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Option reservoir operation during floods

Furstenburg, Leon

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```
1140 RETURN
1150 INPUT £1,GA' 0
1160 DIM GATEMINVERT(GATEMNO),GATEMCOEF(GATEMNO),GATEMWIDTH(GATEMNO)
1170 DIM GATEMHEIGHT(GATEMNO),GATESPILL(GATEMNO),GATEMSIZE(GATEMNO)
1180 FOR J=1 TO GATEMNO
1190 INPUT £1,GATEMINVERT(J),GATEMCOEF(J),GATEMWIDTH(J),GATEMHEIGHT(J),GATEMSIZE
(J),GATESPILL(J)
1200 NEXT J
1210 INPUT £1,Q1$
1220 IF Q1$="U" THEN RETURN
1230 INPUT £1,GATEMSTART,GATEMSUM,GATEMFLOW,FLOWMESC
1240 RETURN
1250 INPUT £1,GATEHNO
1260 DIM GATEHINVERT(GATEHNO),GATEHCOEF(GATEHNO),GATEHWIDTH(GATEHNO),GATEHHEIGHT
(GATEHNO)
1270 FOR J=1 TO GATEHNO
1280 INPUT £1,GATEHINVERT(J),GATEHCOEF(J),GATEHWIDTH(J),GATEHHEIGHT(J)
1290 NEXT J
1300 INPUT £1.Q2$
1310 IF Q2$="U" THEN RETURN
1320 INPUT £1,GATEHSTART,GATEHSUM,GATEHFLOW,FLOWMESC
1330 RETURN
1340 INPUT £1,FUSESTART,FUSECREST,FUSELENGTH,FUSECOEF
1350 RETURN
1360 INPUT £1,PTNOU
1370 DIM ELEVU(PTNOU),DISCHU(PTNOU)
1380 FOR J=1 TO PTNOU
1390 INPUT £1,ELEVU(J),DISCHU(J)
1400 NEXT J
1410 RETURN
1420 IF OTL=2 THEN GOSUB 1460:GOSUB 1520
1430 GOSUB 2650
1440 RETURN
1450 ':PRINT HEADING----------------------------------------------------------
-
1460 IF OPT1=1 THEN QUES=12
1470 CLS:PRINT £1,L$
1480 PRINT £1,TITLE1$:PRINT £1,TITLE2$:PRINT £1,:PRINT £1,L$:PRINT £1,
1490 IF OPT1=1 THEN INPUT"PRESS ANY KEY TO CONTINUE:-",Q$
1500 RETURN
1510 ':PRINT ADDITIONAL DATA--------------------------------------------------
-
1520 PRINT £1,TAB(20);"ELEVATION";TAB(45);"STORAGE"
1530 PRINT £1,TAB(20);"---------";TAB(45);"-------":PRINT £1,
1540 FOR I=1 TO NOSTEL
1550 PRINT £1,TAB(20);ELEV(I);TAB(45);STOR(I)
1560 IF OPT1=1 THEN GOTO 1600
1570 NEXT I
1580 IF OPT1=1 THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:GOTO 1630
1590 GOTO 1630
1600 IF I=QUES THEN INPUT"PRESS ANY KEY TO CONTINUE:-";Q$:CLS:GOTO 1620
1610 GOTO 1570
1620 QUES=QUES+18:PRINT £1,TAB(20);"ELEVATION";TAB(45);"STORAGE":PRINT £1,:GOTO
1570
1630 FOR II=1 TO SPILLNO
1640 ON SPILLWAY(II) GOSUB 1670,1820,1890,2040,2240,2440,2510
1650 NEXT II
1660 RETURN
1670 IF OPT1=1 THEN QUES=16:CLS:GOTO 1690
1680 PRINT £1,:PRINT £1,
1690 PRINT £1,A$:PRINT £1,"------------":PRINT £1,
```

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1700 PRINT £1,"NO   WIDTH      HEIGHT      INVERT      UNCOEF      SUBCOEF":PRI
NT £1,
1710 FOR I=1 TO CULNO
1720 PRINT £1,I;TAB(5);CULWIDTH(I);TAB(17);CULHEIGHT(I);TAB(29);CULIWVERT(I);
1730 PRINT £1,TAB(41);CULUNCOEF(I);TAB(53);CULSUBCOEF(I)
1740 IF OPT1=1 THEN GOTO 1780
1750 NEXT I
1760 IF OPT1=2 THEN RETURN
1770 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-";Q$:RETURN
1780 IF I=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-";Q$:CLS:GOTO 1800
1790 GOTO 1750
1800 QUES=QUES+20
1810 PRINT £1,"NO   WIDTH      HEIGHT      INVERT      UNCOEF      SUBCOEF":PRI
NT £1,:GOTO 1750
1820 IF OPT1=1 THEN CLS:GOTO 1840
1830 PRINT £1,:PRINT £1,
1840 PRINT £1,B$:PRINT £1,"------------------":PRINT £1,
1850 PRINT £1,"WEIRLENGTH          WEIRINVERT          WEIRCOEF":PRINT £1,
1860 PRINT £1,WIERLENGTH;TAB(20);WIERINVERT;TAB(40);WIERCOEF
1870 IF OPT1=2 THEN RETURN
1880 INPUT"PRESS ANY KEY TO CONTINUE:-";Q$:RETURN
1890 IF OPT1=1 THEN QUES=18:CLS:GOTO 1910
1900 PRINT £1,:PRINT £1,
1910 PRINT £1,C$:PRINT £1,"------------------------------------":PRINT £1,
1920 PRINT £1,"NO   INVERT      COEFFICIENT WIDTH       HEIGHT      START EL
END EL":PRINT £1,
1930 FOR J=1 TO GATELNO
1940 PRINT £1,J;TAB(5);GATELINVERT(J);TAB(17);GATELCOEF(J);TAB(29);GATELWIDTH(J)
;
1950 PRINT £1,TAB(41);GATELHEIGHT(J);TAB(53);GATELS(J);TAB(65);GATELE(J)
1960 IF OPT1=1 THEN GOTO 2000
1970 NEXT J
1980 IF OPT1=2 THEN RETURN
1990 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-";Q$:RETURN
2000 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:GOTO 2020
2010 GOTO 1970
2020 QUES=QUES+18
2030 CLS:PRINT £1,"NO   INVERT      COEFFICIENT WIDTH       HEIGHT      START EL
   END EL":PRINT £1,:GOTO 1970
2040 IF OPT1=1 THEN QUES=18:CLS:GOTO 2060
2050 PRINT £1,:PRINT £1,
2060 PRINT £1,D$:PRINT £1,"--------------------------------":PRINT £1,:QUES=16
2070 PRINT £1,"NO   INVERT      FREE COEF   SPILL COEF  WIDTH       HEIGHT
TRAVEL":PRINT £1,
2080 FOR J=1 TO GATEMNO
2090 PRINT £1,J;TAB(5);GATEMINVERT(J);TAB(17);GATEMCOEF(J);TAB(29);GATESPILL(J);
TAB(41);GATEMWIDTH(J);
2100 PRINT £1,TAB(53);GATEMSIZE(J);TAB(65);GATEMHEIGHT(J)
2110 IF OPT1=1 THEN GOTO 2200
2120 NEXT J
2130 IF OPT1=1 AND Q1$="U" THEN GOTO 2180
2140 IF Q1$="U" THEN RETURN
2150 PRINT £1,:PRINT £1,"START TIME     NO OF GATES/OP MAX FLOW       FLOW ESC"
2160 PRINT £1,:PRINT £1,GATEMSTART;TAB(15);GATEMSUM;
2170 PRINT £1,TAB(30);GATEMFLOW;TAB(45);FLOWMESC
2180 IF OPT1=1 THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:RETURN
2190 IF OPT1=2 THEN RETURN
2200 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:CLS:GOTO 2220
2210 GOTO 2120
2220 QUES=QUES+18
2230 PRINT £1,"NO   INVERT      FREE COEF   SPILL COEF  WIDTH       HEIGHT
TRAVEL":PRINT £1,:GOTO 2120
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2240 IF OPT1=1 THEN QUES=18:CLS:GOTO 2260
2250 PRINT £1,:PRINT £1,
2260 PRINT £1,E$:PRINT £1,"---------------------------------------":PRINT £1,
2270 PRINT £1,"NO   INVERT      COEFFICIENT WIDTH       HEIGHT":PRINT £1,
2280 FOR J=1 TO GATEHNO
2290 PRINT £1,J;TAB(5);GATEHINVERT(J);TAB(17);GATE.COEF(J);TAB(29)GATEHWIDTH(J);

2300 PRINT £1,TAB(41),GATEHHEIGHT(J)
2310 IF OPT1=1 THEN GOTO 2400
2320 NEXT J
2330 IF OPT1=1 AND Q2$="U" THEN GOTO 2380
2340 IF Q2$="U" THEN RETURN
2350 PRINT £1,:PRINT £1,"START TIME     NO OF GATES/OP MAX FLOW       FLOW ESC"
2360 PRINT £1:PRINT £1,GATEHSTART;TAB(15);GATEHSUM;
2370 PRINT £1,TAB(30);GATEHFLOW;TAB(45);FLOWHESC
2380 IF OPT1=1 THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:RETURN
2390 IF OPT1=2 THEN RETURN
2400 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:CLS:GOTO 2420
2410 GOTO 2320
2420 QUES=QUES+18
2430 PRINT £1,"NO   INVERT      COEFFICIENT WIDTH       HEIGHT":PRINT £1,:GOTO 2
320
2440 IF OPT1=1 THEN CLS:GOTO 2460
2450 PRINT £1,:PRINT £1,
2460 PRINT £1,F$:PRINT £1,"---------------------------":PRINT £1,
2470 PRINT£1,"WASH ELEVATION     INVERT              LENGTH              COEFFI
CIENT":PRINT £1,
2480 PRINT £1,FUSESTART;TAB(20);FUSECREST;TAB(40);FUSELENGTH;TAB(60);FUSECOEF
2490 IF OPT1=2 THEN RETURN
2500 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:RETURN
2510 IF OPT1=1 THEN QUES=18:CLS:GOTO 2530
2520 PRINT £1,:PRINT £1,
2530 PRINT £1,G$:PRINT £1,"--------------------":PRINT £1,
2540 PRINT £1,"ELEVATION          DISCHARGE":PRINT £1,
2550 FOR J=1 TO PTNOU
2560 PRINT £1,ELEVU(J);TAB(20);DISCHU(J)
2570 IF OPT1=1 THEN GOTO 2610
2580 NEXT J
2590 IF OPT1=1 THEN INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:RETURN
2600 RETURN
2610 IF J=QUES THEN PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:CLS:GOTO 2630
2620 GOTO 2580
2630 QUES=QUES+18
2640 PRINT £1,"ELEVATION          DISCHARGE":PRINT £1,:GOTO 2580
2650 ':PRINT CALCULATION RESULTS-----------------------------------------
-
2660 XX=-1
2670 FOR K=1 TO SPILLNO
2680 IF SPILLWAY(K)=3 THEN XX=XX+1
2690 IF SPILLWAY(K)=4 THEN XX=XX+1
2700 IF SPILLWAY(K)=4 AND Q3=1 THEN GOSUB 2820
2710 IF SPILLWAY(K)=5 THEN XX=XX+1
2720 IF SPILLWAY(K)=5 AND Q4=1 THEN GOSUB 2790
2730 NEXT K
2740 IF XX<0 THEN XX=0
2750 A=1+X+B+E
2760 IF OPT1=1 THEN QUES=INT(15/A):QUEST=QUES
2770 IF OPT1=2 THEN QUES=INT(46/A):QUEST=QUES
2780 GOTO 2850
2790 D=20/GATEHNO:E=INT(D)
```

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2800 IF D>E THEN E=E+1
2810 RETURN
2820 A=A/GATEMND:B=INT(A)
2830 IF A>B THEN B=B+1
2840 RETURN
2850 GOSUB 2730
2860 GOSUB 2870:GOTO 2960
2870 IF OPT1=1 THEN CLS:GOTO 2900
2880 PRINT £1,CHR$(12)
2890 PRINT £1,L$:PRINT £1,TITLE1$:PRINT £1,TITLE2$:PRINT £1,
2900 PRINT £1,L$
2910 PRINT £1,"TIME      INFLOW    WATER     OUTFLOW   STORAGE   ";XX1$;XX2$;XX3
$
2920 PRINT £1,"          RATE      LEVEL     RATE      VOLUME    ";YY1$;YY2$;YY3
$
2930 PRINT £1,"(hours)   (m3/s)    (m)       (m3/s)    (m3)      ";ZZ1$
2940 PRINT £1,:PRINT £1,L$
2950 RETURN
2960 FOR J=0 TO NOSTEP
2970 PRINT £1,USING "£££££.££";TIME(J);
2980 PRINT £1,TAB(11);
2990 PRINT £1,USING "£££££.££";INFL(J);
3000 PRINT £1,TAB(21);
3010 PRINT £1,USING "£££££.£££";HT(J);
3020 PRINT £1,TAB(31);
3030 PRINT £1,USING "£££££.££";OUTFL(J);
3040 PRINT £1,TAB(41);
3050 PRINT £1,USING "£.£££^^^^";STO(J);
3060 FOR I=1 TO SPILLNO
3070 IF SPILLWAY(I)=3 THEN XX4$=SPACE$(10):LSET XX4$=STR$(LGATE(J))
3080 IF SPILLWAY(I)=3 THEN PRINT £1,XX4$
3090 IF SPILLWAY(I)=4 THEN YY4$=SPACE$(10):LSET YY4$=STR$(MGATE(J))
3100 IF SPILLWAY(I)=4 AND Q3=2 THEN YY5$=SPACE$(9):LSET YY5$=STR$(MGATEOP(J))
3110 IF SPILLWAY(I)=4 THEN YY6$=SPACE$(10):LSET YY6$=STR$(SPILL(J))
3120 IF SPILLWAY(I)=4 AND Q3=2 THEN PRINT £1,TAB(51);YY4$;YY5$;YY6$
3130 IF SPILLWAY(I)=4 AND Q3=1 THEN GOTO 3150
3140 GOTO 3210
3150 PRINT £1,TAB(51);YY4$;"          ";YY6$
3160 FOR J2=1 TO GATEMNO
3170 YY5$=SPACE$(4):LSET YY5$=STR$(MGATEOP(J,J2))
3180 PRINT £1,YY5$;
3190 NEXT J2
3200 PRINT £1,
3210 IF SPILLWAY(I)=5 THEN ZZ4$=SPACE$(10):LSET ZZ4$=STR$(HGATE(J))
3220 IF SPILLWAY(I)=5 AND Q4=2 THEN ZZ5$=SPACE$(10):LSET ZZ5$=STR$(HGATEOP(J))
3230 IF SPILLWAY(I)=5 AND Q4=2 THEN PRINT £1,TAB(51);ZZ4$;ZZ5$
3240 IF SPILLWAY(I)=5 AND Q4=1 THEN GOTO 3260
3250 GOTO 3320
3260 PRINT £1,TAB(51);ZZ4$
3270 FOR J2=1 TO GATEHNO
3280 ZZ5$=SPACE$(4):LSET ZZ5$=STR$(HGATEOP(J,J2))
3290 PRINT £1,ZZ5$;
3300 NEXT J2
3310 PRINT £1,
3320 NEXT I
3330 FOR I=1 TO SPILLNO
3340 IF SPILLWAY(I)>=3 AND SPILLWAY(I)<=5 THEN GOTO 3370
3350 NEXT I
3360 PRINT £1,
3370 IF OPT1=1 THEN GOTO 3430
3380 IF J=QUES THEN GOSUB 2870:QUES=QUES+QUEST
```

```
3390 NEXT J
3400 GOSUB 3640
3410 IF OPT1=1 THEN INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:GOTO 3460
3420 GOTO 3460
3430 IF J=QUES THEN INPUT"PRESS ANY KEY TO CONTINUE:-",Q$:GOSUB 2870:GOTO 3450
3440 GOTO 3390
3450 QUES=QUES+QUEST:GOTO 3390
3460 ':PRINT SUMMARY-------------------------------------------------------
-
3470 IF OPT1=1 THEN CLS
3480 PRINT £1,L$:PRINT £1,
3490 PRINT £1,"PEAK INFLOW RATE=";
3500 PRINT £1,USING "£££££.££";INFLOWRATE;
3510 PRINT £1,"m3/s"
3520 PRINT £1,"PEAK OUTFLOW RATE=";
3530 PRINT £1,USING "£££££.££";OUTFLOWRATE;
3540 PRINT £1,"m3/s"
3550 PRINT £1,"LAG TIME=";
3560 PRINT £1,USING"£££££.££";LAGTIME;
3570 PRINT £1,"hours"
3580 PRINT £1,"PERCENTAGE ATTENUATION=";
3590 PRINT £1,USING"£££.££";ATTEN;
3600 PRINT £1,"%"
3610 PRINT £1,:PRINT £1,L$
3620 PRINT:INPUT"PRESS ANY KEY TO CONTINUE:-",Q$
3630 RETURN
3640 ':CALCULATE SUMMARY---------------------------------------------------
-
3650 INFLOWRATE=0:OUTFLOWRATE=0
3660 FOR J=0 TO NOSTEP
3670 IF INFLOWRATE<INFL(J) THEN INFLOWRATE=INFL(J):T1=TIME(J)
3680 IF OUTFLOWRATE<OUTFL(J) THEN OUTFLOWRATE=OUTFL(J):T2=TIME(J)
3690 NEXT J
3700 LAGTIME=T2-T1
3710 ATTEN=((INFLOWRATE-OUTFLOWRATE)/INFLOWRATE)*100
3720 RETURN
3730 ':ADDITIONAL HEADINGS-------------------------------------------------
-
3740 FOR I=1 TO  SPILLNO
3750 IF SPILLWAY(I)=3 THEN GOSUB 3820
3760 IF SPILLWAY(I)=4 THEN GOSUB 3800
3770 IF SPILLWAY(I)=5 THEN GOSUB 3810
3780 NEXT I
3790 RETURN
3800 XX3$="SPILL":YY3$="(m3/s) "
3810 XX2$="NUMBER    ":YY2$="OF GATES  "
3820 XX1$="GATED     ":YY1$="FLOW      ":ZZ1$="(m3/s)    ":RETURN
```

Appendix E

Variables list

Appendix E

Description of Program variables

This appendix contains a detailed description of each variable used in the program. As a particular variable name may be used in more than one of the program blocks, the variables are presented alphabetically in three groups. They are:

Group 1	:	String variables
Group 2	:	Variables
Group 3	:	Arrays and Matrices

Group 1 **String variables**

Variable	Description
A$	"BOX CULVERTS"
B$	"FREE OVERFLOW WEIR"
C$	"AUTOMATICALLY CONTROLLED OVERFLOW WEIR"
D$	"MANUALLY CONTROLLED OVERFLOW WEIR"
E$	"MANUALLY CONTROLLED HIGH PRESSURE OUTLET"
F$	"FUSE PLUG EMERGENCY SPILLWAY"
G$	"USER DEFINED SPILLWAY"
H$	"PLEASE ENTER CORRECT DATA DISK IN DRIVE A"
I$	"PLEASE REVISE SENSITIVITY AS MODELLING MATRIX TOO LARGE"
II$	STRING TO STORE INPUT VALUES FOR MGATEOP(M) TEMPORARILY
J$	"USER DEFINED SPILLWAY CAPACITY EXCEEDED"
JJ$	STRING TO STORE INPUT VALUES FOR MGATEOP(M) TEMPORARILY
K$	"JOB ABANDONED ***"
L$	"**********"
M$	"RESERVOIR LEVEL EXCEEDS STORAGE/ELEVATION DATA"
N$	"RESERVOIR LEVEL EXCEEDS MAXIMUM ALLOWABLE LEVEL"
O$	"STORAGE - INDICATION CURVE EXCEEDED"
P$	"DATA SET INCONSISTENT"
Q$	GENERAL QUESTION STRING VARIABLE
Q1$	OPERATION MODE STRING VARIABLE FOR MANUAL GATES
Q2$	OPERATION MODE STRING VARIABLE FOR HIGH PRESSURE OUTLETS.
R$	"MAXIMUM DESIRABLE OUTFLOW RATE EXCEEDED"
S$	"MAXIMUM ALLOWABLE OUTFLOW RATE INCREASE EXCEEDED"
TITLE1$	FIRST TITLE ENTERED BY USER TO DESCRIBE RESERVOIR & FLOOD STATUS
TITLE2$	SECOND TITLE ENTERED BY USER TO DESCRIBE FLOOD EVENT
X$	DATA FILE NAME USED
XX$	DISK/DIRECTORY NAME FOR DISPLAY PURPOSES
XX1$	"AUTOMATIC"
XX2$	"MANUAL"
XX3$	"HIGH PRES"
YY1$	"GATE FLOW"
YY2$	"GATE FLOW"
YY3$	"OUTLET"
ZZ1$	"(m3/S)"
ZZ2$	"(m3/S)"
ZZ3$	"(m3/S)"

Group 2 Variables

Variable	Description
A	HEIGHT DIFFERENCE BETWEEN MAXIMUM ALLOWABLE WATER LEVEL AND FINAL REQUIRED WATER LEVEL IN DAM
ADJUST	CHANGE IN OUTFLOW RATE DUE TO OPERATION OF ONE GATE
ATTEN	PERCENTAGE ATTENUATION ACHIEVED DURING SIMULATION
B	HEIGHT DIFFERENCE BETWEEN MAXIMUM ALLOWABLE WATER LEVEL AND INITIAL WATER LEVEL IN DAM
BAL	FIRST ESTIMATE OF CORRECTION REQUIRED FOR MANUAL GATES & FUSE PLUG FLOW ON STORAGE INDICATION CURVE
BALA	CORRECTION OF FIRST ESTIMATE FOR MANUAL GATES AND FUSEPLUG FLOW ON STORAGE INDICATION CURVE
C	NO OF POINTS ON THE STORAGE INDICATION CURVE
C1	DISCHARGE COEFFICIENT THROUGH PARTIALLY OPENED SPILLWAY GATES
COUNT	INTERMEDIATE COUNTER
CSTEP	COMPUTATIONAL TIME STEP (HOURS)
CULHEIGHT	CULVERT HEIGHT FOR A SET OF IDENTICAL CULVERTS
CULINVERT	CULVERT INVERT LEVEL FOR A SET OF IDENTICAL CULVERTS
CULUNCOEF	UNSUBMERGED CULVERT DISCHARGE COEFF FOR A SET OF IDENTICAL CULVERTS
CULNO	NUMBER OF CULVERTS
CULSUBCOEF	SUBMERGED CULVERT DISCHARGE COEFF FOR A SET OF IDENTICAL CULVERTS
CULWIDTH	CULVERT WIDTH FOR A SET OF IDENTICAL CULVERTS
D	GATE OPENING FOR MANUAL AND AUTOMATICALLY CONTROLLED GATES ON AN OVERFLOW WEIR
DFF	DISCHARGE COEFF FOR FREE FLOW THROUGH MANUAL OR AUTOMATIC GATES IF THEY ARE ALL IDENTICAL
DISCHVOL	INTERMEDIATE VOLUME USED TO CALCULATE TARGET DURING OPTIMIZATION
DISCREP	VARIANCE BETWEEN ACTUAL OUTFLOW AND TARGET OUTFLOW
EXCESS	CORRECTION FACTOR FOR TARGET
EXVOL	EXCESS VOLUME THAT MUST BE DISCHARGED BEFORE THE OUTFLOW HYDROGRAPH CUTS THROUGH THE DECLINING LIMB OF THE INFLOW HYDROGRAPH DURING AN OPTIMISATION RUN

Variables (cont'd)

Variable	Description
F	INTERMEDIATE GATE FLOW VALUE
FLOWRESC	ALLOWABLE HIGH PRESSURE OUTLET FLOW ESCALATION
FLOWMESC	ALLOWABLE MANUAL GATE FLOW ESCALATION
FUSECHECK	VARIABLE TO ENSURE FUSEPLUG OPERATION DOWN TO FUSECREST LEVEL AFTER WASHOUT
FUSECOEF	FUSE CREST DISCHARGE COEFFICIENT
FUSECREST	ELEVATION OF FUSE PLUG CREST
FUSELENGTH	LENGTH OF FUSE PLUG SPILLWAY
FUSESTART	ELEVATION AT START OF FUSEPLUG WASHOUT
GATEHFLOW	MAXIMUM DESIRABLE OUTFLOW RATE THROUGH HIGH PRESSSURE OUTLETS
GATEHNO	NUMBER OF HIGH PRESSURE OUTLETS IN SPILLWAY SYSTEM
GATEHSTART	DELAY TIME TO FIRST OPERATION OF HIGH PRESSURE OUTLET
GATEHSUM	NUMBER OF OUTLETS OPERABLE AT ONE TIME
GATELNO	NUMBER OF AUTOMATICALLY CONTROLLED GATES IN SPILLWAY SYSTEM
GATEMFLOW	MAXIMUM DESIRABLE OUTFLOW RATE THROUGH MANUAL GATES
GATEMNO	NUMBER OF MANUALLY CONTROLLED GATES IN SPILLWAY SYSTEM
GATEMSTART	DELAY TIME TO FIRST OPERATION OF MANUAL GATES
GATEMSUM	NUMBER OF MANUAL GATES OPERABLE AT ONE TIME
GT	GATE TRAVELS FOR A SET OF IDENTICAL GATES
GW	GATE WIDTH FOR A SET OF IDENTICAL GATES
H	INTERMEDIATE HEIGHT USED IN CALCULATIONS
H1	INTERMEDIATE HEIGHT USED IN CALCUALTIONS
H2	INTERMEDIATE HEIGHT USED IN CALCUALTIONS
I	INTERMEDIATE COUNTER
INCREMENT	INCREMENT USED DURING ITERATIONS FOR VOLUME BALANCE
INFLOW	VOLUME OF WATER AVAILABLE TO A REACH DURING AN ANALYSIS TIME STEP
INFLOWRATE	INFLOW HYDROGRAPH PEAK
INVOL	VOLUME UNDER INFLOW HYDROGRAPH
ISTEP	INPUT TIME STEP (HOURS)
J	INTERMEDIATE COUNTER
J1	INTERMEDIATE COUNTER
J2	INTERMEDIATE COUNTER
K	INTERMEDIATE COUNTER

Variables (cont'd)

Variable	Description
L	INTERMEDIATE COUNTER
LAGTIME	LAG TIME BETWEEN INFLOW & OUTFLOW HYDROGRAPH PEAKS
LEVSENSE	ANALYSIS SENSITIVITY SET BY THE USER IN THE FORM OF A SIGNIFICANT STEP SIZE FOR THE CONSTRUCTION OF THE STORAGE - INDICATION CURVE
N	INTERMEDIATE COUNTER
NO	INTERMEDIATE COUNTER
NOHYD	NUMBER OF INFLOW HYDROGRAPH POINTS
NOSPILL	NUMBER OF MANUAL GATES OVER WHICH SPILL OCCURS AT A SPECIFIC TIME STEP END.
NOSTEL	NUMBER OF STORAGE ELEVATION POINTS
NOSTEP	NUMBER OF TIME STEPS TO BE ANALYSED
NZ	INTERMEDIATE COUNTER
OPT	OPTION SELECTED FROM VARIOUS MENUS
OPT1	OPTION SELECTED FROM VARIOUS MENUS
OTL	SELECTOR FOR LEVEL OF OUTPUT REQURIED
OUTFLOW	VOLUME OF WATER ACCOUNTED FOR DURING AN ANALYSIS TIME STEP
OUTFLOWRATE	OUTFLOW HYDROGRAPH PEAK
OUTVOL	VOLUME OF WATER DISCHARGED FROM RESERVOIR TO END OF ANALYSIS TIME STEP UNDER CONSIDERATION DURING OPTIMIZATION
PERMSTOR	VOLUME OF PERMANENT STORAGE AVAILABLE IN THE DAM
PTNOU	NUMBER OF DISCHARGE - ELEVATION POINTS FOR THE USER DEFINED SPILLWAY
Q	INTERMEDIATE COUNTER
Q1	INTERMEDIATE COUNTER
Q3	MANUAL GATE USER OPERATION MODE
Q4	HIGH PRESSURE OUTLET USER OPERATION MODE
R	GATE OPENING / WATER DEPTH RATIO
REMAIN	FRACTION OF VOLUME DURING TARGET CALCULATION
RESLEV	WATER LEVEL REQURIED IN THE RESERVOIR AFTER SIMULATION
RESMAX	MAXIMUM ALLOWABLE WATER LEVEL IN THE RESERVOIR DURING SIMULATION
RESSTA	WATER LEVEL IN RESERVOIR AT START OF SIMULATION

Variables (cont'd)

Variable	Description
SPILL	INTERMEDIATE FLOWRATE FOR SPILL OVER GATES
SPILLNO	NUMBER OF SPILLWAY COMPONENTS
STATIME	TIME AT START OF ANALYSIS
STOR	INTERMEDIATE STORAGE VALUE TO CALCULATE STORAGE INDICATION CURVE
STORIND	INDICATOR TO DENOTE USE OF STORAGE - INDICATION CURVE
STOR1	STORAGE IN DAM AT RESSTA
STOR2	STORAGE IN DAM AT RESLEV
STOR3	STORAGE IN DAM AT RESMAX
T	INTERMEDIATE COUNTER
TARCHECK	INDICATOR FOR POSITION ON OUTFLOW CURVE DURING OPTIMIZATION
TARGET	TARGET VALUE FOR GATE CONTROLLED SPILLWAY TO ACHIEVE
TEMPSTOR	VOLUME OF TEMPORARY STORAGE AVAILABLE IN DAM
TEST	INDICATOR TO CHECK NUMBER OF GATE OPERATIONS DURING A TIME STEP
TT	TIME DURING WHICH SPILLWAY GATES MUST BE CLOSED TO ACHIEVE FINAL WATER LEVEL REQUIRED
T1	TIME AT ANALYSIS POINT
W	INTERMEDIATE COUNTER
WCL	WEIR CREST LEVEL FOR IDENTICAL MANUAL OR AUTOMATIC GATES
WIERCOEF	DISCHARGE COEFF FOR OGEE SPILLWAY
WIERLENGTH	LENGTH OF OGEE CREST
WIERINVERT	CREST LEVEL OF OGEE SPILLWAY
XX	INTERMEDIATE COUNTER
ZI	INTERMEDIATE COUNTER

Group 3 **Arrays & Matrices**

Variable	Dimension	Description
BAL(M)	NOSTEP+1	STORAGE INDICATION VALUE AT BEGINING OF TIMESTEP
BOXFLOW(M)	C+1	FLOW THROUGH BOX CULVERTS AT EACH POINT ON THE STORAGE - INDICATION CURVE
CULHEIGHT(M)	CULNO	ARRAY OF CULVERT HEIGHTS
CULINVERT(M)	CULNO	ARRAY OF CULVERT INVERT LEVELS
CULSUBCOEF(M)	CULNO	ARRAY OF SUBMERGED DISCHARGE COEFFICIENTS FOR CULVERTS
CULUNCOEF(M)	CULNO	ARRAY OF UNSUBMERGED DISCHARGE CEOFFI-CIENTS FOR CULVERTS
CULWIDTH(M)	CULNO	ARRAY OF CULVERT WIDTHS
DISCH(M)	PTNOU+J1	TEMPORARY ARRAY OF DISCHARGES FOR USER DEFINED SPILLWAY DURING EXTENSION OF SPILLWAY DATA
DISCHU(M)	PTNOU	ARRAY OF DISCHARGES FOR USER DEFINED SPILLWAY
ELEV(M)	NOSTEL	ARRAY OF ELEVATIONS TO DESCRIBE THE STORAGE - ELEVATION CURVE
ELEVE(M)	PNTOU+J1	TEMPORARY ARRAY OF ELEVATIONS FOR USER DEFINED SPILLWAY DURING EXTENSION OF SPILLWAY DATA
ELEVU(M)	PTNOU	ARRAY OF ELEVATIONS FOR USER DEFINED SPILLWAY
FUSE(M)	NOSTEP+1	FLOW THROUGH FUSEPLUG SPILLWAY AT THE BEGINNING OF EACH ANALYSIS INTERVAL
FUSEFLOW(M)	C+1	FLOW THROUGH FUSEPLUG SPILLWAY AT EACH POINT ON THE STORAGE INDICATION CURVE
GATEHCOEF(M)	GATEHNO	ARRAY OF DISCHARGE COEFFICIENTS FOR ORIFICE FLOW THROUGH HIGH PRESSURE BOTTOM OUTLET WORKS
GATEHHEIGHT(M)	GATEHNO	ARRAY OF HEIGHTS OF BOTTOM OUTLETS
GATEHINVERT(M)	GATEHNO	ARRAY OF INVERT LEVELS FOR BOTTOM OUTLETS
GATEHWIDTH(M)	GATEHNO	ARRAY OF WIDTHS OF BOTTOM OUTLETS
GATELCOEF(M)	GATELNO	ARRAY OF DISCHARGE COEFFICIENTS FOR FREE FLOW THROUGH FULLY OPENED AUTOMATICALLY CONTROLLED GATES
GATELE(M)	GATELNO	ARRAY OF WATER ELEVATIONS REQUIRED IN THE RESERVOIR FOR FULL AUTOMATIC GATE OPENING
GATELHEIGHT(M)	GATELNO	ARRAY OF GATE TRAVELS FOR AUTOMATIC GATES

Arrays & Matrices (cont'd)

Variable	Dimension	Description
GATELINVERT(M)	GATELNO	ARRAY OF INVERT LEVELS FOR AUTOMATIC GATES
GATELS(M)	GATELNO	ARRAY OF WATER ELEVATIONS REQUIRED IN THE RESERVOIR FOR START OF AUTOMATIC GATE OPENING
GATELWIDTH(M)	GATELNO	ARRAY OF GATE WIDTHS FOR AUTOMATIC GATES
GATEMCOEF(M)	GATEMNO	ARRAY OF DISCHARGE COEFFICIENTS FOR FREE FLOW THROUGH FULLY OPENED MANUALLY CONTROLLED GATES
GATEMHEIGHT(M)	GATEMNO	ARRAY OF GATE TRAVELS FOR MANUAL GATES
GATEMINVERT(M)	GATEMNO	ARRAY OF INVERT LEVELS FOR MANUAL GATES
GATEMSIZE(M)	GATEMNO	ARRAY OF PHYSICAL GATE HEIGHTS
GATEMWIDTH(M)	GATEMNO	ARRAY OF GATE WIDTHS FOR MANUAL GATES
GATESPILL(M)	GATEMNO	DISCHARGE COEFFICIENT FOR SPILL OVER GATES
HEIGHT(M)	C+1	ARRAY OF ELEVATIONS FOR EACH STORAGE INDICATION POINT
HGATE(M)	NOSTEP+1	FLOW THROUGH HIGH PRESSURE BOTTOM OUTLETS AT THE BEGINNING OF EACH ANALYSIS INTERVAL
HGATEOP(M)	NOSTEP+1	ARRAY OF NUMBER OF HIGH PRESSURE OULETS OPENED BY THE USER AT EACH ANALYSIS INTERVAL
HGATEOP(M,K)	NOSTEP+1, GATEHNO	ARRAY OF PERCENTAGE OPENING FOR EACH INDIVIDUAL HIGH PRESSURE OUTLET OPENED BY THE USER AT EACH ANALYSIS INTERVAL
HT(M)	NOSTEP+1	WATER LEVEL IN RESERVOIR AT THE BEGINNING OF EACH ANALYSIS INTERVAL
INFL(M)	NOSTEP+1	INFLOW INTO RESERVOIR AT THE BEGINNING OF EACH ANALYSIS INTERVAL
INFLOW(M)	NOHYD+2	ARRAY OF INFLOW HYDROGRAPH POINTS
LGATE(M)	NOSTEP+1	FLOWTHROUGH AUTOMATIC GATES AT BEGINNING OF EACH ANALYSIS INTERVAL
LGATEFLOW(M)	C+1	FLOW THROUGH AUTOMATIC GATES AT EACH POINT ON THE STORAGE INDICATION CURVE
LGATEOP(M,K)	NOSTEP+1, GATELNO	ARRAY OF PERCENTAGE OPENING OF EACH INDIVIDUAL AUTOMATIC GATE AT EACH ANALYSES INTERVAL

Arrays & Matrices (cont'd)

Variable	Dimension	Description
MGATE(M)	NOSTEP+1	FLOW THROUGH MANUAL GATES AT THE BEGINNING OF EACH ANALYSIS INTERVAL
MGATEOP(M)	NOSTEP+1	ARRAY OF NUMBER OF MANUAL GATES OPENED BY THE USER AT EACH ANALYSIS INTERVAL
MGATEOP(M,K)	NOSTEP+1, GATEMNO	ARRAY OF PERCENTAGE OPENING OF EACH INDIVIDUAL MANUAL GATE OPENED BY THE USER AT EACH ANALYSIS INTERVAL
OGEEFLOW(M)	C+1	FLOW OVER OGEE WEIR AT EACH POINT ON THE STORAGE - INDICATION CURVE
OPT(M)	NZ	ARRAY OF DATA BLOCKS TO BE REVISED
OUTFL(M)	NOSTEP+1	OUTFLOW FROM RESERVOIR AT THE BEGINNING OF EACH ANALYSIS INTERVAL
OUTFLOW(M)	C+1	OUTFLOW FROM RESERVOIR AT EACH POINT ON THE STORAGE INDICATION CURVE, EXCLUDING FLOW THROUGH MANUAL SPILLWAY COMPONENTS AND FUSEPLUG
S(M)	5	INPUT INDICATOR
SPILL(M)	NOSTEP+1	SPILL OVER MANUAL GATES AT BEGINNING OF EACH ANALYSIS INTERVAL
SPILLWAY(M)	SPILLNO	ARRAY OF SPILLWAY COMPONENTS IN RESERVOIR TO BE ANALYSED
STO(M)	NOSTEP+1	STORAGE VOLUME IN RESERVOIR AT THE BEGINNING OF EACH ANALYSIS INTERVAL
STOR(M)	NOSTEL	ARRAY OF STORAGES TO DESCRIBE THE STORAGE ELEVATION CURVE
STORIND(M)	C+1	STORAGE INDICATION VALUE AT EACH POINT ON THE STORAGE INDICATION CURVE
T(M)	4	INPUT INDICATOR
TE(M)	4	INPUT INDICATOR
TIME(M)	NOSTEP+1	TIME AT START OF EACH ANALYSIS INTERVAL
U(M)	4	INPUT INDICATOR
USERFLOW(M)	C+1	FLOW THROUGH USER-SPILLWAY AT EACH POINT ON THE STORAGE INDICATION CURVE

Appendix F

Demonstration runs

Appendix F

Demonstration runs

This appendix contains a number of printouts from various reservoir simulation models, presenting the results of various reservoir simulations during floods. For a discussion of the case studies as well as a comparison of the results see Chapter 3 in the main report.

Emmarentia Dam Case Study
Analysis by Johannesburg City
Council using program by Green

:CEDDS.LEON

#LISTING OF :LEON.OUT4(1/) PRODUCED ON 30JUN83 AT 14.35.38

#OUTPUT BY LISTFILE IN *:CEDDS.LEON* ON 30JUN83 AT 14.58.14 USING U47

DOCUMENT OUT4

FLOOD ROUTING BY STORAGE INDICATION METHOD
****

FLOODROUTING THROUGH EMMARENTIAM. NO BOATHOUSE. 60M SPILLWAY.
400 YEAR, 70 MINUTE STORM.

RESERVOIR ELEVATION-STORAGE DATA

ELEVATION	STORAGE
91.50	0.00
92.00	46127.00
92.50	96087.00
93.00	150039.00
93.50	208362.00
94.00	272429.00
94.50	341789.00
95.00	415844.00

INVERT LEVEL OF CULVERTS = 91.50 NUMBER OF CULVERT SECTIONS = 6

HEIGHT OF CULVERT = 1.47 WIDTH OF SINGLE SECTION = 3.35

C(UNSUBMERGED) = 0.70 C(SUBMERGED) = 0.76

ELEVATION OF SPILLWAY CREST = 93.10 LENGTH OF SPILLWAY = 60.00 C(SPILLWAY) =1.85

TIME	INFLOW RATE	OUTFLOW RATE			LEVEL OF WATER	STORAGE
		CULVERT	SPILLWAY	TOTAL	IN RESERVOIR	
5	17.72	0.00	0.00	0.00	91.50	0.00
10	45.81	2.18	0.00	2.18	91.60	9208.32
15	87.76	6.61	0.00	6.61	91.80	27922.25
20	151.25	16.57	0.00	16.57	92.14	60297.29
25	210.28	35.93	0.00	35.93	92.60	106650.78
30	254.30	68.05	0.00	68.05	93.09	160740.21
35	284.64	92.74	31.72	124.46 *	93.53	212784.41
40	305.30	108.21	74.29	182.51 *	93.87	255150.61
45	319.66	116.77	112.07	228.84 *	94.11	287193.61

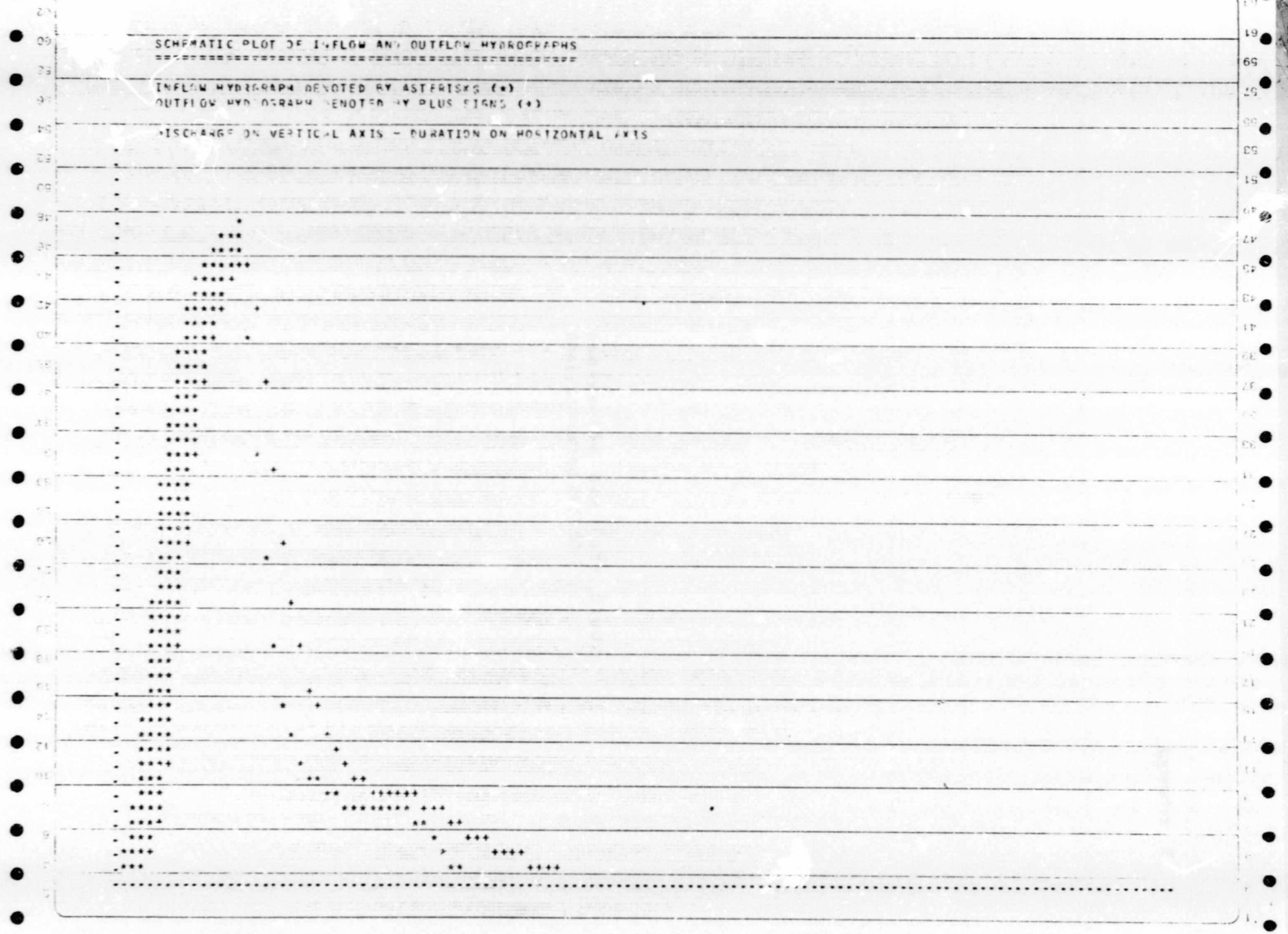
RUN 8. OVERFLOW SPILLWAY
60 m WIDE OKAY.

50	329.73	123.42	141.36	264.77	*	94.27	3105 60.52
55	336.91	126.83	163.64	290.47	*	94.40	327269.17
60	342.03	128.61	180.23	308.84	*	94.48	339213.62
65	345.73	130.75	191.78	322.52	*	94.54	347674.89
70	348.40	132.49	199.77	332.26	*	94.58	353577.27
75	293.70	131.72	196.15	327.81	*	94.56	350880.33
80	228.48	128.01	173.95	301.96	*	94.45	334761.18
85	173.22	123.50	140.75	264.06	*	94.27	310093.40
90	129.26	115.19	106.58	221.76	*	94.07	282591.76
95	100.60	108.36	75.50	183.96	*	93.87	256212.33
100	81.85	101.67	50.72	152.39	*	93.69	233127.33
105	69.14	93.39	32.83	126.21	*	93.54	213985.42
110	60.45	88.36	19.52	107.87	*	93.41	199311.71
115	54.38	83.96	10.07	94.03	*	93.30	185280.98
120	50.05	78.56	4.00	82.56	*	93.21	174426.90
125	46.95	72.53	0.68	73.21	*	93.13	165611.38
130	44.89	65.70	0.00	65.70		93.07	155520.39
135	43.04	59.71	0.00	59.71		93.02	152868.22
140	41.84	55.86	0.00	55.86		92.98	148264.82
145	40.99	53.92	0.00	53.92		92.95	144221.78
150	40.38	52.15	0.00	52.15		92.91	140516.72
155	39.94	50.54	0.00	50.54		92.88	137161.11
160	39.62	49.10	0.00	49.10		92.85	134148.16
165	39.36	47.81	0.00	47.81		92.83	131458.79
170	37.96	46.58	0.00	46.58		92.80	128897.36
175	33.18	45.11	0.00	45.11		92.78	125814.45
180	25.60	43.00	0.00	43.00		92.73	121416.36
185	18.30	40.18	0.00	40.18		92.68	115525.33
190	12.89	36.88	0.00	36.88		92.62	108644.22
195	9.19	33.42	0.00	33.42		92.55	101409.83
200	6.68	30.14	0.00	30.14		92.48	94256.98
205	4.97	27.39	0.00	27.39		92.41	87375.73
210	3.77	24.79	0.00	24.79		92.35	80860.06
215	2.92	22.36	0.00	22.36		92.29	74790.46
220	2.30	20.13	0.00	20.13		92.23	69194.32
225	1.84	18.09	0.00	18.09		92.18	64085.41
230	1.49	16.23	0.00	16.23		92.13	59436.32
235	1.22	14.55	0.00	14.55		92.09	55226.09
240	1.02	13.03	0.00	13.03		92.05	51425.02
245	0.00	11.61	0.00	11.61		92.02	47882.76
250	0.00	10.34	0.00	10.34		91.98	44557.22

ASTERISK (*) DENOTES SPILLWAY IN OPERATION

PEAK INFLOW RATE = 348.40 CUMECS PEAK OUTFLOW RATE = 332.26 CUMECS

ATTENUATION = 4.6 % LAG TIME = 0 MINUTES


SCHEMATIC PLOT OF INFLOW AND OUTFLOW HYDROGRAPHS
INFLOW HYDROGRAPH DENOTED BY ASTERISKS (*)
OUTFLOW HYDROGRAPH DENOTED BY PLUS SIGNS (+)
DISCHARGE ON VERTICAL AXIS - DURATION ON HORIZONTAL AXIS

Emmarentia Dam Case Study
Analysis using RESIMO

****

EMMARENTIA DAM. NO BOATHOUSE. 60m AUXILARY SPILLWAY OVER ROAD.
STORM WITH 400 YEAR R.I. AND 70 MIN. DURATION

****

ELEVATION	STORAGE
91.5	0
92	46127
92.5	96087
93	150039
93.5	208362
94	272429
94.5	341789
95	415844

BOX CULVERTS

NO	WIDTH	HEIGHT	INVERT	UNCOEF	SUBCOEF
1	3.35	1.47	91.5	.9	.7
2	3.35	1.47	91.5	.9	.7
3	3.35	1.47	91.5	.9	.7
4	3.35	1.47	91.5	.9	.7
5	3.35	1.47	91.5	.9	.7
6	3.35	1.47	91.5	.9	.7

FREE OVERFLOW WIER

WEIRLENGTH	WEIRINVERT	WEIRCOEF
60	93.1	1.85

****

EMMARENTIA DAM. NO BOATHOUSE. 60m AUXILARY SPILLWAY OVER ROAD.
STORM WITH 400 YEAR R.I. AND 70 MIN. DURATION

****

TIME (hours)	INFLOW RATE (m3/s)	WATER LEVEL (m)	OUTFLOW RATE (m3/s)	STORAGE VOLUME (m3)
0.00	0.00	91.500	0.00	0.000E+00
0.08	17.72	91.527	0.14	0.253E+04
0.16	45.81	91.624	1.35	0.115E+05
0.24	87.76	91.822	5.63	0.297E+05
0.32	151.25	92.149	16.11	0.610E+05
0.40	216.82	92.597	35.44	0.107E+06
0.48	254.30	93.089	61.77	0.160E+06
0.56	284.64	93.486	155.69	0.207E+06
0.64	305.30	93.754	196.32	0.241E+06
0.72	319.66	93.973	234.53	0.269E+06
0.80	329.73	94.131	264.71	0.291E+06
0.88	336.91	94.248	288.46	0.307E+06
0.96	342.93	94.336	306.83	0.319E+06
1.04	345.73	94.400	320.49	0.328E+06
1.12	348.40	94.445	330.31	0.334E+06
1.20	293.70	94.429	326.87	0.332E+06
1.28	228.48	94.317	302.88	0.316E+06
1.36	173.22	94.143	267.12	0.292E+06
1.44	129.26	93.938	228.17	0.264E+06
1.52	100.60	93.725	191.44	0.237E+06
1.60	81.85	93.532	162.15	0.212E+06
1.68	69.14	93.351	138.56	0.191E+06
1.76	60.45	93.244	77.14	0.179E+06
1.84	54.38	93.202	72.08	0.174E+06
1.92	50.05	93.159	67.45	0.169E+06
2.00	46.95	93.116	63.63	0.164E+06
2.08	44.69	93.076	61.00	0.159E+06
2.16	43.94	93.037	58.78	0.154E+06
2.24	41 84	93.001	56.69	0.150E+06
2.32	40.99	92.963	54.56	0.146E+06
2.40	40.38	92.928	52.64	0.142E+06
2.48	39.94	92.897	50.94	0.139E+06
2.56	39.62	92.869	49.43	0.136E+06
2.64	39.36	92.845	48.09	0.133E+06
2.72	37.96	92.821	46.84	0.131E+06
2.80	33.18	92.793	45.35	0.128E+06
2.88	25.60	92.753	43.27	0.123E+06
2.96	18.30	92.700	40.54	0.118E+06
3.04	12.89	92.638	37.42	0.111E+06
3.12	9.19	92.571	34.21	0.104E+06
3.20	6.68	92.505	31.10	0.967E+05
3.28	4.97	92.438	28.00	0.898E+05
3.36	3.77	92.374	25.18	0.834E+05
3.44	2.92	92.314	22.66	0.775E+05
3.52	2.30	92.260	20.42	0.721E+05
3.60	1.84	92.210	18.44	0.671E+05
3.68	1.49	92.164	16.68	0.625E+05

****

EMMARENTIA DAM. NO BOATHOUSE. 60m AUXILARY SPILLWAY OVER ROAD.
STORM WITH 400 YEAR R.I. AND 70 MIN. DURATION

****

TIME (hours)	INFLOW RATE (m3/s)	WATER LEVEL (m)	OUTFLOW RATE (m3/s)	STORAGE VOLUME (m3)
3.76	1.22	92.122	15.13	0.583E+05
3.84	1.02	92.083	13.75	0.545E+05
3.92	0.00	92.047	12.48	0.508E+05
4.00	0.00	92.013	11.33	0.474E+05

****

PEAK INFLOW RATE= 348.40m3/s
PEAK OUTFLOW RATE= 330.31m3/s
LAG TIME= 0.00hours
PERCENTAGE ATTENUATION= 5.19%

****

Jumbles reservoir Case Study
Analysis by Binnie & Partners,
London using in house program

ELEV./AREA CURVE.

0.0000
247000.0000

1.0000
265000.0000

2.0000
283000.0000

3.0000
301000.0000

4.0000
319000.0000

5.0000
337000.0000

****
OUTFLOW RATING
0.0000
0.0000

0.0600
3.0000

0.1200
7.0000

0.2400
84.0000

0.3700
159.0000

0.4300
181.0000

0.4900
184.0000

1.1900
201.0000

1.5000
219.0000

1.7000
233.0000

1.8500
246.0000

Subject Jumbles Routing - Winter PMF based on 11.25 hr storm over 343 sqkm catchment with existing spillways at each dam.
Computed D&M Chkd

2.2400
262.0000

2.7800
279.0000

3.2200
296.0000

4.1000
330.0000

4.9800
364.0000

dt	15.0000
Ho	0.0382
Qo	1.9100
Qin	2.3000

****

step	Qin	Qout
1	3.1	2.04
2	4.3	2.32
3	6.3	2.81
4	8.7	3.77
5	12.2	5.21
6	15.7	7.46
7	19.5	10.35
8	23.3	21.62
9	27.1	25.46
10	31.5	29.58
11	36.0	34.05
12	40.6	38.61
13	45.9	43.58
14	51.4	49.01
15	57.7	54.94
16	64.9	61.75
17	72.9	69.40
18	82.4	78.23
19	93.6	88.45
20	108.0	101.00
21	125.7	117.09
22	152.1	139.21
23	188.3	168.04
24	225.4	184.32
25	258.4	189.04
26	281.3	195.57
27	298.4	205.65
28	298.7	222.61
29	293.0	238.64
30	283.5	248.44
31	270.6	251.96
32	255.9	253.35
33	240.5	252.72
34	225.0	250.27
35	209.9	246.24
36	197.3	236.06
37	189.4	226.85
38	183.3	218.62
39	178.2	212.02
40	174.2	205.74
41	170.7	200.50
42	167.8	198.05
43	165.1	195.56
44	162.6	193.04
45	160.1	190.51
46	157.2	187.94
47	154.1	185.33
48	150.6	181.31
49	146.7	156.19
50	142.2	144.31
51	138.1	140.10
52	134.2	136.10

Peak inflow-(h)
7.00

Peak outflow-(h)
8.00

Total inflow
million cu.units
6.4652
Total outflow
million cu.units
6.3377

Max inflow
298.7000

Max level 2.0290

Max outflow
av 253.0307
inst 253.3452

Jumbles reservoir Case Study
Analysis using RESIMO

****

JUMBLES RESERVOIR. DEMONSTRATION RUN.
WINTER PMF THROUGH 24 No SIPHONS

****

ELEVATION	STORAGE
0	0
1	256000
2	530000
3	822000
4	1132000
5	1460000

USER DEFINED SPILLWAY

ELEVATION	DISCHARGE
0	0
.06	3
.12	7
.24	84
.37	159
.43	181
.49	184
1.19	201
1.5	219
1.7	233
1.85	246
2.24	262
2.78	279
3.22	296
4.1	330
4.98	364

Author Furstenburg Leon
Name of thesis Optimum Reservoir Operation During Floods. 1985

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