THEN GOSUB 8820
8780 IF SPILLWAY(I)=5 THEN GOSUB 8950
8790 NEXT I
8800 GOTO 9370
8810 ':OPERATE MANUAL GATES TO REDUCE FLOW-----

8820 ADJUST=GATEMCOEF(1)*GATEMWIDTH(1)*(HT(K+1)-GATEMINVERT(1))^1.5
8830 DISCREP=OUTFL(K+1)-TARGET
8840 IF DISCREP/ADJUST<=.5 THEN MGATEOP(K+1)=MGATEOP(K):RETURN
8850 COUNT=INT(DISCREP/ADJUST)
8860 IF COUNT>GATEMSUM THEN COUNT=GATEMSUM:GOTO 8910
8870 REMAIN=DISCREP/ADJUST-COUNT
8880 IF REMAIN<=.5 THEN REMAIN=0:GOTO 8900
8890 REMAIN=1
8900 COUNT=COUNT+REMAIN:IF COUNT>GATEMSUM THEN COUNT=GATEMSUM
8910 MGATEOP(K+1)=MGATEOP(K)-COUNT
8920 IF MGATEOP(K+1)<0 THEN MGATEOP(K+1)=0
8930 RETURN
8940 ':OPERATE HIGH PRESSURE OUTLETS TO REDUCE FLOW-----

8950 ADJUST=GATEHCOEF(1)*GATEHWIDTH(1)*GATEHHEIGHT(1)*SQR(ABS(2*9.810001*(HT(K+1)
      )-GATEHIVERT(1)+GATEHHEIGHT(1)/2)))
8960 DISCREP=OUTFL(K+1)-TARGET
8970 IF ADJUST/DISCREP<=.5 THEN HGATEOP(K+1)=HGATEOP(K):RETURN
8980 COUNT=INT(ADJUST/DISCREP)
8990 IF COUNT>GATEHSUM THEN COUNT=GATEHSUM:GOTO 9010
9000 REM=ADJUST/DISCREP-COUNT
9010 IF REM<-.5 THEN REM=0:GOTO 9002
9020 REM=1
9030 COUNT=COUNT+REM:IF COUNT>GATEHSUM THEN COUNT=GATEHSUM
9040 HGATEOP(K+1)=HGATEOP(K)-COUNT
9050 IF HGATEOP(K+1)<0 THEN HGATEOP(K+1)=0
9060 RETURN
9070 ':INCREASE FLOW TO ACHIEVE TARGET-----
-
9080 FOR I=1 TO SPILLNO
9090 IF SPILLWAY(I)=4 THEN GOSUB 9140
9100 IF SPILLWAY(I)=5 THEN GOSUB 9260
9110 NEXT I
9120 GOTO 9370

```

9130 ':OPERATE MANUAL GATES TO INCREASE FLOW-----

9140 ADJUST=GATEMCOEF(1)*GATEMWIDTH(1)*(HT(K+1)-GATEMINVERT(1))^1.5

9150 DISCREP=TARGET-OUTFL(K+1)

9160 IF DISCREP/ADJUST<=.5 THEN MGATEOP(K+1)=MGATEOP(K):RETURN

9170 COUNT=INT(DISCREP/ADJUST)

9180 IF COUNT>GATEMSUM THEN COUNT=GATEMSUM:GOTO 9230

9190 REMAIN=DISCREP/ADJUST-COUNT

9200 IF REMAIN<=.5 THEN REMAIN=0:GOTO 9220

9210 REMAIN=1

9220 COUNT=COUNT+REMAIN:IF COUNT>GATEMSUM THEN COUNT=GATEMSUM

9230 MGATEOP(K+1)=MGATEOP(K)+COUNT

9240 RETURN

9250 ':OPERATE HIGH PRESSURE OUTLETS TO INCREASE FLOW-----

9260 ADJUST=GATEHCOEF(1)*GATEHWIDTH(1)*GATEHEIGHT(1)*SQRT(ABS(2*9.810001*(HT(K+1)-GATEHIVERT(1)+GATEHEIGHT(1),2)))

9270 DISCREP=TARGET-OUTFL(K+1)

9280 IF ADJUST/DISCREP<=.5 THEN HGATEOP(K+1)=HGATEOP(K):RETURN

9290 COUNT=INT(ADJUST/DISCREP)

9300 IF COUNT>GATEHSUM THEN COUNT=GATEHSUM:GOTO 9350

9310 REM=ADJUST/DISCREP-COUNT

9320 IF REM<=0.5 THEN REM=0:GOTO 7044

9330 REM=1

9340 COUNT=COUNT+REM:IF COUNT>GATEHSUM THEN COUNT=GATEHSUM

9350 HGATEOP(K+1)=HGATEOP(K)+COUNT

9360 RETURN

9370 ':FIND POSITION ON STORAGE INDICATION CURVE-----

9380 BAL(K)=STD(K)-OUTFL(K)*CSTEP/2+(INFL(K)+INFL(K+1))*CSTEP/2

9390 BAL=0

9400 FOR J1=1 TO SPILLNO

9410 IF SPILLWAY(J1)=4 THEN GOSUB 10020: BAL=BAL+MGATE(K+1)*CSTEP/2

9420 IF SPILLWAY(J1)=5 THEN GOSUB 10120: BAL=BAL+HGATE(K+1)*CSTEP/2

9430 IF SPILLWAY(J1)=6 THEN GOSUB 4850: BAL=BAL+FUSE(K+1)*CSTEP/2

9440 NEXT J1

9450 FOR J=1 TO C

9460 IF BAL(K)<=STORIND(J)+BAL THEN GOTO 9490

9470 NEXT J

9480 PRINT 0\$:PRINT K\$:END

9490 HT(K+1)=HEIGHT(J-1)+(HEIGHT(J)-HEIGHT(J-1))*(BAL(K)-STORIND(J-1)-BAL)/(STORIND(J)-STORIND(J-1))

9500 BALA=0

9510 FOR J1=1 TO SPILLNO

9520 IF SPILLWAY(J1)=4 THEN GOSUB 10020: BALA=BALA+MGATE(K+1)*CSTEP/2

9530 IF SPILLWAY(J1)=5 THEN GOSUB 10120: BALA=BALA+HGATE(K+1)*CSTEP/2

9540 IF SPILLWAY(J1)=6 THEN GOSUB 4850: BALA=BALA+FUSE(K+1)*CSTEP/2

9550 NEXT J1

9560 FOR J1=1 TO SPILLNO

9570 IF SPILLWAY(J1)=4 THEN MGATE(K+1)=0

9580 IF SPILLWAY(J1)=5 THEN HGATE(K+1)=0

9590 IF SPILLWAY(J1)=6 THEN FUSE(K+1)=0

9600 NEXT J1

9610 IF INT(BALA)=BAL THEN GOTO 9640

9620 BAL=BALA

9630 GOTO 9450

9640 IF TARCHCK=1 THEN GOSUB 10710

9650 IF K=0 THEN GOTO 9760

9660 OUTVOL=OUTVOL+(OUTFL(K)+OUTFL(K+1))*CSTEP/2

9670 FOR I=1 TO SPILLNO

9680 IF SPILLWAY(I)=4 THEN GOTO 9720

```

9690 IF SPILLWAY(I)=5 THEN GOTO 9760
9700 NEXT I
9710 GOTO 9820
9720 IF OUTFL(K)>GATEFLOW THEN GOTO 9800
9730 IF K=0 THEN GOTO 9820
9740 IF OUTFL(K)-OUTFL(K-1)>FLOWMESC THEN GOTO 9810
9750 GOTO 9820
9760 IF OUTFL(K)>GATEFLOW THEN GOTO 9800
9770 IF K=0 THEN GOTO 9820
9780 IF OUTFL(K)-OUTFL(K-1)>FLOWHESC THEN GOTO 9810
9790 GOTO 9820
9800 PRINT R$:GOTO 9820
9810 PRINT S$
9820 NEXT K
9830 GOSUB 6120
9840 RETURN
9850 ':MANUAL WEIR FLOW ADDED TO EQUATION-----
-
9860 IF Q1$="U" THEN RETURN
9870 IF TIME(K)<T/3600 THEN MGATE(K)=0:RETURN
9880 IF HT(K)<=GATEMINVERT(1) THEN MGATE(K)=0:RETURN
9890 F=GATEMCOEF(1)*GATEMWIDTH(1)*(HT(K)-GATEMINVERT(1))^1.3
9900 MGATE(K)=MGATEOP(K)*F
9910 IF HT(K)<=GATEMINVERT(1)+GATEMSIZE(1) THEN RETURN
9920 NOSPIL=GATEMNO-MGATEOP(K)
9930 IF (HT(K)-GATEMINVERT(1)-GATEMSIZE(1))<=0 THEN SPILL(K)=0:RETURN
9940 SPILL(K)=GATESPILL(1)*GATEMWIDTH(1)*NOSPIL*(HT(K)-GATEMINVERT(1)-GATEMSIZE(1))^1.5
9950 MGATE(K)=MGATE(K)+SPILL(K):RETURN
9960 ':MANUAL HIGH PRESSURE FLOW ADDED TO EQUATION-----

9970 IF Q2$="U" THEN RETURN
9980 IF TIME(K)<T/3600 THEN HGATE(K)=0:RETURN
9990 F=GATEHCOEF(1)*GATEHWIDTH(1)*GATEHHEIGHT(1)*SQR(ABS(2*9.810001*(HT(K)-GATEMINVERT(1)+GATEHHEIGHT(1)/2)))
10000 HGATE(K)=F*HGATEOP(K):RETURN
10010 ':MANUAL WEIR FLOW ADJUSTMENT-----
--
10020 IF Q1$="U" THEN RETURN
10030 IF TIME(K+1)<T/3600 THEN MGATE(K+1)=0:RETURN
10040 IF HT(K+1)<=GATEMINVERT(1) THEN MGATE(K+1)=0:RETURN
10050 MGATE(K+1)=MGATEOP(K)*GATEMCOEF(1)*GATEMWIDTH(1)*(HT(K+1)-GATEMINVERT(1))^1.5
10060 IF HT(K+1)<=GATEMINVERT(1)+GATEMSIZE(1) THEN RETURN
10070 NOSPIL=GATEMNO-MGATEOP(K)
10080 IF (HT(K+1)-GATEMINVERT(1)-GATEMSIZE(1))<=0 THEN SPILL(K+1)=0:RETURN
10090 SPILL(K+1)=GATESPILL(1)*GATEMWIDTH(1)*NOSPIL*(HT(K+1)-GATEMINVERT(1)-GATEMSIZE(1))^1.5
10100 MGATE(K+1)=MGATE(K+1)+SPILL(K+1):RETURN
10110 ':MANUAL HIGH PRESSURE FLOW ADJUSTMENT-----
--
10120 IF Q2$="U" THEN RETURN
10130 IF TIME(K+1)<T/3600 THEN HGATE(K+1)=0:RETURN
10140 F=GATEHCOEF(1)*GATEHWIDTH(1)*GATEHHEIGHT(1)*SQR(ABS(2*9.810001*(HT(K+1)-GATEMINVERT(1)+GATEHHEIGHT(1)/2)))
10150 HGATE(K+1)=F*HGATEOP(K):RETURN
10160 ':VOLUME BALANCE WITHOUT STORAGE INDICATION CURVE-----
-
10170 OUTFL(K)=0
10180 FOR J=1 TO SPILLNO
10190 IF SPILLWAY(J)=4 THEN MGATEOP(K+1)=MGATEOP(K)

```

```

10200 IF SPILLWAY(J)=5 THEN HGATEOP(K+1)=HGATEOP(K)
10210 NEXT J
10220 FOR J1=1 TO SPILLND
10230 IF SPILLWAY(J1)=4 THEN GOSUB 9860:OUTFL(K)=OUTFL(K)+MGATE(K)
10240 IF SPILLWAY(J1)=5 THEN GOSUB 9970:OUTFL(K)=OUTFL(K)+MGATE(K)
10250 IF SPILLWAY(J1)=6 THEN GOSUB 3710:OUTFL(K)=OUTFL(K)+FUSE(K)
10260 NEXT J1
10270 INFLOW=(INFL(K)+INFL(K+1))*CSTEP/2+STD(K)
10280 INCREMENT=1:IF K=0 THEN GOTO 10310
10290 IF HT(K)>HT(K-1) THEN GOTO 10310
10300 HT(K+1)=HT(K)-INCREMENT:GOTO 10320
10310 HT(K+1)=HT(K)+INCREMENT
10320 FOR I=1 TO NOSTEL
10330 IF HT(K+1)<=ELEV(I) THEN GOTO 10360
10340 NEXT I
10350 PRINT M$:GOSUB 6120:PRINT K$:INPUT"PRESS ANY KEY TO CONTINUE: ",Q$:GOTO 10

10360 STD(K+1)=STOR(I-1)+(STOR(I)-STOR(I-1))*(HT(K+1)-ELEV(I-1))/(ELEV(I)-ELEV(I-1))
10370 OUTFL(K+1)=0
10380 FOR I=1 TO SPILLND
10390 IF SPILLWAY(I)=4 THEN GOSUB 10020:OUTFL(K+1)=OUTFL(K+1)+MGATE(K+1)
10400 IF SPILLWAY(I)=5 THEN GOSUB 10120:OUTFL(K+1)=OUTFL(K+1)+MGATE(K+1)
10410 IF SPILLWAY(I)=6 THEN GOSUB 4850:OUTFL(K+1)=OUTFL(K+1)+FUSE(K+1)
10420 NEXT I
10430 OUTFLOW=(OUTFL(K+1)+OUTFL(K))*CSTEP/2+STD(K+1)
10440 A=INFLOW:B=OUTFLOW
10450 IF A<10000 AND B<10000 THEN GOTO 10480
10460 A=A/10:B=B/10
10470 GOTO 10450
10480 IF INT(A)>INT(B) THEN INCREMENT=.B*INCREMENT:HT(K+1)=HT(K+1)+INCREMENT:SPILL(K+1)=0:GOTO 10320
10490 IF INT(A)<INT(B) THEN INCREMENT=.B*INCREMENT:HT(K+1)=HT(K+1)-INCREMENT:SPILL(K+1)=0:GOTO 10320
10500 IF TARCHCK=1 THEN GOSUB 10710
10510 IF INT(OUTFL(K+1))=INT(TARGET) THEN RETURN
10520 IF OUTFL(K+1)<TARGET THEN GOTO 10620
10530 IF TEST=1 THEN RETURN
10540 TEST=1:INCREMENT=1
10550 FOR J=1 TO SPILLND
10560 IF SPILLWAY(J)=4 AND TIME(K+1)<GATESTART THEN RETURN
10570 IF SPILLWAY(J)=4 THEN GOSUB 8820
10580 IF SPILLWAY(J)=5 AND TIME(K+1)<GATESTART THEN RETURN
10590 IF SPILLWAY(J)=5 THEN GOSUB 8950
10600 NEXT J
10610 GOTO 10320
10620 IF TEST=1 THEN RETURN
10630 TEST=1:INCREMENT=1
10640 FOR J=1 TO SPILLND
10650 IF SPILLWAY(J)=4 AND TIME(K+1)<GATESTART THEN RETURN
10660 IF SPILLWAY(J)=4 THEN GOSUB 9140
10670 IF SPILLWAY(J)=5 AND TIME(K+1)<GATESTART THEN RETURN
10680 IF SPILLWAY(J)=5 THEN GOSUB 9260
10690 NEXT J
10700 GOTO 10320
10710 ' :TARGET FLOW FOR RECEDING LIMB OF OUTFLOW HYDROGRAPH-----

10720 DISVOL=INVOL-OUTVOL-PERMSTOR
10730 IF DISVOL<=0 THEN TARGET=0:RETURN
10740 TT=2*DISVOL/OUTFL(K-1)
10750 TARGET=OUTFL(K-1)*(1-CSTEP/TT)
10760 RETURN

```

LISTING FOR PRES PROGRAM BLOCK

```

10 CLEAR:CLS
20 'GENERAL DEFINITIONS -----
30 A$="BOX CULVERTS":B$="FREE OVERFLOW WIER"
40 C$="AUTOMATICALLY CONTROLLED OVERFLOW WIER"
50 D$="MANUALLY CONTROLLED OVERFLOW WEIR"
60 E$="MANUALLY CONTROLLED HIGH PRESSURE OUTLET"
70 F$="FUSEPLUG EMERGENCY SPILLWAY"
80 G$="USER DEFINED SPILLWAY"
90 H$="PLEASE ENTER CORRECT DATA DISK IN DRIVE A"
100 I$="PLEASE REVISE SENSITIVITY AS MODELLING MATRIX TOO LARGE"
110 J$="USER DEFINED SPILLWAY CAPACITY EXCEEDED"
120 K$="JOB ABANDONED****"
130 L$="*****"
*****
140 M$="RESERVOIR LEVEL EXCEEDS STORAGE/ELEVATION DATA"
150 N$="RESERVOIR LEVEL EXCEEDS MAXIMUM ALLOWABLE LEVEL"
160 O$="STORAGE-INDICATION CURVE EXCEEDED"
170 P$="DATA SET INCONSISTENT"
180 'PROGRAM HEADING-----
-
190 PRINT L$:PRINT
200 PRINT"          FLOOD ROUTING THROUGH DAM WITH MULTIPLE SPILLWAY SYSTEM"
210 PRINT:PRINT"          L. FURSTENBURG   (011-683-1665)          1
985"
220 PRINT:PRINT"          PRESENTATION BLOCK":PRINT:PRINT L$:PRINT
230 PRINT"          THE FOLLOWING OPTIONS ARE PROVIDED:-":PRINT
240 PRINT"          1.PRINT RESULTS ON "
250 PRINT"          2.PRINT RESULTS I  TIME PRELIER"
260 PRINT"          3.CHAIN TO DATA"
270 PRINT"          4.CHAIN TO CALC"
280 PRINT"          5.FINISH 'TING PROGRA
290 PRINT:INPUT"          PLEASE SELECT OPTION:-",OPT1
300 ON OPT1 GOSUB 360,360,320,330,340
310 GOTO 10
320 CHAIN "A:DATA"
330 CHAIN "A:CALC"
340 CLS:END
350 'READ DATA FILE FROM DISK-----
-
360 CLS:PRINT L$
370 INPUT"PLEASE ENTER NAME OF DATA FILE RESULTS TO BE PRESENTED:-",X$:IF X$=""
THEN PRINT CHR$(7);"A NAME IS REQUIRED":GOTO 370
380 X$=X$+".RES"
390 ON ERROR GOTO 440
400 OPEN X$ FOR INPUT AS #1
410 ON ERROR GOTO 0
420 GOSUB 520
430 CLOSE #1:GOTO 460
440 PRINT"THIS FILE DOES NOT EXIST"
450 RESUME 370
460 'PRINT DATA FILE ON CORRECT DEVICE-----
-
470 IF OPT1=1 THEN GOTO 510
480 IF OPT1=2 THEN GOTO 500
490 PRINT P$:PRINT K$:END
500 OPEN "LPT1:" FOR OUTPUT AS #1:PRINT #1,CHR$(27);"C";CHR$(70):GOTO 1420
510 OPEN "SCRN:" FOR OUTPUT AS #1:GOTO 1420
520 'READING RESULTS FROM DISK-----
-
530 PRINT:PRINT"READING RESULTS FROM DISK"
540 INPUT #1,TITLE1$,TITLE2$,DTL,NOSTEP,SPILLND

```

```

550 IF DTL=2 THEN GOSUB 880
560 GOSUB 590
570 CLOSE #1
580 RETURN
590 :READ CALCULATION RESULTS-----

600 FOR I=1 TO SPILLNO
610 INPUT #1,SPILLWAY(I)
620 NEXT I
630 INPUT #1,Q3,Q4,Q1$,Q2$
640 IF Q1$="P" THEN Q3=2
650 IF Q2$="P" THEN Q4=2
660 DIM TIME(NOSTEP),INFL(NOSTEP),OUTFL(NOSTEP),HT(NOSTEP),STO(NOSTEP),MGATEOP(NOSTEP)
670 DIM LGATE(NOSTEP),MGATE(NOSTEP),HFTE(NOSTEP),SPILL(NOSTEP),MGATEOP(NOSTEP)
680 FOR J=0 TO NOSTEP
690 INPUT #1,TIME(J),INFL(J),OUTFL(J),HT(J),STO(J)
700 FOR J2=1 TO SPILLNO
710 IF SPILLWAY(J2)=3 THEN INPUT #1,LGATE(J)
720 IF SPILLWAY(J2)=4 AND Q3=2 THEN INPUT #1,MGATE(J),SPILL(J),MGATEOP(J)
730 IF SPILLWAY(J2)=4 AND Q3=1 THEN INPUT #1,MGATE(J),SPILL(J):GOSUB 830
740 IF SPILLWAY(J2)=5 AND Q4=2 THEN INPUT #1,MGATE(J),MGATEOP(J)
750 IF SPILLWAY(J2)=5 AND Q4=1 THEN INPUT #1,MGATE(J):GOSUB 790
760 NEXT J2
770 NEXT J
780 RETURN
790 FOR K2=1 TO GATEHNO
800 INPUT #1,MGATEOP(J,K2)
810 NEXT K2
820 RETURN
830 FOR K2=1 TO GATEMNO
840 INPUT #1,MGATEOP(J,K2)
850 NEXT K2
860 RETURN
870 :READ ADDITIONAL DATA-----
880 INPUT #1,NOSTEL,SPILLNO
890 DIM ELEV(NOSTEL),STOR(NOSTEL)
900 FOR I=1 TO NOSTEL
910 INPUT #1,ELEV(I),STOR(I)
920 NEXT I
930 FOR I=1 TO SPILLNO
940 INPUT #1,SPILLWAY(I)
950 ON SPILLWAY(I) GOSUB 980,1050,1070,1150,1250,1340,1360
960 NEXT I
970 RETURN
980 INPUT #1,CULNO
990 DIM CULWIDTH(CULNO),CULHEIGHT(CULNO),CULINVERT(CULNO)
1000 DIM CULUNCOEF(CULNO),CULSUBCOEF(CULNO)
1010 FOR J=1 TO CULNO
1020 INPUT #1,CULWIDTH(J),CULHEIGHT(J),CULINVERT(J),CULUNCOEF(J),CULSUBCOEF(J)
1030 NEXT J
1040 RETURN
1050 INPUT #1,WIERLENGTH,WIERINVERT,WIERCDEF
1060 RETURN
1070 INPUT #1,GATELNO
1080 DIM GATELINVERT(GATELNO),GATELCOEF(GATELNO),GATELWIDTH(GATELNO)
1090 DIM GATELHEIGHT(GATELNO),GATELS(GATELNO),GATELE(GATELNO)
1100 FOR J=1 TO GATELNO
1110 INPUT #1,GATELINVERT(J),GATELCOEF(J),GATELWIDTH(J)
1120 INPUT #1,GATELHEIGHT(J),GATELS(J),GATELE(J)
1130 NEXT J

```

Author Furstenburg Leon

Name of thesis Optimum Reservoir Operation During Floods. 1985

PUBLISHER:

University of the Witwatersrand, Johannesburg

©2013

LEGAL NOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed, or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page) for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.