

บรรณานุกรม

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ពាក្យស្នើសុំ

จากขั้นตอนการพัฒนโปรแกรมสำหรับการออกแบบโดยไมโครคอมพิวเตอร์ดังแสดงในบทที่ 4 สามารถสรุปกลุ่มการทำงาน (หรือการออกแบบ) ออกเป็นส่วนใหญ่ๆ ได้ดังต่อไปนี้

ส่วนเมนูเลือกการทำงาน

บรรทัดที่ 10 - 30 เป็นการเลือกว่าต้องการออกแบบหรือพิมพ์ผลลัพธ์ เมื่อเลือกแล้ว เครื่องจะ chain ไปยังโปรแกรมเลือกการออกแบบ หรือโปรแกรมการพิมพ์ผลลัพธ์ต่อไป

ส่วนเมนูการออกแบบ

บรรทัดที่ 40 - 140 เป็นการเลือกว่าต้องการออกแบบระบบท่อระบายชนิดใด แล้ว เครื่องจะทำการ chain ต่อไปยังโปรแกรมนั้นในโปรแกรมการออกแบบทั้ง 3 โปรแกรมนี้มีหลักการทำงานที่เหมือนกัน จะต่างกันตรงที่ข้อปลีกย่อยของการออกแบบเท่านั้น เช่นการออกแบบระบบท่อระบายน้ำเสีย ก็มีการหาค่าอัตราการไหลแบบหนึ่ง ส่วนการออกแบบระบบท่อระบายน้ำฝนก็มีการหาอัตราการไหลอีกแบบหนึ่ง หลักการในการเขียนโปรแกรมก็เป็นไปตามข้างล่างนี้

ส่วนเมนูหลัก

บรรทัดที่ 10000 - 10200 เป็นการจองที่สำหรับตัวแปร

บรรทัดที่ 10210 - 10410 เป็นการแสดงตัวเลือกที่มีในเมนู พร้อมทั้งให้เลือกที่ต้องการการทำงานในหัวข้อใด แล้วเครื่องจะสั่งให้ไปทำงานใน subroutine นั้น

บรรทัดที่ 10430 - 10570 เป็นการแสดงความผิดพลาดที่เกิดขึ้นในบรรทัดใด และแสดงรหัสที่ผิดพลาด (ความหมายของรหัสที่ผิดพลาดนี้หาได้จากคู่มือภาษา

basic ที่ทำขึ้นโดยบริษัท microsoft)

- บรรทัดที่ 10590 - 11370 เป็น subroutine ของการป้อนข้อมูลทางแป้นตัวอักษร
- บรรทัดที่ 10390 - 12020 เป็น subroutine ของการป้อนข้อมูลทางแผ่นจาน ที่ได้เคยเก็บข้อมูลมาก่อน
- บรรทัดที่ 12030 - 12660 เป็น subroutine ของการแสดงผลของข้อมูลที่ได้ป้อนเข้าไป โดยแสดงออกทางจอภาพและสามารถพิมพ์ออกทางเครื่องพิมพ์ได้ถ้าต้องการ
- บรรทัดที่ 12680 - 13370 เป็น subroutine ของการเป็นลักษณะสมบัติของ ระบบที่อธิบายที่ได้ป้อนเข้าไปแล้ว
- บรรทัดที่ 13390 - 13580 เป็น subroutine ของการเพิ่มโหนด
- บรรทัดที่ 13600 - 13880 เป็น subroutine ของการลบโหนด
- บรรทัดที่ 13900 - 14210 เป็น subroutine ของการเปลี่ยนข้อมูลในโหนด
- บรรทัดที่ 14230 - 14480 เป็น subroutine ของการเพิ่มลิงค์
- บรรทัดที่ 14500 - 14830 เป็น subroutine ของการลบลิงค์
- บรรทัดที่ 14850 - 15290 เป็น subroutine ของการเปลี่ยนข้อมูลในลิงค์
- บรรทัดที่ 15310 - 15800 เป็น subroutine ของการเริ่มต้นทำการคำนวณ
- บรรทัดที่ 15860 - 16130 เป็น subroutine ของการเก็บข้อมูลลงแผ่นจาน
- บรรทัดที่ 16150 - 16220 เป็น subroutine ของการเริ่มทำการออกแบบใหม่โดยทำการลบข้อมูลที่ได้อป้อนเข้าไปทั้งหมด
- บรรทัดที่ 16660 - 16890 เป็น subroutine ของการแปลงหน่วยที่ใช้ในการคำนวณ และจองที่สำหรับการแสดงผล
- บรรทัดที่ 17350 - 17790 เป็น subroutine ของการหาปริมาณน้ำที่ไหลในท่อ
- บรรทัดที่ 17810 - 18190 เป็น subroutine ของการหาค่าความลาดต่ำสุดและความลาดสูงสุด
- บรรทัดที่ 18210 - 19330 เป็น subroutine ของการหาความลาดของการวางท่อ และระดับที่ท่อวาง
- บรรทัดที่ 19350 - 19630 เป็น subroutine ของการหาความลึกของระดับน้ำและความเร็วในเส้นท่อ
- บรรทัดที่ 19650 - 19750 เป็น subroutine ของการตรวจสอบความลึกของดินที่ปกคลุมหลังท่อ
- บรรทัดที่ 19900 - 21660 เป็น subroutine ของการแสดงผลลัพท์ของการคำนวณ

ออกทางจอมอนิเตอร์และถ้าต้องการให้พิมพ์ผลลัพธ์ออกทางเครื่องพิมพ์ก็
สามารถสั่งได้เช่นกัน

บรรทัดที่ 22040 - 22190 เป็น subroutine ของการเก็บผลลัพธ์ไว้ในแผ่นจาน
เพื่อที่จะนำมาพิมพ์ได้ในภายหลังโดยผ่านทางโปรแกรมการพิมพ์ผลลัพธ์

ส่วนเมนการพิมพ์ผลลัพธ์

บรรทัดที่ 40 - 1140 เป็นการเลือกว่าต้องการพิมพ์ผลลัพธ์ของระบบท่อบายชนิดใด
แล้วเครื่องจะทำการ chain ต่อไปยังโปรแกรมอื่น

ส่วนการพิมพ์ผลลัพธ์

บรรทัดที่ 10000 - 10200 เป็นการจองที่สำหรับตัวแปร

บรรทัดที่ 11500 เป็นการส่งการทำงานไปยัง subroutine ของการโหลดข้อมูล
ผลลัพธ์ที่ต้องการพิมพ์

บรรทัดที่ 22000 - 22200 เป็น subroutine ของการโหลดข้อมูลผลลัพธ์

บรรทัดที่ 11750 - 12660 เป็น subroutine ของการเรียกดูข้อมูลที่เป็นส่วนลักษณะ
สมบัติ ซึ่งสามารถพิมพ์ได้ถ้าต้องการ

บรรทัดที่ 16680 - 16890 เป็น subroutine ของการจองที่สำหรับการแสดงผล

บรรทัดที่ 19900 - 21660 เป็น subroutine ของการแสดงผลลัพธ์ของการคำนวณ
ออกทางจอมอนิเตอร์และถ้าต้องการให้พิมพ์ผลลัพธ์ออกทางเครื่องพิมพ์ก็
สามารถสั่งได้เช่นกัน

Listing ของโปรแกรมเมนูเลือกการทำงาน

```
5 CLS:GOSUB 1000
10 CLS
21 PRINT"SEWERS SYSTEM - VERSION 1.11":PRINT:PRINT TAB(10)"SELECT":PRINT
22 PRINT TAB(10)"1.DESIGN SYSTEM "
23 PRINT TAB(10)"2.PRINT RESULTS":PRINT TAB(10)"3.END"
24 PRINT:INPUT " ENTER NO. ";NO
25 IF NO<1 OR NO >3 THEN PRINT " NOT WITHIN RANGE. PLEASE REENTER ":GOTO 24
26 ON NO GOTO 30,27,140
27 SCREEN 0:WIDTH 80:CHAIN "SELECT2"
30 SCREEN 0:WIDTH 80:CHAIN "SELECT1"
140 SCREEN 0:WIDTH 80:END
1000 SCREEN 1,0:CLS:KEY OFF:COLOR 0,1
1010 PI = 3.14159
1020 CF = (2*PI)/360
1030 CIRCLE(160,100),60,1
1040 PAINT(160,100),1,1
1050 CIRCLE(160,100),40,3,CF*210,CF*330
1060 LINE(120,118)-STEP(10,-6)
1070 LINE(200,118)-STEP(-10,-6)
1080 CIRCLE(145,93),10,0,,,2
1090 PAINT STEP(0,0),0,0
1100 CIRCLE(175,93),10,0,,,2
1110 PAINT STEP(0,0),0,0
1120 FOR I=1 TO 200 :NEXT I
1130 PAINT STEP(0,0),0,31
1140 FOR I=1 TO 200 :NEXT I
1150 RETURN
```

Listing ของโปรแกรมเมนการออกแบบ

```

30 CLS:PRINT "LEAST-COST DESIGN OF GRAVITY SEWERS ":"PRINT:PRINT TAB(10)"SELECT
":PRINT
40 PRINT TAB(10)"1. STORM SEWERS"
50 PRINT TAB(10)"2. DOMESTIC SEWERS"
60 PRINT TAB(10)"3. COMBINED SEWERS"
70 PRINT TAB(10)"4. END":PRINT
80 INPUT "ENTER NO. ";NO
90 IF NO<1 OR NO >4 THEN PRINT "NOT WITHIN RANGE. PLEASE REENTER ":"GOTO 80
100 ON NO GOTO 1110,1120,1130,1140
1110 PRINT
1111 INPUT "STORM WITH INTENSITY (Y/N)";ANS$
1112 IF ANS$ = "Y" OR ANS$ = "y" THEN CHAIN "SIN"
1113 CHAIN "STORM1"
1120 CHAIN "DOMES1"
1130 PRINT
1131 INPUT "COMBINED WITH INTENSITY (Y/N)";ANS$
1132 IF ANS$ = "Y" OR ANS$ = "y" THEN CHAIN "CIN"
1133 CHAIN "COMB2"
1140 SCREEN 0:WIDTH 80:CHAIN "select"

```


Listing ของโปรแกรมเมนูการพิมพ์ผลลัพธ์

```

10 CLS
20 LOCATE 5,5
30 PRINT " PRINT RESULTS & DATA " : PRINT : PRINT TAB(10) "SELECT " : PRINT
40 PRINT TAB(10) "1. STORM SEWERS"
50 PRINT TAB(10) "2. DOMESTIC SEWERS"
60 PRINT TAB(10) "3. COMBINED SEWERS"
70 PRINT TAB(10) "4. END" : PRINT
80 INPUT " ENTER NO. "; NO
90 IF NO < 1 OR NO > 4 THEN PRINT "NOT WITHIN RANGE. PLEASE REENTER " : GOTO 80
100 ON NO GOTO 110,120,130,140
110 PRINT
111 INPUT " STORM WITH INTENSITY (Y/N) "; ANS$
112 IF ANS$ = "Y" OR ANS$ = "y" THEN CHAIN "PSIN"
113 CHAIN "PSTO"
120 SCREEN 0:WIDTH 80:CHAIN "PDOM"
130 PRINT
131 INPUT " COMBINED WITH INTENSITY (Y/N) "; ANS$
132 IF ANS$ = "Y" OR ANS$ = "y" THEN CHAIN "PCIN"
133 CHAIN "PCOM"
140 SCREEN 0:WIDTH 80:CHAIN "SELECT"

```



Listing ส่วนเมนูหลักของโปรแกรมการออกแบบระบบระบายน้ำเสีย

```

10000 CLEAR
10010 CLS
10020 DEFINT I-J,L-N
10030 OPTION BASE 1
10040 IESC = 27
10050 ON ERROR GOTO 10480
10060 KEY OFF
10070 MPAGE = 30000
10080 MLINK = 120
10090 MNODE = 121
10100 ISAVE = 1
10110 DIM ANGLE(MLINK)
10120 DIM COEF(3), COVER(MLINK), CUMDEM(MNODE), CUMDEPTH(MNODE), DEMAND(MNODE)
10125 DIM HA(MNODE), DEN(MNODE), DENH(MNODE), WER(MNODE), WERM(MNODE), C(MNODE)
10126 DIM CUMDEHM(MNODE), FLOWH(MLINK), VELFULL(MLINK), GS(MLINK), STO(MLINK)
10127 DIM T(MLINK), IMIN(MLINK), A(MLINK), PEAK(MNODE), PEAK1(MNODE)
10130 DIM DEPTH(MLINK), DIAM(MLINK), DOWNCROWN(MLINK), DOWNINVERT(MLINK)
10140 DIM DROP(MNODE), ELEV(MNODE), FLOW(MLINK), FM$(6)
10150 DIM GROUNDSLOPE(MLINK), IMAX(MLINK), LINK(MLINK), NDEGREE(MNODE)
10160 DIM NFROM(MLINK), NODE(MNODE), NTO(MLINK), PIPESLOPE(MLINK)
10170 DIM SLOPEMAX(MLINK), SLOPEMIN(MLINK), SPAN(MLINK)
10180 DIM UNIT$(6), UPCROWN(MLINK), UPINVERT(MLINK), VELOCITY(MLINK)
10190 DIM XDOWN(MLINK), XNODE(MNODE), XUP(MLINK)
10200 CLS
10210 PRINT"DOMESTIC SEWER MENU"
10220 PRINT
10230 PRINT"  1. INPUT DATA FROM KEYBOARD"
10240 PRINT"  2. INPUT DATA FROM DISK FILE"
10250 PRINT"  3. LIST DATA"
10260 PRINT"  4. CHANGE SYSTEM CHARACTERISTICS"
10270 PRINT"  5. ADD NODES"
10280 PRINT"  6. DELETE NODES"
10290 PRINT"  7. CHANGE NODE DATA"
10300 PRINT"  8. ADD LINKS"
10310 PRINT"  9. DELETE LINKS"
10320 PRINT" 10. CHANGE LINK DATA"
10330 PRINT" 11. DESIGN SEWERS"
10340 PRINT" 12. SAVE DATA TO DISK"
10350 PRINT" 13. START A NEW RUN"
10360 PRINT" 14. END"
10370 PRINT
10380 INPUT "ENTER NUMBER OF DESIRED ACTION:";IAC
10390 IF IAC<1 OR IAC>14 THEN PRINT"NOT WITHIN RANGE. PLEASE REENTER":GOTO 10380
10400 ON IAC GOSUB 10690,11500,11820,12750,13440,13650,13950,14290,14560,14910,
10410 GOTO 10200
10420 REM -----
10430 REM ** ERROR TRAP **

```

```

10480 CLOSE
10490 CLS: CLOSE: PRINT:PRINT
10500 PRINT TAB(20);"WARNING !!      WARNING !!"
10510 PRINT"AN ERROR HAS OCCURED IN LINE ";ERL;" IN THE MAIN PROGRAM."
10520 PRINT"THE ERROR CODE IS ";ERR
10530 PRINT
10540 PRINT"AFTER THIS MESSAGE, YOU WILL RETURNED TO THE MENU."
10550 PRINT"SAVE YOUR DATA TO DISK IF YOU HAVE NOT ALREADY DONE SO !!"
10560 GOSUB 21730
10570 RESUME 10200
10580 REM -----
10590 REM ** SUBROUTINE TO ENTER DATA FROM KEYBOARD **
10690 IF ISAVE =0 THEN GOSUB 16380
10700 ISAVE=0
10710 CLS
10720 LINE INPUT "ENTER TITLE FOR PROJECT: ";TITLE$
10780 A=0 : B=0 : KK=0
10790 PRINT
10800 PRINT"      FLOW IN LITERS PER SECOND (LPS)"
10810 PRINT"      LENGTHS AND ELEVATIONS IN METERS (M)"
10820 PRINT"      DIAMETERS IN CENTIMETERS (CM)"
10830 PRINT
10840 INPUT "ENTER RATE OF I/I ; (CMD/ha) ";RO
10860 IUNITS = 2
10870 GOSUB 16560 : REM ASSIGN UNIT$()
10880 INPUT "ENTER NUMBER OF THE OUTFALL NODE:";NREF
10890 PRINT"ENTER THE CROWN ELEVATION OF THE OUTFALL NODE:";UNIT$(3);
10900 INPUT ELEVREF
10920 PRINT"ENTER MINIMUM SCOUR VELOCITY ALLOWABLE:";UNIT$(5);
10930 INPUT VELMIN
10940 PRINT"ENTER MAXIMUM VELOCITY ALLOWABLE:";UNIT$(5);
10950 INPUT VELMAX
10960 PRINT"ENTER DEFAULT MINIMUM COVER DEPTH";UNIT$(3);
10970 INPUT COVERMIN
10980 PRINT"ENTER MAXIMUM COVER DEPTH";UNIT$(3);
10990 INPUT COVERMAX
11000 INPUT "ENTER MANNING'S ROUGHNESS COEFFICIENT:";ROUGH
11005 TE = 0
11010 CLS
11020 I=0 : GOTO 11240
11030 PRINT"BEGIN ENTERING LINK DATA"
11040 PRINT:PRINT"ENTER 'M' FOR LINK # TO DISCONTINUE.";TAB(65);"ENTRY #";I+1
11050 PRINT:INPUT "ENTER LINK NUMBER:";LN$
11060 IF LN$ = "M" OR LN$ = " " THEN GOTO 11210
11070 I=I+1
11080 LINK(I) = VAL(LN$)
11090 INPUT "  ENTER FROM NODE:";NFROM(I)
11100 INPUT "  ENTER TO NODE:";NTO(I)
11110 PRINT"  ENTER LENGTH OF LINK ";UNIT$(2);": ";
11120 INPUT SPAN(I)
11130 PRINT"  ENTER LINK DIAMETER ";UNIT$(4);": ";
11140 INPUT DIAM(I)

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11150 COVER$ = ""
11160 PRINT " ENTER MINIMUM COVER DEPTH (DEFAULT =";COVERMIN;");";
11170 INPUT COVER$
11180 IF COVER$ = "" THEN COVER(I) = COVERMIN ELSE COVER(I) = VAL (COVER$)
11190 IF I+1 > NLINK THEN PRINT "MAXIMUM NUMBER OF LINKS ENTERED.":GOSUB 21730:GOT
0 11210
11200 GOTO 11040
11210 NLINK = I:GOTO 11370
11220 CLS
11230 I = 0 : GOTO 11030
11240 PRINT "BEGIN ENTERING NODE DATA"
11250 PRINT:PRINT "ENTER 'M' FOR NODE # TO DISCONTINUE.":TAB(50);"ENTRY #"; I+1
11260 PRINT:INPUT "ENTER NODE NUMBER:":NN$
11270 IF NN$ = "M" OR NN$ = "m" THEN GOTO 11360
11280 I=I+1
11290 NODE(I)=VAL(NN$)
11300 INPUT " AREA (ha) ":BA(I)
11305 INPUT " POP.AT T = Te [ BEGIN TIME ] (CAPITA/ha) ":DENM(I)
11310 INPUT " POP.AT T = Tm [ END OF TIME ] (CAPITA/ha) ":DEN(I)
11311 INPUT " MIN FACTOR = ":PEAK1(I)
11312 INPUT " PEAK FACTOR = ":PEAK(I)
11315 INPUT " WASTE AT T = Te [ LITERS PER CAPITA PER DAY ] ":WERM(I)
11316 INPUT " WASTE AT T = Tm [ LITERS PER CAFITA PER DAY ] ":WER(I)
11317 C(I) = 0
11320 PRINT " ENTER GROUND ELEVATION OF NODE ":UNIT$(3);":":
11330 INPUT ELEV(I)
11340 IF I+1 > NNODE THEN PRINT "MAXIMUM NUMBER OF NODES ENTERED.":GOSUB 21730:GOT
0 11360
11350 GOTO 11250
11360 NNODE = I
11365 GOTO 11220
11370 RETURN
11380 REM -----
11390 REM ** SUBROUTINE TO ENTER DATA FROM DISK FILE **
11500 IF ISAVE = 0 THEN GOSUB 16380: REM TEST IATA SAVE
11510 ISAVE = 0
11520 CLS
11525 FILES "b:*.s*"
11530 INPUT "ENTER NAME OF DISK FILE TO BE READ:":AF$
11535 DF$ = "b:"+AF$
11540 OPEN "I",1,DF$
11550 PRINT "NOW READING DATA"
11560 LINE INPUT #1,TITLE$
11570 INPUT #1,NLINK,NNODE,A,B,KK,RO,NREF
11580 INPUT #1,ELEVREF,ROUGH,TE
11590 INPUT #1,COVERMIN,COVERMAX,VELMIN,VELMAX
11600 FOR I=1 TO NLINK
11610 INPUT #1,LINK(I),NFROM(I),NTO(I),SPAN(I),DIAM(I),COVER(I)
11620 NEXT I
11630 FOR I = 1 TO NNODE
11640 INPUT #1,NODE(I),BA(I),DENM(I),DEN(I),WERM(I),WER(I),C(I),ELEV(I),PEAK1(I)
,PEAK(I)

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11650 NEXT I
11660 CLOSE
11670 GOSUB 16560: REM SET UNIT NAMES
11680 PRINT : PRINT "DATA READ." : PRINT "  FILENAME : ";DF$
11690 PRINT"  PROJECT TITLE : "; TITLE$
11700 GOSUB 21730: REM BOLD SCREEN
11710 RETURN
11720 REM -----
11730 REM ** SUBROUTINE TO LIST DATA **
11820 CLS
11830 OPEN "SCRN:" FOR OUTPUT AS #1
11840 IPAGE = 18
11850 GOSUB 12140
11860 CLOSE
11870 CLS
11880 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)"; ANS$
11890 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 12010
11900 OPEN "LPT1:" FOR OUTPUT AS #1
11910 IPAGE = MPAGE
11920 GOSUB 12140
11930 CLOSE
12010 RETURN
12020 REM -----
12030 REM ** SUBROUTINE TO PRINT OUT DATA **
12140 IF (IPAGE <> MPAGE) THEN CLS
12150 PRINT #1, "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12160 PRINT #1,
12170 PRINT #1, "PROJECT TITLE";TAB(40);TITLE$
12180 PRINT #1, "  NUMBER OF NODES:";TAB(40);NNODE
12190 PRINT #1, "  NUMBER OF LINKS:";TAB(40);NLINK
12200 PRINT #1, "  RATE OF I/I:";TAB(40);RO;" (CMD/ha)"
12210 PRINT #1, "  MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
12220 PRINT #1, "  MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
12230 PRINT #1, "  MANNING'S ROUGHNESS COEFFICIENT:";TAB(40);ROUGH
12240 PRINT #1, "  SEWER OUTFALL NODE #:";TAB(40);NREF
12250 PRINT #1, "  CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)
)
12260 IF IPAGE <> MPAGE THEN GOSUB 21730: CLS: ELSE PRINT #1, "":PRINT #1, ""
12270 GOSUB 12470
12280 FOR I = 1 TO NLINK
12290 PRINT #1,TAB(2);LINK(I);TAB(10);NFROM(I);TAB(18);NTO(I);
12300 PRINT #1,TAB(28);SPAN(I);TAB(43);DIAM(I);TAB(53);COVER(I)
12310 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 12470

12320 NEXT I
12330 IF (IPAGE <> MPAGE) THEN GOSUB 21730: CLS:ELSE PRINT #1, "":PRINT #1, ""
12340 GOSUB 12610
12350 FOR I = 1 TO NNODE
12360 PRINT #1,TAB(2);NODE(I);TAB(7);PEAK1(I);TAB(12);PEAK(I);TAB(19);HA(I);TAB(
25);DENM(I);TAB(35);DEN(I);TAB(45);WERM(I);TAB(55);WER(I);TAB(65);ELEV(I)
12370 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730: CLS: GOSUB 126
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12380 NEXT I
12390 IF (IPAGE <> MPAGE) THEN GOSUB 21730: CLS: ELSE PRINT #1, "": PRINT #1, ""
12400 RETURN
12410 REM -----
12420 REM ** SUBROUTINE TO PRINT LINK HEADING **
12470 PRINT #1, TAB(21); " L I N K   D A T A "
12480 PRINT #1, TAB(10); "FROM"; TAB(19); "TO"; TAB(51); "MIN COVER"
12490 PRINT #1, " LINK"; TAB(10); "NODE"; TAB(18); "NODE";
12500 PRINT #1, " LENGTH"; TAB(41); "DIAMETER"; TAB(53); "DEPTH"
12510 PRINT #1, "  "; TAB(11); " "; TAB(19); " "; TAB(29); UNIT$(2);
12520 PRINT #1, TAB(43); UNIT$(4); TAB(53); UNIT$(3)
12530 PRINT #1, ""
12540 RETURN
12550 REM -----
12560 REM ** SUBROUTINE TO PRINT NODE HEADING **
12610 PRINT #1, TAB(21); " N O D E   D A T A "
12620 PRINT #1, TAB(66); "GROUND"
12630 PRINT #1, " NODE F A C T O R"; TAB(19); "AREA"; TAB(25); "MIN POP"; TAB(35); "MAX
  POP"; TAB(45); "MIN WASTE"; TAB(55); "MAX WASTE"; TAB(65); "ELEVATION"
12640 PRINT #1, "  #   MIN PEAK"; TAB(19); "(ha)"; TAB(25); "(CAF/ha)"; TAB(35); "(CA
  P/ha)"; TAB(45); "(L/CAP)"; TAB(55); "(L/CAP)"; TAB(67); UNIT$(3)
12650 PRINT #1, ""
12660 RETURN
12670 REM -----
12680 REM ** SUBROUTINE TO CHANGE SYSTEM CHARACTERISTICS **
12750 ISAVE = 0
12760 CLS
12770 PRINT "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12780 PRINT
12790 PRINT "PROJECT TITLE"; TAB(40); TITLE$
12800 PRINT "  NUMBER OF NODES:"; TAB(40); NNODE; TAB(45); "  *"
12810 PRINT "  NUMBER OF LINKS:"; TAB(40); NLINK; TAB(45); "  *"
12820 PRINT "  RATE OF I/I:"; TAB(40); RO; " (CMD/ha)"
12830 PRINT "  MINIMUM SCOUR VELOCITY:"; TAB(40); VELMIN; " "; UNIT$(5)
12840 PRINT "  MAXIMUM VELOCITY:"; TAB(40); VELMAX; " "; UNIT$(5)
12850 PRINT "  MINIMUM COVER DEPTH (DEFAULT):"; TAB(40); COVERMIN; " "; UNIT$(3)
12860 PRINT "  MAXIMUM COVER DEPTH:"; TAB(40); COVERMAX; " "; UNIT$(3)
12870 PRINT "  SEWER OUTFALL NODE #:"; TAB(40); NREF
12874 PRINT "  MANNING' ROUGHNESS COEFFICIENT:"; TAB(40); ROUGH
12880 PRINT "  CROWN ELEVATION OF OUTFALL NODE:"; TAB(40); ELEVREF; " "; UNIT$(3)
12890 PRINT " * UPDATED BY PROGRAM AS NEEDED. NOT USER EDITABLE."
12900 GOSUB 21730: REM HOLD SCREEN
12910 CLS
12920 PRINT "PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
12930 PRINT "PROJECT TITLE:"; TAB(40); "DEFAULT = "; TITLE$;
12940 INPUT TEMP$
12941 IF TEMP$ <> "" THEN TITLE$ = TEMP$
12960 PRINT "  RATE OF I/I:"; TAB(40); "DEFAULT = "; RO;
12965 INPUT TEMP$
12970 IF TEMP$ <> "" THEN RO = ABS(VAL(TEMP$))
12990 PRINT "  MINIMUM SCOUR VELOCITY:"; TAB(40); "DEFAULT = "; VELMIN;
13000 INPUT TEMP$

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13010 IF TEMP$ <> "" THEN VELMIN = ABS(VAL(TEMP$))
13020 PRINT " MAXIMUM VELOCITY:";TAB(40);"DEFAULT =";VELMAX;
13030 INPUT TEMP$
13040 IF TEMP$ <> "" THEN VELMAX = ABS(VAL(TEMP$))
13050 PRINT " DEFAULT MINIMUM COVER DEPTH:";TAB(40);"DEFAULT =";COVERMIN;
13060 INPUT TEMP$
13070 IF TEMP$ <> "" THEN COVERMIN = ABS(VAL(TEMP$))
13080 PRINT " MAXIMUM COVER DEPTH:";TAB(40);"DEFAULT =";COVERMAX;
13090 INPUT TEMP$
13100 IF TEMP$ <> "" THEN COVERMAX = ABS(VAL(TEMP$))
13110 PRINT " SEMER OUTFALL NODE #:";TAB(40);"DEFAULT =";NREF;
13120 INPUT TEMP$
13130 IF TEMP$ <> "" THEN NREF = ABS(VAL(TEMP$))
13131 PRINT " MANNING'ROUGNESS COEFFICIENT:";TAB(40);"DEFAULT =";ROUGH;
13132 INPUT TEMP$
13133 IF TEMP$ <> "" THEN ROUGH = ABS(VAL(TEMP$))
13140 PRINT " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);"DEFAULT =";ELEVREF;
13150 INPUT TEMP$
13160 IF TEMP$ <> "" THEN ELEVREF = ABS(VAL(TEMP$))
13170 CLS
13180 PRINT" OPTIONS AVAILABLE FOR UNITS":PRINT
13220 PRINT"     FLOW IN LITERS PER SECOND (LPS)"
13230 PRINT"     LENGTHS AND ELEVATIONS IN METERS (M)"
13240 PRINT"     DIAMETERS IN CENTIMETERS (CM)"
13250 PRINT
13310 IUNITS = 2
13340 GOSUB 16560: REM ASSIGN UNIT$()
13350 PRINT:PRINT"SYSTEM CHANGES COMPLETE."
13360 GOSUB 21730: REM SCREEN BOLD
13370 RETURN
13380 REM -----
13390 REM ** SUBROUTINE TO ADD NODES **
13440 ISAVE = 0
13450 CLS
13460 PRINT" THERE ARE CURRENTLY "; NNODE; "NODES IN THE NETWORK."
13470 IF NNODE +1>MNODE THEN PRINT"MAXIMUM NUMBER OF NODES HAVE BEEN ENTERED.":G
OSUB 21730 :GOTO 13580
13480 PRINT"ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU"
13490 PRINT
13500 INPUT "ENTER NODE NUMBER:";NN$
13510 IF NN$="M"OR NN$="m" THEN GOTO 13580
13520 NNODE = NNODE+1
13530 NODE(NNODE)=VAL(NN$)
13540 INPUT " AREA (ba) ";EA(NNODE)
13541 INPUT " MIN FACTOR = ";PEAK1(NNODE)
13542 INPUT " PEAK FACTOR = ";PEAK(NNODE)
13543 INPUT " POP.AT T = Te [ BEGIN TIME ] (CAPITA/ha) ";DENM(NNODE)
13544 INPUT " POP.AT T = Tm [ END OF TIME ] (CAPITA/ha) ";DEN(NNODE)
13545 INPUT " WASTE AT T = Te [ LITERS PER CAPITA PER DAY ] ";WERM(NNODE)
13546 INPUT " WASTE AT T = Tm [ LITERS PER CAPITA PER DAY ] ";WER(NNODE)
13550 PRINT" ENTER ELEVATION OF NODE ";UNIT$(3);": ";
13560 INPUT ELEV(NNODE)

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13570 GOTO 13470
13580 RETURN
13590 REM -----
13600 REM ** SUBROUTINE TO DELETE NODES **
13650 ISAVE = 0
13660 CLS
13670 PRINT"ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU":PRINT
13680 INPUT "ENTER THE NUMBER OF THE NODE TO BE DELETED"; ND$
13690 IF ND$="M" OR ND$="m" THEN GOTO 13880
13700 ND = ABS(VAL(ND$))
13710 I=1
13720 IF I>NNODE THEN PRINT:PRINT"NODE NUMBER ENTERED NOT IN LIST PLEASE REENTER
":GOTO 13670
13730 IF NODE (I)<>ND THEN I=I+1:GOTO 13720
13740 PRINT"NODE #";ND;"HAS THE FOLLOWING DATA:"
13750 PRINT"   AREA (ba) ";BA(I)
13751 PRINT"   MIN FACTOR = ";PEAK1(I)
13752 PRINT"   PEAK FACTOR = ";PEAK(I)
13753 PRINT"   POP.AT T = Te [ BEGIN TIME ] (CAPITA/ba) ";DENM(I)
13754 PRINT"   POP.AT T = Tm [ END OF TIME ] (CAPITA/ba) ";DEN(I)
13755 PRINT"   WASTE AT T = Te [ LITERS PER CAPITA PER DAY ] ";WERM(I)
13756 PRINT"   WASTE AT T = Tm [ LITERS PER CAPITA PER DAY ] ";WER(I)
13760 PRINT"   ELEV ";UNIT$(3);" = ";ELEV(I)
13770 INPUT "IS THIS THE NODE TO BE DELETED (Y/N)";ANS$
13780 IF ANS$<>"Y" AND ANS$<>"y" THEN GOTO 13670
13790 FOR J=I TO NNODE-1
13800 NODE(J) = NODE(J+1)
13805 HA(J) = HA(J+1)
13809 PEAK1(J) = PEAK1(J+1)
13810 PEAK(J) = PEAK(J+1)
13811 DENM(J) = DENM(J+1)
13812 DEN(J) = DEN(J+1)
13813 WERM(J) = WERM(J+1)
13814 WER(J) = WER(J+1)
13815 C(J) = C(J+1)
13820 ELEV(J) = ELEV(J+1)
13830 NEXT J
13840 NNODE = NNODE-1
13850 PRINT"NODE HAS BEEN DELETED"
13860 PRINT
13870 GOTO 13670
13880 RETURN
13890 REM -----
13900 REM ** SUBROUTINE TO CHANGE NODE DATA **
13950 ISAVE = 0
13960 CLS
13970 PRINT"ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU":PRINT
13980 INPUT "ENTER THE NUMBER OF THE NODE TO CHANGE";ND$
13990 IF ND$="M" OR ND$="m" THEN GOTO 14210
14000 ND = ABS(VAL(ND$))
14010 I=1
14020 IF I>NNODE THEN PRINT :PRINT"NODE NUMBER ENTERED NOT IN LIST. PLEASE REENT
ER":GOTO 13970

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14030 IF NODE(I)<>ND THEN I=I+1:GOTO 14020
14040 PRINT"NODE #";ND;"HAS THE FOLLOWING DATA:"
14050 PRINT" AREA (ba) ";TAB(20);BA(I)
14051 PRINT" MIN FACTOR = ";PEAK1(I)
14052 PRINT" PEAK FACTOR = ";PEAK(I)
14055 PRINT" POP.AT T = Te [ BEGIN TIME ] (CAPITA/ba) ";DENM(I)
14056 PRINT" POP.AT T = Tm [ END OF TIME ] (CAPITA/ba) ";DEN(I)
14057 PRINT" WASTE AT T = Te [LITERS PER CAPITA PER DAY ] ";WERM(I)
14058 PRINT" WASTE AT T = Tm [LITERS PER CAPITA PER DAY ] ";WER(I)
14060 PRINT" ELEV ";UNIT$(3);" = ";TAB(20);ELEV(I)
14070 INPUT "IS THIS THE NODE TO BE CHANGED (Y/N)";ANS$
14080 IF ANS$<>"Y" AND ANS$<>"y" THEN GOTO 13970
14090 PRINT"PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
14100 PRINT"NODE #";TAB(20);"DEFAULT = ";ND;
14110 INPUT TEMP$
14120 IF TEMP$<>" " THEN NODE(I) = ABS(VAL(TEMP$))
14130 PRINT" AREA (ba) ";TAB(20);"DEFAULT = ";BA(I);
14135 INPUT TEMP$
14140 IF TEMP$<>" " THEN BA(I) = VAL(TEMP$)
14141 PRINT" MIN FACTOR ";TAB(20);"DEFAULT = ";PEAK1(I);
14142 INPUT TEMP$
14143 IF TEMP$<>" " THEN PEAK1(I) = VAL(TEMP$)
14144 PRINT" PEAK FACTOR ";TAB(20);"DEFAULT = ";PEAK(I);
14145 INPUT TEMP$
14146 IF TEMP$<>" " THEN PEAK(I) = VAL(TEMP$)
14151 PRINT" POP.AT T = Te ";TAB(20);"DEFAULT = ";DENM(I);
14152 INPUT TEMP$
14153 IF TEMP$<>" " THEN DENM(I) = VAL(TEMP$)
14154 PRINT" POP.AT T = Tm ";TAB(20);"DEFAULT = ";DEN(I);
14155 INPUT TEMP$
14156 IF TEMP$<>" " THEN DEN(I) = VAL(TEMP$)
14157 PRINT" WASTE AT T = Te ";TAB(20);"DEFAULT = ";WERM(I);
14158 INPUT TEMP$
14159 IF TEMP$<>" " THEN WERM(I) = VAL(TEMP$)
14160 PRINT" WASTE AT T = Tm ";TAB(20);"DEFAULT = ";WER(I);
14161 INPUT TEMP$
14162 IF TEMP$<>" " THEN WER(I) = VAL(TEMP$)
14178 PRINT" ELEV ";UNIT$(3);TAB(20);"DEFAULT = ";ELEV(I);
14179 INPUT TEMP$
14180 IF TEMP$<>" " THEN ELEV(I) = VAL(TEMP$)
14190 PRINT"NODE CHANGE COMPLETE":PRINT
14200 GOTO 13970
14210 RETURN
14220 REM -----
14230 REM ** SUBROUTINE TO ADD LINKS **
14290 ISAVE = 0
14300 CLS
14310 PRINT"THERE ARE CURRENTLY";NLINK;" LINK IN THE NETWORK."
14320 IF NLINK+1>MLINK THEN PRINT "MAXIMUM NUMBER OF LINKS HAVE BEEN ENTERED." :G
OSUB 21730:GOTO 14480
14330 PRINT"ENTER 'M' FOR LINK NUMBER AFTER LAST LINK HAS BEEN ENTERED."
14340 PRINT

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14350 INPUT "ENTER LINK NUMBER:";LN$
14360 IF LN$="M" OR LN$="m" THEN GOTO 14480
14370 NLINK=NLINK+1
14380 LINK(NLINK)=VAL(LN$)
14390 INPUT " ENTER FROM NODE:";NFROM(NLINK)
14400 INPUT " ENTER TO NODE:";NTO(NLINK)
14410 PRINT " ENTER LENGTH OF LINK ";UNIT$(2);": ";:INPUT SPAN(NLINK)
14420 PRINT " ENTER DIAMETER OF LINK ";UNIT$(4);": ";:INPUT DIAM(NLINK)
14430 COVER$=" "
14440 PRINT " ENTER MINIMUM COVER DEPTH (DEFAULT=";COVERMIN;"): ";:INPUT COVER$
14450 IF COVER$="" THEN COVER(NLINK)=COVERMIN ELSE COVER(NLINK)=VAL(COVER$)
14460 PRINT
14470 GOTO 14320
14480 RETURN
14490 REM -----
14500 REM ** SUBROUTINE TO DELETED LINKS **
14560 ISAVE = 0
14570 CLS
14580 PRINT"ENTER 'M' TO RETURN TO MAIN MENU":PRINT
14590 INPUT "ENTER THE NUMBER OF THE LINK TO BE DELETED";LN$
14600 IF LN$="M" OR LN$="m" THEN GOTO 14830
14610 LN = ABS(VAL(LN$))
14620 I=1
14630 IF I>NLINK THEN PRINT :PRINT "LINK";LN;" NOT IN LIST. PLEASE REENTER":GOTO
14580
14640 IF LINK(I)<>LN THEN I=I+1:GOTO 14630
14650 PRINT"LINK #";LN;"HAS THE FOLLOWING DATA:"
14660 PRINT" FROM NODE = ";TAB(34);NFROM(I)
14670 PRINT" TO NODE = ";TAB(34);NTO(I)
14680 PRINT" LENGTH";UNIT$(2);" = ";TAB(34);SPAN(I)
14690 PRINT" DIAMETER";UNIT$(4);" = ";TAB(34);DIAM(I)
14700 PRINT" MINIMUM COVER DEPTH = ";TAB(34);COVER(I)
14710 INPUT "IS THIS THE LINK TO BE DELETED (Y/N)";ANS$
14720 IF ANS$<>"Y" AND ANS$<>"y" THEN PRINT :GOTO 14580
14730 FOR J=1 TO NLINK-1
14740 LINK(J) = LINK(J+1)
14750 SPAN(J) = SPAN(J+1)
14760 DIAM(J) = DIAM(J+1)
14770 NFROM(J) = NFROM(J+1)
14780 NTO(J) = NTO(J+1)
14790 COVER(J) = COVER(J+1)
14800 NEXT J
14810 NLINK = NLINK-1
14820 GOTO 14580
14830 RETURN
14840 REM -----
14850 REM ** SUBROUTINE TO CHANGE LINK DATA **
14910 ISAVE = 0
14920 CLS
14930 PRINT"ENTER 'M' FOR THE LINK # TO RETURN TO MAIN MENU":PRINT
14940 INPUT "ENTER THE NUMBER OF THE LINK TO BE CHANGED";LN$
14950 IF LN$="M" OR LN$="m" THEN GOTO 15290

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14960 LN = ABS(VAL(LN$))
14970 I=1
14980 IF I>NLINK THEN PRINT :PRINT"LINK";LN;" NOT IN LIST. PLEASE REENTER":GOTO
14930
14990 IF LINK(I)<>LN THEN I=I+1:GOTO 14980
15000 PRINT"LINK #";LN;"HAS THE FOLLOWING DATA:"
15010 PRINT" FROM NODE = ";TAB(37);NFROM(I)
15020 PRINT" TO NODE = ";TAB(37);NTO(I)
15030 PRINT" LENGTH";UNIT$(2);" = ";TAB(37);SPAN(I)
15040 PRINT" DIAMETER";UNIT$(4);" = ";TAB(37);DIAM(I)
15050 PRINT" MINIMUM COVER DEPTH = ";TAB(37);COVER(I)
15060 INPUT "IS THIS THE LINK TO BE CHANGED (Y/N)";ANS$
15070 IF ANS$<>"Y" AND ANS$<>"y" THEN PRINT :GOTO 14930
15080 PRINT"PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
15090 PRINT"LINK #";TAB(30);"DEFAULT =";LN;
15100 INPUT TEMP$
15110 IF TEMP$<>" " THEN LINK(I) = ABS(VAL(TEMP$))
15120 PRINT"FROM NODE";TAB(30);"DEFAULT =";NFROM(I);
15130 INPUT TEMP$
15140 IF TEMP$<>" " THEN NFROM(I) = ABS(VAL(TEMP$))
15150 PRINT"TO NODE";TAB(30);"DEFAULT =";NTO(I);
15160 INPUT TEMP$
15170 IF TEMP$<>" " THEN NTO(I) = ABS(VAL(TEMP$))
15180 PRINT"LENGTH ";UNIT$(2);TAB(30);"DEFAULT =";SPAN(I);
15190 INPUT TEMP$
15200 IF TEMP$<>" " THEN SPAN(I) = ABS(VAL(TEMP$))
15210 PRINT"DIAMETER ";UNIT$(4);TAB(30);"DEFAULT =";DIAM(I);
15220 INPUT TEMP$
15230 IF TEMP$<>" " THEN DIAM(I) = ABS(VAL(TEMP$))
15240 PRINT"MINIMUM COVER DEPTH";TAB(30);"DEFAULT =";COVER(I);
15250 INPUT TEMP$
15260 IF TEMP$<>" " THEN COVER(I) = ABS(VAL(TEMP$))
15270 PRINT"LINK CHANGE COMPLETE":PRINT
15280 GOTO 14930
15290 RETURN
15300 REM -----
15310 REM ** SUBROUTINE TO PERFORM SEWER DESIGN **
15480 CLS
15490 FULLTHETA = 4.3
15500 FLAT = .0008
15510 NDIGIT = 5
15520 IF NLINK = NNODE-1 THEN GOTO 15660
15530 PRINT"NETWORK IS NOT BRANCHED."
15540 PRINT"NUMBER OF LINKS MUST EQUAL NUMBER OF NODES - 1"
15550 GOSUB 21730
15560 GOTO 15840
15660 COLOR 31,0:PRINT TAB(25);"DOMESTIC SEWERS SYSTEM WORKING":COLOR 7,0:PRINT
15670 GOSUB 16960:REM RENUMBER NODES
15680 IF IERROR = 1 THEN GOSUB 19820:GOSUB 21730:GOTO 15840
15690 GOSUB 17400:REM FLOWS DETERMINED
15700 IF IERROR = 1 THEN GOSUB 19820: GOSUB 21730:GOTO 15840
15740 GOSUB 17870: REM FIND MAX & MIN SLOPES

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15750 IF IERROR = 1 THEN GOSUB 21730: GOTO 15790
15760 GOSUB 18300: REM SET PIPE SLOPES
15770 GOSUB 19400: REM FIND VELOCITIES AND WATER DEPTHS
15780 GOSUB 19700: REM CHECK MAXIMUM COVER DEPTH AND OUTFALL ELEVATION
15790 GOSUB 19820: REM REASSIGN ORIGINAL NODE NUMBERS
15800 GOSUB 20060: REM LIST DATA
15810 FOR I=1 TO NLINE
15830 NEXT I
15840 RETURN
15850 REM -----
15860 REM ** SUBROUTINE TO SAVE DATA TO DISK **
15850 CLS
15860 INPUT "ENTER NAME OF FILE TO BE SAVED: ";A$
15865 DF$ = "DATA" + A$
15870 OPEN "W" + DF$
15880 PRINT "NEW SAVING DATA"
15890 PRINT "*****"
15900 PRINT "LINE NO: NODE NO: PIPE NO: RCP NO: PE"
15910 PRINT "ELEV: ROUGH: TE"
15920 PRINT "COVERMIN: COVERMAX: VELMIN: VELMAX"
15930 FOR I=1 TO NLINK
16040 PRINT "LINK(I);NFROM(I);NTO(I);SPAN(I);DIAM(I);COVER(I)
16050 NEXT I
16060 FOR I=1 TO NNODE
16070 PRINT "NODE(I);HA(I);DENM(I);DEN(I);WERM(I);WER(I);C(I);ELEV(I);PEAK1(I)
;PEAK(I)
16080 NEXT I
16090 CLOSE
16100 ISAVE = 1
16110 PRINT "DATA NOW SAVED IN FILE: ";DF$
16120 GOSUB 21730: REM SCREEN HOLD
16130 RETURN
16140 REM -----
16150 REM ** SUBROUTINE TO START A NEW RUN **
16200 CLS
16210 IF ISAVE = 0 THEN GOSUB 16380
16220 RUN
16230 REM -----
16240 REM ** SUBROUTINE TO END PROGRAM **
16290 CLS
16300 IF ISAVE = 0 THEN GOSUB 16380
16310 CHAIN "SELECT1"
16320 REM -----
16330 REM ** SUBROUTINE TO TEST FOR DATA SAVE **
16380 INPUT "SAVE CURRENT DATA TO DISK (Y/N)";ANS$
16390 IF ANS$ <> "N" AND ANS$ <> "n" THEN GOSUB 15950
16400 RETURN
16410 REM -----
16420 REM ** SUBROUTINE TO SET UNIT NAMES **
16560 ON IUNITS GOTO 16660
16660 COEF(1) = .01
16670 COEF(2) = 80!

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16680 COEF(3) = 4343.06
16690 UNIT$(1) = "(LPS)"
16700 UNIT$(2) = "(M)"
16710 UNIT$(3) = "(M)"
16720 UNIT$(4) = "(CM)"
16730 UNIT$(5) = "(MPS)"
16740 GOTO 16830
16830 FM$(1) = "###"
16840 FM$(2) = "##.###"
16850 FM$(3) = "###.##"
16860 FM$(4) = ".###"
16870 FM$(5) = "##.##"
16880 FM$(6) = "#####.##"
16890 RETURN
16900 REM -----
16910 REM ** SUBROUTINE TO RENUMBER NODES AND LINKS **
16960 IERROR = 0
16970 FOR I=1 TO NLINK
16980 KTO = 0
16990 KFROM = 0
17000 FOR J=1 TO NNODE
17010 IF KFROM = 1 THEN GOTO 17060
17020 IF NFROM(I) <> NODE(J) THEN GOTO 17060
17030 NFROM(I) = J
17040 KFROM = 1
17050 GOTO 17100
17060 IF KTO = 1 THEN GOTO 17100
17070 IF NTO(I) <> NODE(J) THEN GOTO 17100
17080 NTO(I) = J
17090 KTO = 1
17100 NEXT J
17110 IF KTO = 1 AND KFROM = 1 THEN GOTO 17150
17120 IF KFROM <> 1 THEN PRINT "NODE";NFROM(I);" NOT IN 'FROM NODE #' LIST"
17130 IF KTO <> 1 THEN PRINT "NODE";NTO(I);" NOT IN 'TO NODE #' LIST"
17140 IERROR = 1
17150 NEXT I
17160 IF IERROR <> 1 THEN GOTO 17210
17170 PRINT"PLEASE CHECK TO AND FROM NODE NUMBERS AND REFERENCE NODE NUMBER."
17180 PRINT"THEY MAY HAVE BEEN CHANGED INCORRECTLY BECAUSE OF THIS ERROR."
17190 GOSUB 21730: REM SCREEN HOLD
17200 GOTO 17330
17210 KNODE = 0
17220 FOR I=1 TO NNODE
17230 IF (KNODE=0) AND (NODE(I) = NREF) THEN NREF = I:KNODE = 1
17240 NEXT I
17250 IF KNODE=1 THEN GOTO 17320
17260 PRINT"REFERENCE NODE #";NREF;" IS NOT IN 'NODE #' LIST"
17270 PRINT"PLEASE CHECK TO AND FROM NODE NUMBERS AND REFERENCE NODE NUMBER."
17280 PRINT"THEY MAY HAVE BEEN CHANGED INCORRECTLY BECAUSE OF THIS ERROR."
17290 IERROR = 1
17300 GOSUB 21730: REM SCREEN HOLD
17310 GOTO 17330

```

```

17320 PRINT
17330 RETURN
17340 REM -----
17350 REM ** SUBROUTINE TO ASSIGN INITIAL FLOWS **
17400 FOR I=1 TO NNODE
17410 NDEGREE(I) = 0
17420 CUMDEM(I) = (BA(I)*DEN(I)*WER(I)*PEAK(I)/86400!) + (BA(I)*RO/86.4)
17425 CUMDEM(I) = (BA(I)*DENM(I)*WERM(I)*PEAK(I)/86400!) + (BA(I)*RO/86.4)
17430 NEXT I
17440 FOR I=1 TO NLINK
17450 FLOW(I) = 0
17455 FLOWM(I) = 0
17460 NEXT I
17470 REM FIND DEGREE OF ALL NODES
17480 FOR I=1 TO NLINK
17490 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
17500 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
17510 NEXT I
17520 REM SET FLOWS
17530 FOR I=1 TO NLINK
17540 IF (NDEGREE(NFROM(I)) <> 1) OR (NDEGREE(NTO(I)) = 0) THEN GOTO 17600
17550 FLOW(I) = CUMDEM(NFROM(I))
17555 FLOWM(I) = CUMDEM(NFROM(I))
17560 CUMDEM(NTO(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17565 CUMDEM(NTO(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17570 NDEGREE(NFROM(I)) = 0
17580 NDEGREE(NTO(I)) = NDEGREE(NTO(I))-1
17590 GOTO 17650
17600 IF (NDEGREE(NTO(I)) <> 1) OR (NDEGREE(NFROM(I)) = 0) THEN GOTO 17650
17610 FLOW(I) = -CUMDEM(NTO(I))
17615 FLOWM(I) = -CUMDEM(NTO(I))
17620 CUMDEM(NFROM(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17625 CUMDEM(NFROM(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17630 NDEGREE(NTO(I)) = 0
17640 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))-1
17650 NEXT I
17660 NSUM = 0
17670 FOR I=1 TO NNODE
17680 NSUM = NSUM+NDEGREE(I)
17690 NEXT I
17700 IF NSUM > 0 THEN GOTO 17530
17710 IERROR = 0
17720 FOR I=1 TO NLINK
17730 IF FLOW(I) > 0! THEN GOTO 17770
17735 IF FLOWM(I) > 0! THEN GOTO 17770
17740 PRINT "THE CALCULATED FLOW IN LINK";LINK(I); "IS NEGATIVE."
17750 PRINT "PLEASE CHECK THAT THE FROM AND TO NODES ARE ASSIGNED CORRECTLY."
17760 IERROR = 1
17770 NEXT I
17780 PRINT " FLOWS DETERMINED."
17790 RETURN
17800 REM -----

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17810 REM ** SUBROUTINE TO FIND MIN AND MAX ALLOWABLE SLOPES **
17870 FOR J=1 TO NLINK
17880 CONST = COEF(2)*FLOWM(J)/(VELMIN*DIAM(J)^2)
17890 THETA = 0!
17900 FOR K=1 TO NDIGIT
17910 FOR I=1 TO 10
17920 TEMP = THETA+(I*10!^(1-K))
17930 IF (TEMP-SIN(TEMP)) > CONST THEN GOTO 17950
17940 NEXT I
17950 THETA = TEMP-(10!^(1-K))
17960 NEXT K
17970 IF THETA > FULLTHETA THEN THETA = FULLTHETA
17980 SLOPEMIN(J) = (COEF(3)*ROUGH*FLOWM(J)*THETA^(2!/3!)/(DIAM(J)^(8!/3!))*(THET
A-SIN(THETA))^(5!/3!))^2
17990 IF SLOPEMIN(J) < FLAT THEN SLOPEMIN(J) = FLAT
18000 NEXT J
18010 IERROR = 0
18020 FOR J=1 TO NLINK
18030 THETA = 0!
18040 CONST = COEF(2)*FLOW(J)/(VELMAX*DIAM(J)^2)
18050 FOR K=1 TO NDIGIT
18060 FOR I=1 TO 10
18070 TEMP = THETA+(I*10!^(1-K))
18080 IF (TEMP-SIN(TEMP)) >CONST THEN GOTO 18100
18090 NEXT I
18100 THETA = TEMP-(10!^(1-K))
18110 NEXT K
18120 IF THETA <= FULLTHETA THEN GOTO 18150
18130 IERROR = 1
18140 PRINT"LINK ";LINK(J);" TOO SMALL TO CARRY THE FLOW."
18150 SLOPEMAX(J)=(COEF(3)*ROUGH*FLOW(J)*THETA^(2!/3!)/(DIAM(J)^(8!/3!))*(THETA-S
IN(THETA))^(5!/3!))^2
18160 IF SLOPEMAX(J) < FLAT THEN SLOPEMAX(J) = FLAT
18170 NEXT J
18180 PRINT" MINIMUM AND MAXIMUM ALLOWABLE SLOPES FOUND."
18190 RETURN
18200 REM -----
18210 REM ** SUBROUTINE TO ASSIGN PIPE SLOPES AND ELEVATIONS **
18300 FOR I=1 TO NLINK
18310 GROUNDSLOPE(I) = (ELEV(NFROM(I))-ELEV(NTO(I)))/SPAN(I)
18320 NEXT I
18330 FOR I=1 TO NNODE
18340 NDEGREE(I) = 0
18350 CUMDEPTH(I) = ELEV(I)
18360 NEXT I
18370 FOR I=1 TO NLINK
18380 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
18390 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
18400 NEXT I
18410 FOR I=1 TO NLINK
18420 IF NDEGREE(NFROM(I)) = 1 THEN CUMDEPTH(NFROM(I)) = ELEV(NFROM(I))-COVER(I)

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18430 NEXT I
18440 FOR I=1 TO NLINK
18450 IF NDEGREE(NFROM(I)) <> 1 THEN GOTO 18820
18460 IF GROUNDSLOPE(I) > SLOPEMIN(I) THEN GOTO 18520
18465 IF SLOPEMIN(I) < SLOPEMAX(I) THEN GOTO 18470
18466 PIPESLOPE(I) = SLOPEMAX(I)
18467 GOTO 18480
18470 PIPESLOPE(I) = SLOPEMIN(I)
18480 TEMPCROWN = ELEV(NFROM(I))-COVER(I)
18490 IF TEMPCROWN < CUMDEPTH(NFROM(I)) THEN UPCROWN(I) = TEMPCROWN ELSE UPCROWN
(I) = CUMDEPTH(NFROM(I))
18500 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18510 GOTO 18790
18520 IF GROUNDSLOPE(I) < SLOPEMAX(I) THEN GOTO 18700
18530 TEMPDOWN = ELEV(NTO(I))-COVER(I)
18540 TEMPUP = TEMPDOWN+SPAN(I)*SLOPEMAX(I)
18550 IF TEMPUP > CUMDEPTH(NFROM(I)) THEN GOTO 18600
18560 PIPESLOPE(I) = SLOPEMAX(I)
18570 UPCROWN(I) = TEMPUP
18580 DOWNCROWN(I) = TEMPDOWN
18590 GOTO 18790
18600 TEMPSLOPE = (CUMDEPTH(NFROM(I))-(ELEV(NTO(I))-COVER(I)))/SPAN(I)
18610 IF TEMPSLOPE > SLOPEMAX(I) THEN GOTO 18660
18620 IF TEMPSLOPE > SLOPEMIN(I) THEN PIPESLOPE(I) = TEMPSLOPE ELSE PIPESLOPE(I)
= SLOPEMIN(I)
18630 UPCROWN(I) = CUMDEPTH(NFROM(I))
18640 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18650 GOTO 18790
18660 PIPESLOPE(I) = SLOPEMAX(I)
18670 DOWNCROWN(I) = ELEV(NTO(I))-COVER(I)
18680 UPCROWN(I) = DOWNCROWN(I)+SPAN(I)*PIPESLOPE(I)
18690 GOTO 18790
18700 IF CUMDEPTH(NFROM(I)) < (ELEV(NFROM(I))-COVER(I)) THEN GOTO 18750
18710 PIPESLOPE(I) = GROUNDSLOPE(I)
18720 UPCROWN(I) = ELEV(NFROM(I))-COVER(I)
18730 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18740 GOTO 18790
18750 TEMPSLOPE = (CUMDEPTH(NFROM(I))-(ELEV(NTO(I))-COVER(I)))/SPAN(I)
18760 IF TEMPSLOPE > SLOPEMIN(I) THEN PIPESLOPE(I) = TEMPSLOPE ELSE PIPESLOPE(I)
= SLOPEMIN(I)
18770 UPCROWN(I) = CUMDEPTH(NFROM(I))
18780 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18790 IF DOWNCROWN(I) < CUMDEPTH(NTO(I)) THEN CUMDEPTH(NTO(I)) = DOWNCROWN(I)
18800 NDEGREE(NTO(I)) = NDEGREE(NTO(I))-1
18810 NDEGREE(NFROM(I)) = 0
18820 NEXT I
18830 NSUM = 0
18840 FOR I=1 TO NNODE
18850 NSUM = NSUM+NDEGREE(I)
18860 NEXT I
18870 IF NSUM > 0 THEN GOTO 18440
18880 OUTCROWN = CUMDEPTH(NREF)

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18890 FOR I=1 TO NLINK
18900 UPINVERT(I) = UPCROWN(I)-DIAM(I)*COEF(1)
18910 DOWNINVERT(I) = DOWNCROWN(I)-DIAM(I)*COEF(1)
18920 XUP(I) = ELEV(NFROM(I))-UPINVERT(I)
18930 XDOWN(I) = ELEV(NTO(I))-DOWNINVERT(I)
18940 NEXT I
18950 FOR I=1 TO NNODE
18960 NDEGREE(I) = 0
18970 NEXT I
18980 FOR I=1 TO NLINK
18990 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
19000 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
19010 NEXT I
19020 FOR I=1 TO NLINK
19030 TOP = DOWNINVERT(I)
19040 BOTTOM = DOWNINVERT(I)
19050 FOR J=1 TO NLINK
19060 IF (NTO(I) = NTO(J)) AND (DOWNINVERT(J) > TOP) THEN TOP = DOWNINVERT(J)
19070 IF (NTO(I) = NFROM(J)) AND (UPINVERT(J) < BOTTOM) THEN BOTTOM = UPINVERT(J)
)
19080 NEXT J
19090 DROP(NTO(I)) = TOP - BOTTOM
19100 XNODE(NTO(I)) = ELEV(NTO(I))-BOTTOM
19110 IF NDEGREE(NTO(I)) <> 1 THEN GOTO 19140
19120 DROP(NTO(I)) = 0!
19130 XNODE(NTO(I)) = ELEV(NTO(I))-DOWNINVERT(I)
19140 IF NDEGREE(NFROM(I)) <> 1 THEN GOTO 19170
19150 DROP(NFROM(I)) = 0!
19160 XNODE(NFROM(I)) = ELEV(NFROM(I))-UPINVERT(I)
19170 NEXT I
19180 SLENGTH = 0!
19190 SDEPTH = 0!
19200 SAREA = 0!
19210 SDIAM = 0!
19220 FOR I=1 TO NLINK
19230 SLENGTH = SLENGTH+SPAN(I)
19240 XDEPTH = .5*(XUP(I)+XDOWN(I))
19250 SDEPTH = SDEPTH+XDEPTH*SPAN(I)
19260 SAREA = SAREA+XDEPTH*SPAN(I)*DIAM(I)*COEF(1)
19270 SDIAM = SDIAM+DIAM(I)*SPAN(I)
19280 NEXT I
19290 AVGDEPTH = SDEPTH/SLENGTH
19300 AVGAREA = SAREA/SLENGTH
19310 AVGDIAM = SDIAM/SLENGTH
19320 PRINT " PIPE SLOPES AND ELEVATIONS FOUND."
19330 RETURN
19340 REM -----
19350 REM ** SUBROUTINE TO FIND WATER DEPTHS AND VELOCITIES **
19400 FOR J=1 TO NLINK
19410 CONST = COEF(3)*ROUGH*FLOW(J)/(DIAM(J)^(8!/3!)*SQR(PIPESLOPE(J)))
19420 THETA = 0!
19430 FOR K=1 TO NDIGIT

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19440 FOR I=1 TO 10
19450 TEMP = THETA+(1*10!^(1-K))
19460 COMPAR = (TEMP-SIN(TEMP))^(5!/3!)/(TEMP^(2!/3!))
19470 IF COMPAR > CONST THEN GOTO 19490
19480 NEXT I
19490 THETA = TEMP-(10!^(1-K))
19500 NEXT K
19510 ANGLE(J) = THETA
19520 NEXT J
19530 FOR I=1 TO NLINK
19540 VELOCITY(I)=COEF(2)*FLOW(I)/(DIAM(I)^2*(ANGLE(I)-SIN(ANGLE(I))))
19545 DEPTH(I) = (1!-COS(ANGLE(I)/2!))*DIAM(I)/2!
19550 NEXT I
19551 FOR J=1 TO NLINK
19552 CONST = COEF(3)*ROUGH*FLOW(J)/(DIAM(J)^(8!/2!)*SQR(PIPESLOPE(J)))
19553 THETA = 0!
19554 FOR K=1 TO NDIGIT
19555 FOR I=1 TO 10
19556 TEMP = THETA+(1*10!^(1-K))
19557 COMPAR = (TEMP-SIN(TEMP))^(5!/3!)/(TEMP^(2!/3!))
19558 IF COMPAR > CONST THEN GOTO 19560
19559 NEXT I
19560 THETA = TEMP-(10!^(1-K))
19561 NEXT K
19562 ANGLE(J) = THETA
19563 NEXT J
19564 FOR I=1 TO NLINK
19565 VELOCITYM(I)=COEF(2)*FLOWM(I)/(DIAM(I)^2*(ANGLE(I)-SIN(ANGLE(I))))
19566 DEPTHM(I) = (1!-COS(ANGLE(I)/2!))*DIAM(I)/2!
19569 PIPESLOPE(I) = PIPESLOPE(I)*100!
19570 REM **                SLOPEMAX(),SLOPEMIN(),SPAN() **
19580 SLOPEMIN(I) = SLOPEMIN(I)*100!
19590 SLOPEMAX(I) = SLOPEMAX(I)*100!
19600 GROUNDSLOPE(I) = GROUNDSLOPE(I)*100!
19610 NEXT I
19620 PRINT"  VELOCITIES AND DEPTHS OF FLOW FOUND. "
19630 RETURN
19640 REM -----
19650 REM ** SUBROUTINE TO CHECK MAX COVER CONSTRAINT **
19700 FOR I=1 TO NLINK
19710 IMAX(I)=0
19715 IMIN(I)=0
19716 A(I)=0
19720 IF ((ELEV(NFROM(I))-UPCROWN(I)) > COVERMAX) OR ((ELEV(NTO(I))-DOWNCROWN(I))
) > COVERMAX) THEN IMAX(I) = 1
19725 IF VELOCITYM(I) < VELMIN THEN IMIN(I) = 1
19726 IF SLOPEMIN(I) > SLOPEMAX(I) THEN A(I) = 1
19730 NEXT I
19740 PRINT"  MAXIMUM COVER DEPTHS CHECKED. "
19750 RETURN
19760 REM -----
19770 REM ** SUBROUTINE TO REASSIGN ORIGINAL NODE AND LINK NUMBERS **

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19820 FOR I=1 TO NLINK
19830 NTO(I) = NODE(NTO(I))
19840 NFROM(I) = NODE(NFROM(I))
19850 NEXT I
19860 NREF = NODE(NREF)
19870 PRINT
19880 RETURN
19890 REM -----
19900 REM ** SUBROUTINE TO PRINT RESULTS **
20060 CLS
20070 OPEN "SCRN:" FOR OUTPUT AS #1
20080 IPAGE = 15
20090 GOSUB 20470
20100 CLOSE
20110 CLS
20120 INPUT "WOULD YOU LIKE TO REVIEW RESULTS AGAIN (Y/N)";ANS$
20130 IF ANS$ = "Y" OR ANS$ = "y" THEN GOTO 20060
20140 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)";ANS$
20150 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20200
20160 OPEN "LPT1:" FOR OUTPUT AS #1
20170 IPAGE = MPAGE
20180 GOSUB 20470
20190 CLOSE
20200 INPUT "DO YOU WANT A DISK COPY OF THE DATA (Y/N)";ANS$
20210 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20270
20220 GOSUB 22000
20270 RETURN
20280 REM -----
20290 REM ** SUBROUTINE TO PRINT OUT RESULTS DATA **
20470 IF (IPAGE <> MPAGE) THEN CLS
20480 IUNITS=2:PRINT #1,"PROJECT TITLE:";TAB(17);TITLE$
20490 PRINT #1,""
20500 PRINT #1," NUMBER OF NODES:";TAB(40);NNODE
20510 PRINT #1," NUMBER OF LINKS:";TAB(40);NLINK
20530 PRINT #1," MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
20540 PRINT #1," MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
20550 PRINT #1," MAXIMUM COVER DEPTH:";TAB(40);COVERMAX;" ";UNIT$(3)
20560 PRINT #1," SEWER OUTFALL NODE #:";TAB(40);NREF
20570 PRINT #1," CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)

20580 PRINT #1,""
20590 PRINT #1,"TOTAL SYSTEM LENGTH:";TAB(40);SLENGTH
20600 PRINT #1,"AVERAGE WEIGHTED DIAMETER:";TAB(40);AVGDIAM
20610 PRINT #1,"AVERAGE WEIGHTED EXCAVATION DEPTH:";TAB(40);AVGDEPTH
20620 PRINT #1,"AVERAGE WEIGHTED EXCAVATION AREA:";TAB(40);AVGAREA
20630 PRINT #1,""
20640 IF OUTCROWN < ELEVREF THEN PRINT #1,"WARNING : ELEVATION OF LAST PIPE IS LOWER THAN CROWN OF OUTFALL NODE."
20650 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20660 GOSUB 21160
20670 FOR I=1 TO NLINK
20680 IF IMAX(I) = 1 THEN PRINT #1,"*";

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20685 IF IMIN(1) = 1 THEN PRINT #1,TAB(2);"-";
20686 IF A(1) = 1 THEN PRINT #1,TAB(3);"$";
20690 PRINT #1,TAB(4);USING FM$(1);LINK(I);
20700 PRINT #1,TAB(9);USING FM$(1);WFROM(I);
20710 PRINT #1,TAB(14);USING FM$(1);WTO(I);
20720 PRINT #1,TAB(17);USING FM$(2);FLOW(I)*.001;
20730 PRINT #1,TAB(23);USING FM$(2);FLOWM(I)*.001;
20740 PRINT #1,TAB(30);USING FM$(1);DIAM(I);
20750 PRINT #1,TAB(34);USING FM$(5);SLOPEMAX(I);
20760 PRINT #1,TAB(40);USING FM$(5);SLOPEMIN(I);
20765 PRINT #1,TAB(46);USING FM$(5);GROUNDSLOPE(I);
20770 PRINT #1,TAB(52);USING FM$(5);PIPESLOPE(I);
20775 PRINT #1,TAB(57);USING FM$(5);VELOCITY(I);
20780 PRINT #1,TAB(62);USING FM$(5);VELOCITYM(I);
20790 PRINT #1,TAB(67);USING FM$(3);DEPTH(I);
20800 PRINT #1,TAB(73);USING FM$(3);DEPTHM(I)
20810 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21160

20820 NEXT I
20830 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20840 GOSUB 21370
20850 FOR I=1 TO NLINK
20860 IF IMAX(I) = 1 THEN PRINT #1,"*";
20870 PRINT #1,TAB(2);USING FM$(1);LINK(I);
20875 PRINT #1,TAB(8);USING FM$(3);SPAN(I);
20880 PRINT #1,TAB(15);USING FM$(3);XUP(I)+UPINVERT(I);
20890 PRINT #1,TAB(23);USING FM$(3);XDOWN(I)+DOWNINVERT(I);
20900 PRINT #1,TAB(31);USING FM$(3);UPCROWN(I);
20910 PRINT #1,TAB(39);USING FM$(3);DOWNCROWN(I);
20920 PRINT #1,TAB(46);USING FM$(3);UPINVERT(I);
20930 PRINT #1,TAB(54);USING FM$(3);DOWNINVERT(I);
20940 PRINT #1,TAB(63);USING FM$(3);XUP(I);
20950 PRINT #1,TAB(72);USING FM$(3);XDOWN(I)
20960 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21370

20970 NEXT I
20980 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20990 GOSUB 21560
21000 FOR I=1 TO NNODE
21010 PRINT #1,TAB(2);USING FM$(1);NODE(I);
21020 PRINT #1,TAB(9);USING FM$(5);HA(I);
21030 PRINT #1,TAB(20);USING FM$(3);ELEV(I);
21040 PRINT #1,TAB(32);USING FM$(3);XNODE(I);
21050 PRINT #1,TAB(52);USING FM$(3);DROP(I)
21060 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21560

21070 NEXT I
21080 IF (IPAGE <> MPAGE) THEN GOSUB 21730:ELSE PRINT #1,"":PRINT #1,""
21090 RETURN
21100 REM -----
21110 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING : **
21160 PRINT #1,"PROJECT TITLE:";TITLE$

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21170 PRINT #1,TAB(20);" L I N K   D A T A";TAB(50);"* => MAX COVER DEPTH EXCEED
ED"
21175 PRINT #1,"                - => MIN VELOCI
TY TOO LOW"
21176 PRINT #1,"                # => MIN SLOPE
EXCEED"
21180 PRINT #1,""
21190 PRINT #1,"  LINK";TAB(10);" N O D E";
21200 PRINT #1,TAB(20);" F L O W";TAB(30);" DIAM";TAB(36);" S L O P E",
21210 PRINT #1,TAB(46);" S L O P E";
21220 PRINT #1,TAB(59);" VELOCITY";TAB(69);" D E P T H "
21230 PRINT #1,TAB(9);" FROM";TAB(15);" TO";TAB(19);" MAX";TAB(25);" MIN";TAB(36);" M
AX";TAB(42);" MIN";TAB(46);" GROUND";TAB(53);" PIPE";TAB(59);" MAX";TAB(64);" MIN";
21240 PRINT #1,TAB(69);" MAX";
21250 PRINT #1,TAB(75);" MIN"
21260 PRINT #1,"    #";TAB(11);" #";TAB(16);" #";TAB(19);"(cu.m/s)";TAB(30);"(CM
);TAB(37);" #";
21270 PRINT #1,TAB(43);" #";TAB(48);" #";TAB(54);" #";TAB(59);"(m/s)";TAB(72);"(C
M)"
21290 PRINT #1,""
21300 RETURN
21310 REM -----
21320 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 2 **
21370 PRINT #1,"PROJECT TITLE: ";TITLE$
21380 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"
21390 PRINT #1,""
21400 PRINT #1,TAB(15);" GROUND ELEV";TAB(31);" CROWN ELEV";
21410 PRINT #1,TAB(46);" INVERT ELEV";TAB(61);" EXCAVATION DEPTH"
21420 PRINT #1,TAB(2);" LINK";TAB(8);" LENGTH";TAB(15);" UPSTRM";TAB(23);" DNSTRM";
21430 PRINT #1,TAB(31);" UPSTRM";TAB(39);" DNSTRM";TAB(46);" UPSTRM";
21440 PRINT #1,TAB(54);" DNSTRM";TAB(63);" UPSTRM";TAB(72);" DNSTRM"
21450 PRINT #1," #";TAB(10);"(M)";TAB(17);UNIT$(3);TAB(25);"(M)";
21460 PRINT #1,TAB(33);UNIT$(3);TAB(41);UNIT$(3);TAB(49);UNIT$(3);
21470 PRINT #1,TAB(55);UNIT$(3);TAB(64);UNIT$(3);TAB(73);UNIT$(3)
21480 PRINT #1,""
21490 RETURN
21500 REM -----
21510 REM ** SUBROUTINE TO PRINT NODE RESULTS HEADING **
21560 PRINT #1,"PROJECT TITLE: ";TITLE$
21570 PRINT #1,TAB(13);" N O D E   D A T A "
21580 PRINT #1,""
21590 PRINT #1,TAB(21);" GROUND";TAB(31);" EXCAVATION";
21600 PRINT #1,TAB(47);" DIST HIGH INVERT"
21610 PRINT #1," NODE";TAB(10);" AREA";TAB(22);" ELEV";
21620 PRINT #1,TAB(34);" DEPTH";TAB(49);" TO LOW INVERT"
21630 PRINT #1," #";TAB(10);"(ha)";TAB(23);UNIT$(3);
21640 PRINT #1,TAB(35);UNIT$(3);TAB(54);UNIT$(3)
21650 PRINT #1,""
21660 RETURN
21670 REM -----
21680 REM ** SUBROUTINE TO HOLD SCREEN **

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```

21730 LOCATE 24,1
21740 COLOR 0,7
21750 PRINT"PRESS ANY KEY TO CONTINUE";
21760 COLOR 7,0
21770 A$ = INKEY$:IF A$="" THEN GOTO 21770
21780 RETURN
22000 REM ** SUBROUTINE TO SAVE DATA TO DISK **
22010 CLS
22020 INPUT "ENTER NAME OF DISK FILE TO BE SAVED:";AF$
22021 DF$ = "b:"+AF$+".dom"
22030 OPEN "O",1,DF$
22040 PRINT"NOW SAVING DATA"
22050 PRINT #1,TITLE$
22060 PRINT #1,NLINK;NNODE;A;B;KK;RO;NEEF
22070 PRINT #1,ELEVREF;ROUGH;TE
22080 PRINT #1,COVERMIN,COVERMAX,VELMIN,VELMAX,SLENGTB,AVGDIAM,AVGDEPTH,AVGAREA,
OUTCROWN
22090 FOR I=1 TO NLINK
22100 PRINT #1,LINK(I);NFROM(I);NTO(I);SPAN(I);DIAM(I);COVER(I);IMAX(I);IMIN(I);
FLOW(I);FLOWM(I);DEPTH(I);VELOCITY(I);VELOCITYM(I);PIPESLOPE(I);SLOPEMIN(I);SLOP
EMAX(I);GROUNDSLOPE(I);XUP(I);UPINVERT(I);XDOWN(I);DOWNINVERT(I);DPCROWN(I);DOWN
CROWN(I)
22105 PRINT #1,A(I);DEPTHM(I)
22110 NEXT I
22120 FOR I=1 TO NNODE
22130 PRINT #1,NODE(I);HA(I);DENM(I);DEN(I);WERM(I);WER(I);C(I);ELEV(I);XNODE(I)
;DROP(I);PEAK1(I);PEAK(I)
22140 NEXT I
22150 CLOSE
22170 PRINT"DATA NOW SAVED IN FILE:";DF$
22180 GOSUB 21730: REM SCREEN HOLD
22190 RETURN

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Listing ส่วนเมนูหลักของของโปรแกรมการออกแบบระบบระบายน้ำฝน

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10000 CLEAR
10010 CLS
10020 DEFINT I-J,L-M
10030 OPTION BASE 1
10040 IESC = 27
10050 ON ERROR GOTO 10480
10060 KEY OFF
10070 MPAGE = 30000
10080 MLINK = 120
10090 MNODE = 121
10100 ISAVE = 1
10110 DIM ANGLE(MLINK),PEAK1(MNODE),PEAK(MNODE)
10120 DIM COEF(3),COVER(MLINK),CUMDEM(MNODE),COMDEPTH(MNODE),A(MLINK)
10125 DIM BA(MNODE),DEN(MNODE),DENH(MNODE),WER(MNODE),WERM(MNODE),C(MNODE)
10126 DIM CUMDEM(MNODE),FLOWM(MLINK),VELFULL(MLINK),GS(MLINK),STO(MLINK)
10127 DIM T(MLINK),IMIN(MLINK),FL(MLINK),FLO(MLINK),DEPTHM(MLINK)
10130 DIM DEPTH(MLINK),DIAM(MLINK),DOWNCROWN(MLINK),DOWNINVERT(MLINK)
10140 DIM DROP(MNODE),ELEV(MNODE),FLOW(MLINK),FM$(6),VELOCITYM(MLINK)
10150 DIM GROUNDSLOPE(MLINK),IMAX(MLINK),LINK(MLINK),NDEGREE(MNODE)
10160 DIM NFROM(MLINK),NODE(MNODE),WTO(MLINK),PIPESLOPE(MLINK)
10170 DIM SLOPEMAX(MLINK),SLOPEMIN(MLINK),SPAN(MLINK)
10180 DIM UNIT$(6),UPCROWN(MLINK),UPINVERT(MLINK),VELOCITY(MLINK)
10190 DIM XDOWN(MLINK),XNODE(MNODE),XOP(MLINK)
10200 CLS
10210 PRINT"STORM SEWER MENU"
10220 PRINT
10230 PRINT"  1. INPUT DATA FROM KEYBOARD"
10240 PRINT"  2. INPUT DATA FROM DISK FILE"
10250 PRINT"  3. LIST DATA"
10260 PRINT"  4. CHANGE SYSTEM CHARACTERISTICS"
10270 PRINT"  5. ADD NODES"
10280 PRINT"  6. DELETE NODES"
10290 PRINT"  7. CHANGE NODE DATA"
10300 PRINT"  8. ADD LINKS"
10310 PRINT"  9. DELETE LINKS"
10320 PRINT" 10. CHANGE LINK DATA"
10330 PRINT" 11. DESIGN SEWERS"
10340 PRINT" 12. SAVE DATA TO DISK"
10350 PRINT" 13. START A NEW RUN"
10360 PRINT" 14. END"
10370 PRINT
10380 INPUT "ENTER NUMBER OF DESIRED ACTION: ";IAC
10390 IF IAC<1 OR IAC>14 THEN PRINT"NOT WITHIN RANGE. PLEASE REENTER":GOTO 103
80
10400 ON IAC GOSUB 10690,11500,11820,12750,13440,13650,13950,14290,14560,14910,
15480,15950,16200,16290
10410 GOTO 10200
10420 REM -----
10430 REM ** ERROR TRAP **
10480 CLOSE
10490 CLS: CLOSE: PRINT:PRINT

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10500 PRINT TAB(20);"WARNING !!      WARNING !!"
10510 PRINT"AN ERROR HAS OCCURED IN LINE ";ERL;" IN THE MAIN PROGRAM."
10520 PRINT"THE ERROR CODE IS ";ERR
10530 PRINT
10540 PRINT"AFTER THIS MESSAGE, YOU WILL RETURNED TO THE MENU."
10550 PRINT"SAVE YOUR DATA TO DISK IF YOU HAVE NOT ALREADY DONE SO !!"
10560 GOSUB 21730
10570 RESUME 10200
10580 REM -----
10590 REM ** SUBROUTINE TO ENTER DATA FROM KEYBOARD **
10690 IF ISAVE =0 THEN GOSUB 16380
10700 ISAVE=0
10710 CLS
10720 LINE INPUT "ENTER TITLE FOR PROJECT: ";TITLE$
10730 PRINT"          a "
10740 PRINT" i -----"
10750 PRINT"      (t+b)^k  ":PRINT
10755 PRINT" i = 14648/(t+48)^1.03 [ Rainfall intensity frequency in 100 years {
Bangkok } ]"
10756 PRINT" i = 12667/(t+45)^1.02 [ Rainfall intensity frequency in 50 years {
Bangkok } ]"
10757 PRINT" i = 10868/(t+42)^1.01 [ Rainfall intensity frequency in 25 years {
Bangkok } ]"
10760 PRINT" i = 8418/(t+37)^1.00 [ Rainfall intensity frequency in 10 years {
Bangkok } ]"
10770 PRINT" i = 6994/(t+34)^0.99 [ Rainfall intensity frequency in 5 years {
Bangkok } ]"
10775 PRINT" i = 4803/(t+28)^0.97 [ Rainfall intensity frequency in 2 years {
Bangkok } ]"
10780 INPUT " a = ";A:INPUT " b = ";B:INPUT " k = ";KK
10790 PRINT
10800 PRINT"          FLOW IN LITERS PER SECOND (LPS)"
10810 PRINT"          LENGTHS AND ELEVATIONS IN METERS (M)"
10820 PRINT"          DIAMETERS IN CENTIMETERS (CM)"
10830 PRINT
10840 INPUT "ENTER RATE OF I/I ; (CMD/ha) ";RO
10860 IUNITS = 2
10870 GOSUB 16560 : REM ASSIGN UNIT$( )
10880 INPUT "ENTER NUMBER OF THE OUTFALL NODE:";NREF
10890 PRINT"ENTER THE CROWN ELEVATION OF THE OUTFALL NODE:";UNIT$(3);
10900 INPUT ELEVREF
10920 PRINT"ENTER MINIMUM SCOUR VELOCITY ALLOWABLE:";UNIT$(5);
10930 INPUT VELMIN
10940 PRINT"ENTER MAXIMUM VELOCITY ALLOWABLE:";UNIT$(5);
10950 INPUT VELMAX
10960 PRINT"ENTER DEFAULT MINIMUM COVER DEPTH:";UNIT$(3);
10970 INPUT COVERMIN
10980 PRINT"ENTER MAXIMUM COVER DEPTH:";UNIT$(3);
10990 INPUT COVERMAX
11000 INPUT "ENTER MANNING'S ROUGHNESS COEFFICIENT:";ROUGH
11001 INPUT "TIME OF ENTRY (MIN)";TE
11010 CLS

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11020 I=0 : GOTO 11240
11030 PRINT"BEGIN ENTERING LINK DATA"
11040 PRINT:PRINT"ENTER 'M' FOR LINK # TO DISCONTINUE.";TAB(65);"ENTRY #";I+1
11050 PRINT:INPUT "ENTER LINK NUMBER:";LN$
11060 IF LN$ = "M" OR LN$ = "m" THEN GOTO 11210
11070 I=I+1
11080 LINK(I) = VAL(LN$)
11090 INPUT " ENTER FROM NODE:";NFROM(I)
11100 INPUT " ENTER TO NODE:";NTO(I)
11110 PRINT" ENTER LENGTH OF LINK ";UNIT$(2);": ";
11120 INPUT SPAN(I)
11130 PRINT" ENTER LINK DIAMETER ";UNIT$(4);": ";
11140 INPUT DIAM(I)
11150 COVER$ = ""
11160 PRINT" ENTER MINIMUM COVER DEPTH (DEFAULT =";COVERMIN;"): ";
11170 INPUT COVER$
11180 IF COVER$ = "" THEN COVER(I) = COVERMIN ELSE COVER(I) = VAL (COVER$)
11190 IF I+1 > NLINK THEN PRINT"MAXIMUM NUMBER OF LINKS ENTERED.":GOSUB 21730:GOT
O 11210
11200 GOTO 11040
11210 NLINK = I:GOTO 11370
11220 CLS
11230 I = 0 : GOTO 11030
11240 PRINT"BEGIN ENTERING NODE DATA"
11250 PRINT:PRINT"ENTER 'M' FOR NODE # TO DISCONTINUE."; TAB(50);"ENTRY #"; I+1
11260 PRINT:INPUT "ENTER NODE NUMBER:";NN$
11270 IF NN$ = "M" OR NN$ = "m" THEN GOTO 11360
11280 I=I+1
11290 NODE(I)=VAL(NN$)
11300 INPUT " AREA (ba) ";HA(I)
11305 PEAK1(I)=0 : PEAK(I)=0 : DENM(I)=0 : DEN(I)=0 : WERM(I)=0 : WER(I)=0
11310 INPUT " RUNOFF COEFFICIENT = ";C(I)
11320 PRINT" ENTER GROUND ELEVATION OF NODE "; UNIT$(3);": ";
11330 INPUT ELEV(I)
11340 IF I+1 > NNODE THEN PRINT "MAXIMUM NUMBER OF NODES ENTERED.":GOSUB 21730:GOT
O 11360
11350 GOTO 11250
11360 NNODE = I
11365 GOTO 11220
11370 RETURN
11380 REM -----
11390 REM ** SUBROUTINE TO ENTER DATA FROM DISK FILE **
11500 IF ISAVE = 0 THEN GOSUB 16380: REM TEST DATA SAVE
11510 ISAVE = 0
11520 CLS
11525 FILES "b:*.s*"
11530 INPUT "ENTER NAME OF DISK FILE TO BE READ:"; AF$
11535 DF$ = "b:"+AF$
11540 OPEN "I",1,DF$
11550 PRINT"NOW READING DATA"
11560 LINE INPUT #1,TITLE$
11570 INPUT #1,NLINK,NNODE,A,B,KK,RO,WREF

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```

11580 INPUT #1, ELEVREF, ROUGH, TE
11590 INPUT #1, COVERMIN, COVERMAX, VELMIN, VELMAX
11600 FOR I=1 TO NLINK
11610 INPUT #1, LINK(I), NFROM(I), NTO(I), SPAN(I), DIAM(I), COVER(I)
11620 NEXT I
11630 FOR I = 1 TO NNODE
11640 INPUT #1, NODE(I), HA(I), DENM(I), DEN(I), WERM(I), WER(I), C(I), ELEV(I), PEAK1(I)
, PEAK(I)
11650 NEXT I
11660 CLOSE
11670 GOSUB 16560: REM SET UNIT NAMES
11680 PRINT : PRINT "DATA READ." : PRINT "  FILENAME : "; DF$
11690 PRINT " PROJECT TITLE : "; TITLE$
11700 GOSUB 21730: REM HOLD SCREEN
11710 RETURN
11720 REM -----
11730 REM ** SUBROUTINE TO LIST DATA **
11820 CLS
11830 OPEN "SCRN:" FOR OUTPUT AS #1
11840 IPAGE = 18
11850 GOSUB 12140
11860 CLOSE
11870 CLS
11880 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)"; ANS$
11890 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 12010
11900 OPEN "LPT1:" FOR OUTPUT AS #1
11910 IPAGE = MPAGE
11920 GOSUB 12140
11930 CLOSE
12010 RETURN
12020 REM -----
12030 REM ** SUBROUTINE TO PRINT OUT DATA **
12140 IF (IPAGE <> MPAGE) THEN CLS
12150 PRINT #1, "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12160 PRINT #1,
12170 PRINT #1, "PROJECT TITLE"; TAB(40); TITLE$
12180 PRINT #1, " NUMBER OF NODES:"; TAB(40); NNODE
12190 PRINT #1, " NUMBER OF LINKS:"; TAB(40); NLINK
12191 PRINT #1, "          a "
12192 PRINT #1, "  i -----"
12193 PRINT #1, "      (t+b)^k  ": PRINT #1,
12194 PRINT #1, "  a = "; TAB(40); A: PRINT #1, "  b = "; TAB(40); B: PRINT #1, "  k
= "; TAB(40); KK
12200 PRINT #1, "  RATE OF I/I:"; TAB(40); RO; " (CMD/ba)"
12210 PRINT #1, "  MINIMUM SCOUR VELOCITY:"; TAB(40); VELMIN; " "; UNIT$(5)
12220 PRINT #1, "  MAXIMUM VELOCITY:"; TAB(40); VELMAX; " "; UNIT$(5)
12230 PRINT #1, "  MANNING'S ROUGHNESS COEFFICIENT:"; TAB(40); ROUGH
12235 PRINT #1, "  TIME OF ENTRY:"; TAB(40); TE
12240 PRINT #1, "  SEWER OUTFALL NODE #:"; TAB(40); NREF
12250 PRINT #1, "  CROWN ELEVATION OF OUTFALL NODE:"; TAB(40); ELEVREF; " "; UNIT$(3)
)
12260 IF IPAGE <> MPAGE THEN GOSUB 21730: CLS: ELSE PRINT #1, "": PRINT #1, ""

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12270 GOSUB 12470
12280 FOR I = 1 TO NLINK
12290 PRINT #1,TAB(2);LINK(I);TAB(10);NFROM(I);TAB(18);NTO(I);
12300 PRINT #1,TAB(28);SPAN(I);TAB(43);DIAM(I);TAB(53);COVER(I)
12310 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 12470

12320 NEXT I
12330 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
12340 GOSUB 12610
12350 FOR I = 1 TO NNODE
12360 PRINT #1,TAB(2);NODE(I);TAB(17);HA(I);TAB(30);C(I);TAB(50);ELEV(I)
12370 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 126
10
12380 NEXT I
12390 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
12400 RETURN
12410 REM -----
12420 REM ** SUBROUTINE TO PRINT LINK HEADING **
12470 PRINT #1,TAB(21); " L I N K   D A T A "
12480 PRINT #1,TAB(10); "FROM";TAB(19);"TO";TAB(51);"MIN COVER"
12490 PRINT #1," LINK";TAB(10);"NODE";TAB(18);"NODE";
12500 PRINT #1,TAB(28);"LENGTH";TAB(41);"DIAMETER";TAB(53);"DEPTH"
12510 PRINT #1," #";TAB(11);"#";TAB(19);"#";TAB(29);UNIT$(2);
12520 PRINT #1,TAB(43);UNIT$(4);TAB(53);UNIT$(3)
12530 PRINT #1,""
12540 RETURN
12550 REM -----
12560 REM ** SUBROUTINE TO PRINT NODE HEADING **
12610 PRINT #1,TAB(21);" N O D E   D A T A "
12620 PRINT #1,TAB(51);"GROUND"
12630 PRINT #1," NODE";TAB(17);"AREA";TAB(30);"RUNOFF COE.";TAB(50);"ELEVATION"

12640 PRINT #1," #";TAB(17);" ha";TAB(55);UNIT$(3)
12650 PRINT #1,""
12660 RETURN
12670 REM -----
12680 REM ** SUBROUTINE TO CHANGE SYSTEM CHARACTERISTICS **
12750 ISAVE = 0
12760 CLS
12770 PRINT "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12780 PRINT
12790 PRINT"PROJECT TITLE";TAB(40);TITLE$
12800 PRINT"  NUMBER OF NODES:";TAB(40);NNODE;TAB(45);" #"
12810 PRINT"  NUMBER OF LINKS:";TAB(40);NLINK;TAB(45);" #"
12811 PRINT"          a "
12812 PRINT"  i =-----"
12813 PRINT"          (t+b)^k   :PRINT
12814 PRINT"  a = ";TAB(40);A:PRINT"  b = ";TAB(40);B:PRINT"  k = ";TAB(40
);KK
12820 PRINT"  RATE OF I/I:";TAB(40);RO;" (CMD/ha)"
12830 PRINT"  MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
12840 PRINT"  MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)

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12850 PRINT " MINIMUM COVER DEPTH (DEFAULT):";TAB(40);COVERMIN;" ";UNIT$(3)
12860 PRINT " MAXIMUM COVER DEPTH:";TAB(40);COVERMAX;" ";UNIT$(3)
12870 PRINT " SEWER OUTFALL NODE #:";TAB(40);NREF
12875 PRINT " MANNING' ROUGHNESS COEFFICIENT:";TAB(40);ROUGH
12876 PRINT " TIME OF ENTRY:";TAB(40);TE
12880 PRINT " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)
12890 PRINT:PRINT:PRINT " * UPDATED BY PROGRAM AS NEEDED. NOT USER EDITABLE."
12900 GOSUB 21730:REM HOLD SCREEN
12910 CLS
12920 PRINT "PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
12930 PRINT "PROJECT TITLE:";TAB(40);"DEFAULT = ";TITLE$;
12940 INPUT TEMP$
12941 IF TEMP$ <> "" THEN TITLE$ = TEMP$
12942 PRINT "          a "
12943 PRINT " i =-----"
12944 PRINT "          (t+b)^k ";PRINT
12945 PRINT " i = 14648/(t+48)^1.03 [ Rainfall intensity frequency in 100 years { Bangkok } ]"
12946 PRINT " i = 12667/(t+45)^1.02 [ Rainfall intensity frequency in 50 years { Bangkok } ]"
12947 PRINT " i = 10868/(t+42)^1.01 [ Rainfall intensity frequency in 25 years { Bangkok } ]"
12948 PRINT " i = 8418/(t+37)^1.00 [ Rainfall intensity frequency in 10 years { Bangkok } ]"
12949 PRINT " i = 6994/(t+34)^0.99 [ Rainfall intensity frequency in 5 years { Bangkok } ]"
12950 PRINT " i = 4803/(t+28)^0.97 [ Rainfall intensity frequency in 2 years { Bangkok } ]"
12951 PRINT " a:";TAB(40);"DEFAULT =";A;
12952 INPUT TEMP$
12953 IF TEMP$ <> "" THEN A = ABS(VAL(TEMP$))
12954 PRINT " b:";TAB(40);"DEFAULT =";B;
12955 INPUT TEMP$
12956 IF TEMP$ <> "" THEN B = ABS(VAL(TEMP$))
12957 PRINT " c:";TAB(40);"DEFAULT =";CK;
12958 INPUT TEMP$
12959 IF TEMP$ <> "" THEN CK = ABS(VAL(TEMP$))
12960 PRINT " RATE OF I/I:";TAB(40);"DEFAULT =";RO;
12961 INPUT TEMP$
12970 IF TEMP$ <> "" THEN RO = ABS(VAL(TEMP$))
12990 PRINT " MINIMUM SCOUR VELOCITY:";TAB(40);"DEFAULT =";VELMIN;
13000 INPUT TEMP$
13010 IF TEMP$ <> "" THEN VELMIN = ABS(VAL(TEMP$))
13020 PRINT " MAXIMUM VELOCITY:";TAB(40);"DEFAULT =";VELMAX;
13030 INPUT TEMP$
13040 IF TEMP$ <> "" THEN VELMAX = ABS(VAL(TEMP$))
13050 PRINT " DEFAULT MINIMUM COVER DEPTH:";TAB(40);"DEFAULT =";COVERMIN;
13060 INPUT TEMP$
13070 IF TEMP$ <> "" THEN COVERMIN = ABS(VAL(TEMP$))
13080 PRINT " MAXIMUM COVER DEPTH:";TAB(40);"DEFAULT =";COVERMAX;
13090 INPUT TEMP$
13100 IF TEMP$ <> "" THEN COVERMAX = ABS(VAL(TEMP$))

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13110 PRINT "SEWER OUTFALL NODE #:";TAB(40);"DEFAULT =";NREF;
13120 INPUT TEMP$
13130 IF TEMP$ (<) "" THEN NREF = ABS(VAL(TEMP$))
13131 PRINT "MANNING' ROUGHNESS COEFFICIENT:";TAB(40);"DEFAULT =";ROUGH;
13132 INPUT TEMP$
13133 IF TEMP$ (<) "" THEN ROUGH = ABS(VAL(TEMP$))
13134 PRINT "TIME OF ENTRY:";TAB(40);"DEFAULT =";TE;
13135 INPUT TEMP$
13136 IF TEMP$ (<) "" THEN TE = ABS(VAL(TEMP$))
13140 PRINT "CROWN ELEVATION OF OUTFALL NODE:";TAB(40);"DEFAULT =";ELEVREF;
13150 INPUT TEMP$
13160 IF TEMP$ (<) "" THEN ELEVREF = ABS(VAL(TEMP$))
13170 CLS
13180 PRINT "OPTIONS AVAILABLE FOR UNITS":PRINT
13220 PRINT "FLOW IN LITERS PER SECOND (LFS)"
13230 PRINT "LENGTHS AND ELEVATIONS IN METERS (M)"
13240 PRINT "DIAMETERS IN CENTIMETERS (CM)"
13250 PRINT
13310 IUNITS = 2
13340 GOSUB 16560: REM ASSIGN UNIT$()
13350 PRINT:PRINT"SYSTEM CHANGES COMPLETE."
13360 GOSUB 21730: REM SCREEN HOLD
13370 RETURN
13380 REM -----
13390 REM ** SUBROUTINE TO ADD NODES **
13440 ISAVE = 0
13450 CLS
13460 PRINT "THERE ARE CURRENTLY "; NNODE; "NODES IN THE NETWORK."
13470 IF NNODE +1 > NNODE THEN PRINT "MAXIMUM NUMBER OF NODES HAVE BEEN ENTERED.":G
OSUB 21730 :GOTO 13580
13480 PRINT "ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU"
13490 PRINT
13500 INPUT "ENTER NODE NUMBER:";NN$
13510 IF NN$="M" OR NN$="m" THEN GOTO 13580
13520 NNODE = NNODE+1
13530 NODE(NNODE)=VAL(NN$)
13540 INPUT "AREA (ha) ";BA(NNODE)
13541 PEAK1(NNODE)=0 : PEAK(NNODE)=0
13542 DENM(NNODE)=0 : DEN(NNODE)=0 : WERM(NNODE)=0 : WER(NNODE)=0
13545 INPUT "RUNOFF COEFFICIENT = ";C(NNODE)
13550 PRINT "ENTER ELEVATION OF NODE ";UNIT$(3);":";
13560 INPUT ELEV(NNODE)
13570 GOTO 13470
13580 RETURN
13590 REM -----
13600 REM ** SUBROUTINE TO DELETE NODES **
13650 ISAVE = 0
13660 CLS
13670 PRINT "ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU":PRINT
13680 INPUT "ENTER THE NUMBER OF THE NODE TO BE DELETED"; ND$
13690 IF ND$="M" OR ND$="m" THEN GOTO 13880
13700 ND = ABS(VAL(ND$))

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13710 I=1
13720 IF I>NNODE THEN PRINT:PRINT"NODE NUMBER ENTERED NOT IN LIST PLEASE REENTER
":GOTO 13670
13730 IF NODE(I)<>ND THEN I=I+1:GOTO 13720
13740 PRINT"NODE #";ND;"HAS THE FOLLOWING DATA:"
13750 PRINT" AREA (ba) ";HA(I)
13755 PRINT" RUNOFF COEFFICIENT = ";C(I)
13760 PRINT" ELEV ";UNIT$(3);" = ";ELEV(I)
13770 INPUT "IS THIS THE NODE TO BE DELETED (Y/N)";ANS$
13780 IF ANS$<>"Y" AND ANS$<>"y" THEN GOTO 13670
13790 FOR J=I TO NNODE-1
13800 NODE(J) = NODE(J+1)
13805 HA(J) = HA(J+1)
13809 PEAK1(J) = PEAK1(J+1)
13810 PEAK(J) = PEAK(J+1)
13811 DENM(J) = DENM(J+1)
13812 DEN(J) = DEN(J+1)
13813 WERM(J) = WERM(J+1)
13814 MER(J) = MER(J+1)
13815 C(J) = C(J+1)
13820 ELEV(J) = ELEV(J+1)
13830 NEXT J
13840 NNODE = NNODE-1
13850 PRINT"NODE HAS BEEN DELETED"
13860 PRINT
13870 GOTO 13670
13880 RETURN
13890 REM -----
13900 REM ** SUBROUTINE TO CHANGE NODE DATA **
13950 ISAVE = 0
13960 CLS
13970 PRINT"ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU":PRINT
13980 INPUT "ENTER THE NUMBER OF THE NODE TO CHANGE";ND$
13990 IF ND$="M" OR ND$="m" THEN GOTO 14210
14000 ND = ABS(VAL(ND$))
14010 I=1
14020 IF I>NNODE THEN PRINT :PRINT"NODE NUMBER ENTERED NOT IN LIST. PLEASE REENT
ER":GOTO 13970
14030 IF NODE(I)<>ND THEN I=I+1:GOTO 14020
14040 PRINT"NODE #";ND;"HAS THE FOLLOWING DATA:"
14050 PRINT" AREA (ba) ";TAB(20);HA(I)
14055 PRINT" RUNOFF COE. = ";TAB(20);C(I)
14060 PRINT" ELEV ";UNIT$(3);" = ";TAB(20);ELEV(I)
14070 INPUT "IS THIS THE NODE TO BE CHANGED (Y/N)" ANS$
14080 IF ANS$<>"Y" AND ANS$<>"y" THEN GOTO 13970
14090 PRINT"PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
14100 PRINT"NODE #";TAB(20);"DEFAULT = ";ND;
14110 INPUT TEMP$
14120 IF TEMP$<>" " THEN NODE(I) = ABS(VAL(TEMP$))
14130 PRINT" AREA (ba) ";TAB(20);"DEFAULT = ";HA(I);
14140 INPUT TEMP$
14150 IF TEMP$<>" " THEN HA(I) = VAL(TEMP$)

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14151 PRINT " RONOFF COE. = ";TAB(20);"DEFAULT = ";C(1);
14152 INPUT TEMP$
14153 IF TEMP$(<)" THEN C(1) = VAL(TEMP$)
14160 PRINT " ELEV ";UNIT$(3);TAB(20);"DEFAULT = ";ELEV(1);
14170 INPUT TEMP$
14180 IF TEMP$(<)" THEN ELEV(1) = VAL(TEMP$)
14190 PRINT"MODE CHANGE COMPLETE":PRINT
14200 GOTO 13970
14210 RETURN
14220 REM -----
14230 REM ** SUBROUTINE TO ADD LINKS **
14290 ISAVE = 0
14300 CLS
14310 PRINT"THERE ARE CURRENTLY";NLINK;" LINK IN THE NETWORK."
14320 IF NLINK+1>NLINK THEN PRINT "MAXIMUM NUMBER OF LINKS HAVE BEEN ENTERED.":G
OSUB 21730:GOTO 14480
14330 PRINT"ENTER 'M' FOR LINK NUMBER AFTER LAST LINK HAS BEEN ENTERED."
14340 PRINT
14350 INPUT "ENTER LINK NUMBER: ";LN$
14360 IF LN$="M" OR LN$=" " THEN GOTO 14480
14370 NLINK=NLINK+1
14380 LINK(NLINK)=VAL(LN$)
14390 INPUT " ENTER FROM NODE: ";NFROM(NLINK)
14400 INPUT " ENTER TO NODE: ";NTO(NLINK)
14410 PRINT " ENTER LENGTH OF LINK ";UNIT$(2);" :";INPUT SPAN(NLINK)
14420 PRINT " ENTER DIAMETER OF LINK ";UNIT$(4);" :";INPUT DIAM(NLINK)
14430 COVER$= ""
14440 PRINT " ENTER MINIMUM COVER DEPTH (DEFAULT=";COVERMIN;" )";INPUT COVER$
14450 IF COVER$="" THEN COVER(NLINK)=COVERMIN ELSE COVER(NLINK)=VAL(COVER$)
14460 PRINT
14470 GOTO 14320
14480 RETURN
14490 REM -----
14500 REM ** SUBROUTINE TO DELETED LINKS **
14560 ISAVE = 0
14570 CLS
14580 PRINT"ENTER 'M' TO RETURN TO MAIN MENU":PRINT
14590 INPUT "ENTER THE NUMBER OF THE LINK TO BE DELETED";LN$
14600 IF LN$="M" OR LN$=" " THEN GOTO 14830
14610 LN = ABS(VAL(LN$))
14620 I=1
14630 IF I>NLINK THEN PRINT :PRINT "LINK";LN;" NOT IN LIST. PLEASE REENTER":GOTO
14580
14640 IF LINK(I)<>LN THEN I=I+1:GOTO 14630
14650 PRINT"LINK ";LN;" HAS THE FOLLOWING DATA:"
14660 PRINT " FROM NODE = ";TAB(34);NFROM(I)
14670 PRINT " TO NODE = ";TAB(34);NTO(I)
14680 PRINT " LENGTH";UNIT$(2);" = ";TAB(34);SPAN(I)
14690 PRINT " DIAMETER";UNIT$(4);" = ";TAB(34);DIAM(I)
14700 PRINT " MINIMUM COVER DEPTH = ";TAB(34);COVER(I)
14710 INPUT "IS THIS THE LINK TO BE DELETED (Y/N)";ANS$
14720 IF ANS$(<)"Y" AND ANS$(<)"y" THEN PRINT :GOTO 14580

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14730 FOR J=1 TO NLINK-1
14740 LINK(J) = LINK(J+1)
14750 SPAN(J) = SPAN(J+1)
14760 DIAM(J) = DIAM(J+1)
14770 NFROM(J) = NFROM(J+1)
14780 NTO(J) = NTO(J+1)
14790 COVER(J) = COVER(J+1)
14800 NEXT J
14810 NLINK = NLINK-1
14820 GOTO 14580
14830 RETURN
14840 REM -----
14850 REM ** SUBROUTINE TO CHANGE LINK DATA **
14910 ISAVE = 0
14920 CLS
14930 PRINT "ENTER 'M' FOR THE LINK $ TO RETURN TO MAIN MENU":PRINT
14940 INPUT "ENTER THE NUMBER OF THE LINK TO BE CHANGED";LN$
14950 IF LN$="M" OR LN$="m" THEN GOTO 15290
14960 LN = ABS(VAL(LN$))
14970 I=1
14980 IF I>NLINK THEN PRINT "LINK";LN;" NOT IN LIST. PLEASE REENTER":GOTO
14930
14990 IF LINK(I)<>LN THEN I=I+1:GOTO 14980
15000 PRINT "LINK ";LN;" HAS THE FOLLOWING DATA:"
15010 PRINT " FROM NODE = ";TAB(37);NFROM(I)
15020 PRINT " TO NODE = ";TAB(37);NTO(I)
15030 PRINT " LENGTH";UNIT$(2);" = ";TAB(37);SPAN(I)
15040 PRINT " DIAMETER";UNIT$(4);" = ";TAB(37);DIAM(I)
15050 PRINT " MINIMUM COVER DEPTH = ";TAB(37);COVER(I)
15060 INPUT "IS THIS THE LINK TO BE CHANGED (Y/N)";ANS$
15070 IF ANS$<>"Y" AND ANS$<>"y" THEN PRINT :GOTO 14930
15080 PRINT "PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
15090 PRINT "LINK ";TAB(30);"DEFAULT =";LN;
15100 INPUT TEMP$
15110 IF TEMP$<>" " THEN LINK(I) = ABS(VAL(TEMP$))
15120 PRINT "FROM NODE";TAB(30);"DEFAULT =";NFROM(I);
15130 INPUT TEMP$
15140 IF TEMP$<>" " THEN NFROM(I) = ABS(VAL(TEMP$))
15150 PRINT "TO NODE";TAB(30);"DEFAULT =";NTO(I);
15160 INPUT TEMP$
15170 IF TEMP$<>" " THEN NTO(I) = ABS(VAL(TEMP$))
15180 PRINT "LENGTH ";UNIT$(2);TAB(30);"DEFAULT =";SPAN(I);
15190 INPUT TEMP$
15200 IF TEMP$<>" " THEN SPAN(I) = ABS(VAL(TEMP$))
15210 PRINT "DIAMETER ";UNIT$(4);TAB(30);"DEFAULT =";DIAM(I);
15220 INPUT TEMP$
15230 IF TEMP$<>" " THEN DIAM(I) = ABS(VAL(TEMP$))
15240 PRINT "MINIMUM COVER DEPTH";TAB(30);"DEFAULT =";COVER(I);
15250 INPUT TEMP$
15260 IF TEMP$<>" " THEN COVER(I) = ABS(VAL(TEMP$))
15270 PRINT "LINK CHANGE COMPLETE":PRINT
15280 GOTO 14930

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15290 RETURN
15300 REM -----
15310 REM ** SUBROUTINE TO PERFORM SEWER DESIGN **
15480 CLS
15490 FULLTHETA = 4.3
15500 FLAT = .0008
15510 NDIGIT = 5
15520 IF NLINK = NNODE-1 THEN GOTO 15660
15530 PRINT "NETWORK IS NOT BRANCHED."
15540 PRINT "NUMBER OF LINKS MUST EQUAL NUMBER OF NODES - 1"
15550 GOSUB 21730
15560 GOTO 15840
15660 COLOR 31,0:PRINT TAB(28);"STORM SEWERS SYSTEM WORKING":COLOR 7,0:PRINT
15670 GOSUB 16960:REM RENUMBER NODES
15680 IF IERROR = 1 THEN GOSUB 19820:GOSUB 21730:GOTO 15840
15690 GOSUB 17400:REM FLOWS DETERMINED
15700 IF IERROR = 1 THEN GOSUB 19820: GOSUB 21730:GOTO 15840
15740 GOSUB 17870: REM FIND MAX & MIN SLOPES
15750 IF IERROR = 1 THEN GOSUB 21730: GOTO 15790
15760 GOSUB 18300: REM SET PIPE SLOPES
15770 GOSUB 19400: REM FIND VELOCITIES AND WATER DEPTHS
15780 GOSUB 19700: REM CHECK MAXIMUM COVER DEPTH AND OUTFALL ELEVATION
15790 GOSUB 19820: REM REASSIGN ORIGINAL NODE NUMBERS
15800 GOSUB 20060: REM LIST DATA
15840 RETURN
15850 REM -----
15860 REM ** SUBROUTINE TO SAVE DATA TO DISK **
15950 CLS
15960 INPUT "ENTER NAME OF DISK FILE TO BE SAVED: ";AF$
15965 DF$ = "b:"+AF$+".stm"
15970 OPEN "O",1,DF$
15980 PRINT "NOW SAVING DATA"
15990 PRINT #1,TITLE$
16000 PRINT #1,NLINK;NNODE;A;B;KK;RO;NREF
16010 PRINT #1,ELEVREF;ROUGH;TE
16020 PRINT #1,COVERMIN;COVERMAX;VELMIN;VELMAX
16030 FOR I=1 TO NLINK
16040 PRINT #1,LINK(I);NFROM(I);NTO(I);SPAN(I);DIAM(I);COVER(I)
16050 NEXT I
16060 FOR I=1 TO NNODE
16070 PRINT #1,NODE(I);HA(I);DENM(I);DEN(I);WERM(I);WER(I);C(I);ELEV(I);PEAK1(I)
;PEAK(I)
16080 NEXT I
16090 CLOSE
16100 ISAVE = 1
16110 PRINT "DATA NOW SAVED IN FILE: ";DF$
16120 GOSUB 21730: REM SCREEN HOLD
16130 RETURN
16140 REM -----
16150 REM ** SUBROUTINE TO START A NEW RUN **
16200 CLS
16210 IF ISAVE = 0 THEN GOSUB 16380

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16220 RUN
16230 REM -----
16240 REM ** SUBROUTINE TO END PROGRAM **
16290 CLS
16300 IF ISAVE = 0 THEN GOSUB 16380
16310 CHAIN "SELECT1"
16320 REM -----
16330 REM ** SUBROUTINE TO TEST FOR DATA SAVE **
16380 INPUT "SAVE CURRENT DATA TO DISK (Y/N)";ANS$
16390 IF ANS$("<"N" AND ANS$("<"n" THEN GOSUB 15950
16400 RETURN
16410 REM -----
16420 REM ** SUBROUTINE TO SET UNIT NAMES **
16560 ON IONITS GOTO 16660
16660 COEF(1) = .01
16670 COEF(2) = 80!
16680 COEF(3) = 4343.06
16690 UNIT$(1) = "(LPS)"
16700 UNIT$(2) = "(M)"
16710 UNIT$(3) = "(M)"
16720 UNIT$(4) = "(CM)"
16730 UNIT$(5) = "(MPS)"
16740 GOTO 16830
16830 FM$(1) = "####"
16840 FM$(2) = "####.###"
16850 FM$(3) = "###.##"
16860 FM$(4) = ".###"
16870 FM$(5) = "##.##"
16880 FM$(6) = "####.##"
16890 RETURN
16900 REM -----
16910 REM ** SUBROUTINE TO RENUMBER NODES AND LINKS **
16960 IERROR = 0
16970 FOR I=1 TO NLINK
16980 KTO = 0
16990 KFROM = 0
17000 FOR J=1 TO NNODE
17010 IF KFROM = 1 THEN GOTO 17060
17020 IF NFROM(I) <> NODE(J) THEN GOTO 17060
17030 NFROM(I) = J
17040 KFROM = 1
17050 GOTO 17100
17060 IF KTO = 1 THEN GOTO 17100
17070 IF NTO(I) <> NODE(J) THEN GOTO 17100
17080 NTO(I) = J
17090 KTO = 1
17100 NEXT J
17110 IF KTO = 1 AND KFROM = 1 THEN GOTO 17150
17120 IF KFROM <> 1 THEN PRINT "NODE";NFROM(1);" NOT IN 'FROM NODE #' LIST"
17130 IF KTO <> 1 THEN PRINT "NODE";NTO(1);" NOT IN 'TO NODE #' LIST"
17140 IERROR = 1
17150 NEXT I

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17160 IF IERROR <> 1 THEN GOTO 17210
17170 PRINT"PLEASE CHECK TO AND FROM NODE NUMBERS AND REFERENCE NODE NUMBER."
17180 PRINT"THEY MAY HAVE BEEN CHANGED INCORRECTLY BECAUSE OF THIS ERROR."
17190 GOSUB 21730: REM SCREEN HOLD
17200 GOTO 17330
17210 KNODE = 0
17220 FOR I=1 TO NNODE
17230 IF (KNODE=0) AND (NODE(I) = NREF) THEN NREF = I:KNODE = 1
17240 NEXT I
17250 IF KNODE=1 THEN GOTO 17320
17260 PRINT"REFERENCE NODE #";NREF;" IS NOT IN 'NODE #' LIST"
17270 PRINT"PLEASE CHECK TO AND FROM NODE NUMBERS AND REFERENCE NODE NUMBER."
17280 PRINT"THEY MAY HAVE BEEN CHANGED INCORRECTLY BECAUSE OF THIS ERROR."
17290 IERROR = 1
17300 GOSUB 21730: REM SCREEN HOLD
17310 GOTO 17330
17320 PRINT
17330 RETURN
17340 REM -----
17350 REM ** SUBROUTINE TO ASSIGN INITIAL FLOWS **
17400 FOR I=1 TO NNODE
17410 NDEGREE(I) = 0
17430 NEXT I
17470 REM FIND DEGREE OF ALL NODES
17480 FOR I=1 TO NLINK
17490 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
17500 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
17510 NEXT I
17520 REM SET FLOWS
17521 H = 0 : TF = 0 : HP = 0
17522 FOR I=1 TO NLINK
17526 CUMDEM(NFROM(I)) = 0
17528 NEXT I
17530 FOR I=1 TO NLINK
17531 GS(I) = (ELEV(NFROM(I))-ELEV(NTO(I)))/SPAN(I)
17532 IF GS(I) < .0008 THEN GS(I) = FLAT
17534 VELFULL(I) = (DIAM(I)/400)^(2/3)*GS(I)^.5/ROUGH
17540 IF (NDEGREE(NFROM(I)) <> 1) OR (NDEGREE(NTO(I)) = 0) THEN GOTO 17600
17544 IF I=1 THEN GOTO 17546
17545 T(I)=SPAN(I-1)/VELFULL(I-1)/60: TF=TF+T(I)
17546 TC=TE+TF : INTEN = A/((TC+B)^KK) : HP = HP+HA(I) : PP = (72*(TC^.105))/((HP
+68158!)*((LOG (HP/96)/LOG (10))/60))/100 : IF PP > 1 THEN PP = 1
17547 H = HP*PP : FLO(I) = (H*C(I)*INTEN*25/9)
17548 FL(I) = (HA(I)*RO/86.4)
17549 FLOO = FLOO + FL(I)
17550 FLOW(I) = FLO(I)+FLOO
17555 CUMDEM(NFROM(I)) = FLOW(I)
17560 CUMDEM(NTO(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17570 NDEGREE(NFROM(I)) = 0
17580 NDEGREE(NTO(I)) = NDEGREE(NTO(I))-1
17590 GOTO 17650
17600 IF (NDEGREE(NTO(I)) <> 1) OR (NDEGREE(NFROM(I)) = 0) THEN GOTO 17650

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17610 FLOW(I) = -CUMDEM(NTO(I))*INTEN
17620 CUMDEM(NFROM(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17630 NDEGREE(NTO(I)) = 0
17640 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))-1
17650 NEXT I
17660 NSUM = 0
17670 FOR I=1 TO NNODE
17680 NSUM = NSUM+NDEGREE(I)
17690 NEXT I
17700 IF NSUM > 0 THEN GOTO 17530
17710 IERROR = 0
17720 FOR I=1 TO NLINK
17730 IF FLOW(I) > 0! THEN GOTO 17770
17740 PRINT"THE CALCULATED FLOW IN LINK";LINK(I);" IS NEGATIVE."
17750 PRINT"PLEASE CHECK THAT THE FROM AND TO NODES ARE ASSIGNED CORRECTLY."
17760 IERROR = 1
17770 NEXT I
17780 PRINT" FLOWS DETERMINED."
17790 RETURN
17800 REM -----
17810 REM ** SUBROUTINE TO FIND MIN AND MAX ALLOWABLE SLOPES **
17870 FOR J=1 TO NLINK
17880 CONST = COEF(2)*FLOW(J)/(VELMIN*DIAM(J)^2)
17890 THETA = 0!
17900 FOR K=1 TO NDIGIT
17910 FOR I=1 TO 10
17920 TEMP = THETA+(I*10!^(1-K))
17930 IF (TEMP-SIN(TEMP)) > CONST THEN GOTO 17950
17940 NEXT I
17950 THETA = TEMP-(10!^(1-K))
17960 NEXT K
17970 IF THETA > FULLTHETA THEN THETA = FULLTHETA
17980 SLOPEMIN(J) = (COEF(3)*ROUGH*FLOW(J)*THETA^(2!/3!)/(DIAM(J)^(8!/3!))*(THETA-SIN(THETA))^(5!/3!))^2
17990 IF SLOPEMIN(J) < FLAT THEN SLOPEMIN(J) = FLAT
18000 NEXT J
18010 IERROR = 0
18020 FOR J=1 TO NLINK
18030 THETA = 0!
18040 CONST = COEF(2)*FLOW(J)/(VELMAX*DIAM(J)^2)
18050 FOR K=1 TO NDIGIT
18060 FOR I=1 TO 10
18070 TEMP = THETA+(I*10!^(1-K))
18080 IF (TEMP-SIN(TEMP)) > CONST THEN GOTO 18100
18090 NEXT I
18100 THETA = TEMP-(10!^(1-K))
18110 NEXT K
18120 IF THETA <= FULLTHETA THEN GOTO 18150
18130 IERROR = 1
18140 PRINT"LINK ";LINK(J);" TOO SMALL TO CARRY THE FLOW."
18150 SLOPEMAX(J)=(COEF(3)*ROUGH*FLOW(J)*THETA^(2!/3!)/(DIAM(J)^(8!/3!))*(THETA-SIN(THETA))^(5!/3!))^2

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18160 IF SLOPEMAX(J) < FLAT THEN SLOPEMAX(J) = FLAT
18170 NEXT J
18180 PRINT "  MINIMUM AND MAXIMUM ALLOWABLE SLOPES FOUND. "
18190 RETURN
18200 REM -----
18210 REM ** SUBROUTINE TO ASSIGN PIPE SLOPES AND ELEVATIONS **
18300 FOR I=1 TO NLINK
18310 GOUNDSLOPE(I) = (ELEV(NFROM(I))-ELEV(NTO(I)))/SPAN(I)
18320 NEXT I
18330 FOR I=1 TO NNODE
18340 NDEGREE(I) = 0
18350 CUMDEPTH(I) = ELEV(I)
18360 NEXT I
18370 FOR I=1 TO NLINK
18380 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
18390 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
18400 NEXT I
18410 FOR I=1 TO NLINK
18420 IF NDEGREE(NFROM(I)) = 1 THEN CUMDEPTH(NFROM(I)) = ELEV(NFROM(I))-COVER(I)

18430 NEXT I
18440 FOR I=1 TO NLINK
18450 IF NDEGREE(NFROM(I)) <> 1 THEN GOTO 18820
18460 IF GOUNDSLOPE(I) > SLOPEMIN(I) THEN GOTO 18520
18465 IF SLOPEMIN(I) < SLOPEMAX(I) THEN GOTO 18470
18466 PIPESLOPE(I) = SLOPEMAX(I)
18467 GOTO 18480
18470 PIPESLOPE(I) = SLOPEMIN(I)
18480 TEMPDOWN = ELEV(NFROM(I))-COVER(I)
18490 IF TEMPDOWN < CUMDEPTH(NFROM(I)) THEN UPCROWN(I) = TEMPDOWN ELSE UPCROWN
(I) = CUMDEPTH(NFROM(I))
18500 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18510 GOTO 18790
18520 IF GOUNDSLOPE(I) < SLOPEMAX(I) THEN GOTO 18700
18530 TEMPDOWN = ELEV(NTO(I))-COVER(I)
18540 TEMPUP = TEMPDOWN+SPAN(I)*SLOPEMAX(I)
18550 IF TEMPUP > CUMDEPTH(NFROM(I)) THEN GOTO 18600
18560 PIPESLOPE(I) = SLOPEMAX(I)
18570 UPCROWN(I) = TEMPUP
18580 DOWNCROWN(I) = TEMPDOWN
18590 GOTO 18790
18600 TEMPSLOPE = (CUMDEPTH(NFROM(I))-(ELEV(NTO(I))-COVER(I)))/SPAN(I)
18610 IF TEMPSLOPE > SLOPEMAX(I) THEN GOTO 18660
18620 IF TEMPSLOPE > SLOPEMIN(I) THEN PIPESLOPE(I) = TEMPSLOPE ELSE PIPESLOPE(I)
= SLOPEMIN(I)
18630 UPCROWN(I) = CUMDEPTH(NFROM(I))
18640 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18650 GOTO 18790
18660 PIPESLOPE(I) = SLOPEMAX(I)
18670 DOWNCROWN(I) = ELEV(NTO(I))-COVER(I)
18680 UPCROWN(I) = DOWNCROWN(I)+SPAN(I)*PIPESLOPE(I)
18690 GOTO 18790

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18700 IF CUMDEPTH(NFROM(I)) < (ELEV(NFROM(I))-COVER(I)) THEN GOTO 18750
18710 PIPESLOPE(I) = GROUNDSLOPE(I)
18720 UPCROWN(I) = ELEV(NFROM(I))-COVER(I)
18730 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18740 GOTO 18790
18750 TEMPSLOPE = (CUMDEPTH(NFROM(I))-(ELEV(NTO(I))-COVER(I)))/SPAN(I)
18760 IF TEMPSLOPE > SLOPEMIN(I) THEN PIPESLOPE(I) = TEMPSLOPE ELSE PIPESLOPE(I)
  = SLOPEMIN(I)
18770 UPCROWN(I) = CUMDEPTH(NFROM(I))
18780 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18790 IF DOWNCROWN(I) < CUMDEPTH(NTO(I)) THEN CUMDEPTH(NTO(I)) = DOWNCROWN(I)
18800 NDEGREE(NTO(I)) = NDEGREE(NTO(I))-1
18810 NDEGREE(NFROM(I)) = 0
18820 NEXT I
18830 NSUM = 0
18840 FOR I=1 TO NNODE
18850 NSUM = NSUM+NDEGREE(I)
18860 NEXT I
18870 IF NSUM > 0 THEN GOTO 18440
18880 OUTCROWN = CUMDEPTH(NREF)
18890 FOR I=1 TO NLINK
18900 UPINVERT(I) = UPCROWN(I)-DIAM(I)*COEF(I)
18910 DOWNINVERT(I) = DOWNCROWN(I)-DIAM(I)*COEF(I)
18920 XUP(I) = ELEV(NFROM(I))-UPINVERT(I)
18930 XDOWN(I) = ELEV(NTO(I))-DOWNINVERT(I)
18940 NEXT I
18950 FOR I=1 TO NNODE
18960 NDEGREE(I) = 0
18970 NEXT I
18980 FOR I=1 TO NLINK
18990 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
19000 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
19010 NEXT I
19020 FOR I=1 TO NLINK
19030 TOP = DOWNINVERT(I)
19040 BOTTOM = DOWNINVERT(I)
19050 FOR J=1 TO NLINK
19060 IF (NTO(I) = NTO(J)) AND (DOWNINVERT(J) > TOP) THEN TOP = DOWNINVERT(J)
19070 IF (NTO(I) = NFROM(J)) AND (UPINVERT(J) < BOTTOM) THEN BOTTOM = UPINVERT(J)
)
19080 NEXT J
19090 DROP(NTO(I)) = TOP - BOTTOM
19100 XNODE(NTO(I)) = ELEV(NTO(I))-BOTTOM
19110 IF NDEGREE(NTO(I)) <> 1 THEN GOTO 19140
19120 DROP(NTO(I)) = 0!
19130 XNODE(NTO(I)) = ELEV(NTO(I))-DOWNINVERT(I)
19140 IF NDEGREE(NFROM(I)) <> 1 THEN GOTO 19170
19150 DROP(NFROM(I)) = 0!
19160 XNODE(NFROM(I)) = ELEV(NFROM(I))-UPINVERT(I)
19170 NEXT I
19180 SLENGTH = 0!
19190 SDEPTH = 0!

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19200 SAREA = 0!
19210 SDIAM = 0!
19220 FOR I=1 TO NLINK
19230 SLENGTH = SLENGTH+SPAN(I)
19240 XDEPTH = .5*(XUP(I)+XDOWN(I))
19250 SDEPTH = SDEPTH+XDEPTH*SPAN(I)
19260 SAREA = SAREA+XDEPTH*SPAN(I)*DIAM(I)*COEF(1)
19270 SDIAM = SDIAM+DIAM(I)*SPAN(I)
19280 NEXT I
19290 AVGDEPTH = SDEPTH/SLENGTH
19300 AVGAREA = SAREA/SLENGTH
19310 AVGDIAM = SDIAM/SLENGTH
19320 PRINT " PIPE SLOPES AND ELEVATIONS FOUND."
19330 RETURN
19340 REM -----
19350 REM ** SUBROUTINE TO FIND WATER DEPTHS AND VELOCITIES **
19400 FOR J=1 TO NLINK
19410 CONST = COEF(3)*ROUGH*FLOW(J)/(DIAM(J)^(8!/3!)*SQR(PIPESLOPE(J)))
19420 THETA = 0!
19430 FOR K=1 TO NDIGIT
19440 FOR I=1 TO 10
19450 TEMP = THETA+(I*10!^(1-K))
19460 COMPAR = (TEMP-SIN(TEMP))^(5!/3!)/(TEMP^(2!/3!))
19470 IF COMPAR > CONST THEN GOTO 19490
19480 NEXT I
19490 THETA = TEMP-(10!^(1-K))
19500 NEXT K
19510 ANGLE(J) = THETA
19520 NEXT J
19530 FOR I=1 TO NLINK
19540 VELOCITY(I)=COEF(2)*FLOW(I)/(DIAM(I)^2*(ANGLE(I)-SIN(ANGLE(I))))
19545 DEPTH(I) = (1!-COS(ANGLE(I)/2!))*DIAM(I)/2!
19550 NEXT I
19551 FOR J=1 TO NLINK
19552 CONST = COEF(3)*ROUGH*FLOW(J)/(DIAM(J)^(8!/3!)*SQR(PIPESLOPE(J)))
19553 THETA = 0!
19554 FOR K=1 TO NDIGIT
19555 FOR I=1 TO 10
19556 TEMP = THETA+(I*10!^(1-K))
19557 COMPAR = (TEMP-SIN(TEMP))^(5!/3!)/(TEMP^(2!/3!))
19558 IF COMPAR > CONST THEN GOTO 19560
19559 NEXT I
19560 THETA = TEMP-(10!^(1-K))
19561 NEXT K
19562 ANGLE(J) = THETA
19563 NEXT J
19564 FOR I=1 TO NLINK
19565 VELOCITY(I)=COEF(2)*FLOW(I)/(DIAM(I)^2*(ANGLE(I)-SIN(ANGLE(I))))
19566 DEPTH(I) = (1!-COS(ANGLE(I)/2!))*DIAM(I)/2!
19569 PIPESLOPE(I) = PIPESLOPE(I)*100!
19570 REM **          SLOPEMAX(), SLOPEMIN(), SPAN() **
19580 SLOPEMIN(I) = SLOPEMIN(I)*100!

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19590 SLOPEMAX(I) = SLOPEMAX(I)*100!
19600 GROUNDSLOPE(I) = GROUNDSLOPE(I)*100!
19610 NEXT I
19620 PRINT"  VELOCITIES AND DEPTHS OF FLOW FOUND."
19630 RETURN
19640 REM -----
19650 REM ** SUBROUTINE TO CHECK MAX COVER CONSTRAINT **
19700 FOR I=1 TO NLINK
19710 IMAX(I)=0
19716 A(I)=0
19720 IF ((ELEV(NFROM(I))-UPCROWN(I)) > COVERMAX) OR ((ELEV(NTO(I))-DOWNCROWN(I))
) > COVERMAX) THEN IMAX(I) = 1
19726 IF SLOPEMIN(I) > SLOPEMAX(I) THEN A(I) = 1
19730 NEXT I
19740 PRINT"  MAXIMUM COVER DEPTHS CHECKED."
19750 RETURN
19760 REM -----
19770 REM ** SUBROUTINE TO REASSIGN ORIGINAL NODE AND LINK NUMBERS **
19820 FOR I=1 TO NLINK
19830 NTO(I) = NODE(NTO(I))
19840 NFROM(I) = NODE(NFROM(I))
19850 NEXT I
19860 NREF = NODE(NREF)
19870 PRINT
19880 RETURN
19890 REM -----
19900 REM ** SUBROUTINE TO PRINT RESULTS **
20060 CLS
20070 OPEN "SCRN:" FOR OUTPUT AS #1
20080 IPAGE = 15
20090 GOSUB 20470
20100 CLOSE
20110 CLS
20120 INPUT "WOULD YOU LIKE TO REVIEW RESULTS AGAIN (Y/N)";ANS$
20130 IF ANS$ ="Y" OR ANS$ ="y" THEN GOTO 20060
20140 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)";ANS$
20150 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20200
20160 OPEN "LPT1:" FOR OUTPUT AS #1
20170 IPAGE = MPAGE
20180 GOSUB 20470
20190 CLOSE
20200 INPUT "DO YOU WANT A DISK COPY OF THE DATA (Y/N)";ANS$
20210 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20270
20220 GOSUB 22000
20270 RETURN
20280 REM -----
20290 REM ** SUBROUTINE TO PRINT OUT RESULTS DATA **
20470 IF (IPAGE <> MPAGE) THEN CLS
20480 IUNITS=2:PRINT #1,"PROJECT TITLE:";TAB(17);TITLE$
20490 PRINT #1,"
20500 PRINT #1,"  NUMBER OF NODES:";TAB(40);NNODE
20510 PRINT #1,"  NUMBER OF LINKS:";TAB(40);NLINK

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20530 PRINT #1, " MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
20540 PRINT #1, " MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
20550 PRINT #1, " MAXIMUM COVER DEPTH:";TAB(40);COVERMAX;" ";UNIT$(3)
20560 PRINT #1, " SEWER OUTFALL NODE #:";TAB(40);NREF
20570 PRINT #1, " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)

20580 PRINT #1, ""
20590 PRINT #1, "TOTAL SYSTEM LENGTH:";TAB(40);SLENGTH
20600 PRINT #1, "AVERAGE WEIGHTED DIAMETER:";TAB(40);AVGDIA
20610 PRINT #1, "AVERAGE WEIGHTED EXCAVATION DEPTH:";TAB(40);AVGDEPTH
20620 PRINT #1, "AVERAGE WEIGHTED EXCAVATION AREA:";TAB(40);AVGAREA
20630 PRINT #1, ""
20640 IF OUTCROWN < ELEVREF THEN PRINT #1, "WARNING : ELEVATION OF LAST PIPE IS L
OWER THAN CROWN OF OUTFALL NODE."
20650 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20660 GOSUB 21160
20670 FOR I=1 TO NLINK
20680 IF IMAX(I) = 1 THEN PRINT #1, "*";
20690 PRINT #1, TAB(2);USING FM$(1);LINK(I);
20700 PRINT #1, TAB(7);USING FM$(1);NFROM(I);
20710 PRINT #1, TAB(12);USING FM$(1);NTO(I);
20720 PRINT #1, TAB(16);USING FM$(2);FLOW(I)*.001;
20730 PRINT #1, TAB(25);USING FM$(6);SPAN(I);
20740 PRINT #1, TAB(33);USING FM$(3);DIAM(I);
20750 PRINT #1, TAB(40);USING FM$(5);SLOPEMIN(I);
20760 PRINT #1, TAB(47);USING FM$(5);SLOPEMAX(I);
20770 PRINT #1, TAB(53);USING FM$(5);GROUNDSLOPE(I);
20780 PRINT #1, TAB(59);USING FM$(5);PIPESLOPE(I);
20790 PRINT #1, TAB(65);USING FM$(3);DEPTH(I);
20800 PRINT #1, TAB(72);USING FM$(4);VELOCITY(I)
20810 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21160

20820 NEXT I
20830 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20840 GOSUB 21370
20850 FOR I=1 TO NLINK
20860 IF IMAX(I) = 1 THEN PRINT #1, "*";
20870 PRINT #1, TAB(2);USING FM$(1);LINK(I);
20880 PRINT #1, TAB(9);USING FM$(3);XUP(I)+OPINVERT(I);
20890 PRINT #1, TAB(18);USING FM$(3);XDOWN(I)+DOWNINVERT(I);
20900 PRINT #1, TAB(27);USING FM$(3);UPCROWN(I);
20910 PRINT #1, TAB(36);USING FM$(3);DOWNCROWN(I);
20920 PRINT #1, TAB(45);USING FM$(3);UPINVERT(I);
20930 PRINT #1, TAB(54);USING FM$(3);DOWNINVERT(I);
20940 PRINT #1, TAB(63);USING FM$(3);XUP(I);
20950 PRINT #1, TAB(72);USING FM$(3);XDOWN(I)
20960 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21370

20970 NEXT I
20980 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20990 GOSUB 21560
21000 FOR I=1 TO NNODE

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21010 PRINT #1,TAB(2);USING FM$(1);NODE(I);
21020 PRINT #1,TAB(9);USING FM$(5);HA(I);
21025 PRINT #1,TAB(18);USING FM$(5);C(I);
21030 PRINT #1,TAB(27);USING FM$(3);ELEV(I);
21040 PRINT #1,TAB(37);USING FM$(3);XNODE(I);
21050 PRINT #1,TAB(53);USING FM$(3);DROP(I)
21060 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21560

21070 NEXT I
21080 IF (IPAGE <> MPAGE) THEN GOSUB 21730:ELSE PRINT #1,"":PRINT #1,""
21090 RETURN
21100 REM -----
21110 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 1 **
21160 PRINT #1,"PROJECT TITLE: ";TITLE$
21170 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"
21180 PRINT #1,""
21190 PRINT #1,TAB(7);"FROM";TAB(13);"TO";TAB(41);" MIN";TAB(48);"MAX";
21200 PRINT #1,TAB(53);"GROUND";TAB(60);"PIPE";TAB(65);" WATER"
21220 PRINT #1," LINK";TAB(7);"NODE";TAB(12);"NODE";
21230 PRINT #1,TAB(19);"FLOW";TAB(26);"LENGTH";TAB(35);"DIAM";
21240 PRINT #1,TAB(41);"SLOPE";TAB(47);"SLOPE";TAB(53);"SLOPE";
21250 PRINT #1,TAB(59);"SLOPE";TAB(65);" DEPTH";TAB(73);"VEL"
21260 PRINT #1," #";TAB(9);"#";TAB(14);"#";TAB(18);" (CMS)";
21270 PRINT #1,TAB(27);"(M)";TAB(35);"(CM)";TAB(42);" %";TAB(49);"%";
21280 PRINT #1,TAB(55);"%";TAB(61);"%";TAB(67);"(CM)";TAB(73);"m/s"
21290 PRINT #1,""
21300 RETURN
21310 REM -----
21320 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 2 **
21370 PRINT #1,"PROJECT TITLE: ";TITLE$
21380 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"
21390 PRINT #1,""
21400 PRINT #1,TAB( 9);"GROUND  ELEV";TAB(27);"CROWN  ELEV";
21410 PRINT #1,TAB(45);"INVERT  ELEV";TAB(61);"EXCAVATION DEPTH"
21420 PRINT #1,TAB(2);"LINK";TAB(9);"UPSTRM";TAB(18);"DNSTRM";
21430 PRINT #1,TAB(27);"UPSTRM";TAB(36);"DNSTRM";TAB(45);"UPSTRM";
21440 PRINT #1,TAB(54);"DNSTRM";TAB(63);"UPSTRM";TAB(72);"DNSTRM"
21450 PRINT #1," #";TAB(10);UNIT$(3);TAB(19);UNIT$(3);
21460 PRINT #1,TAB(28);UNIT$(3);TAB(37);UNIT$(3);TAB(46);UNIT$(3);
21470 PRINT #1,TAB(55);UNIT$(3);TAB(64);UNIT$(3);TAB(73);UNIT$(3)
21480 PRINT #1,""
21490 RETURN
21500 REM -----
21510 REM ** SUBROUTINE TO PRINT NODE RESULTS HEADING **
21560 PRINT #1,"PROJECT TITLE: ";TITLE$
21570 PRINT #1,TAB(13);" N O D E   D A T A "
21580 PRINT #1,""
21590 PRINT #1,TAB(27);"GROUND";TAB(36);"EXCAVATION";
21600 PRINT #1,TAB(49);"DIST HIGH INVERT"
21610 PRINT #1," NODE";TAB(10);"AREA";TAB(18);"RUNOFF ";TAB(28);"ELEV";

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21620 PRINT #1,TAB(38);"DEPTH";TAB(50);"TO LOW INVERT"
21630 PRINT #1,"  ",TAB(10);"(ha)";TAB(19);" COE.";TAB(28);UNIT$(3);
21640 PRINT #1,TAB(38);UNIT$(3);TAB(55);UNIT$(3)
21650 PRINT #1,""
21660 RETURN
21670 REM -----
21680 REM ** SUBROUTINE TO HOLD SCREEN **
21730 LOCATE 24,1
21740 COLOR 0,7
21750 PRINT"PRESS ANY KEY TO CONTINUE";
21760 COLOR 7,0
21770 A$ = INKEY$:IF A$="" THEN GOTO 21770
21780 RETURN
22000 REM ** SUBROUTINE TO SAVE DATA TO DISK **
22010 CLS
22020 INPUT "ENTER NAME OF DISK FILE TO BE SAVED:";AF$
22021 DF$ = "b:"+AF$+".sto"
22030 OPEN "O",1,DF$
22040 PRINT"NOW SAVING DATA"
22050 PRINT #1,TITLE$
22060 PRINT #1,NLINK;NNODE;A;B;KK;RO;NREF
22070 PRINT #1,ELEVREF;ROUGH;TE
22080 PRINT #1,COVERMIN,COVERMAX,VELMIN,VELMAX,SLENGTH,AVGDIAM,AVGDEPTH,AVGAREA,
OUTCROWN
22090 FOR I=1 TO NLINK
22100 PRINT #1,LINK(I);NFROM(I);NTO(I);SPAN(I);DIAM(I);COVER(I);IMAX(I);IMIN(I);
FLOW(I);FLOWN(I);DEPTH(I);VELOCITY(I);VELOCITYM(I);PIPESLOPE(I);SLOPEMIN(I);SLOP
EMAX(I);GROUNDSLOPE(I);XUP(I);UPINVERT(I);XDOWN(I);DOWNINVERT(I);DPCROWN(I);DOWN
CROWN(I)
22105 PRINT #1,A(I);DEPTHM(I)
22110 NEXT I
22120 FOR I=1 TO NNODE
22130 PRINT #1,NODE(I);HA(I);DENM(I);DEN(I);WERM(I);WER(I);C(I);ELEV(I);XNODE(I)
;DROP(I);PEAK1(I);PEAK(I)
22140 NEXT I
22150 CLOSE
22170 PRINT"DATA NOW SAVED IN FILE:";DF$
22180 GOSUB 21730: REM SCREEN HOLD
22190 RETURN

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Listing ส่วนเมนูหลักของของโปรแกรมการออกแบบระบบระบายน้ำร่วม

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10000 CLEAR
10010 CLS
10020 DEFINT I-J,L-N
10030 OPTION BASE 1
10040 IESC = 27
10050 ON ERROR GOTO 10480
10060 KEY OFF
10070 MPAGE = 30000
10080 MLINK = 120
10090 MNODE = 121
10100 ISAVE = 1
10110 DIM ANGLE(MLINK),PEAK1(MNODE),PEAK(MNODE)
10120 DIM COEF(3),COVER(MLINK),CUMDEM(MNODE),CUMDEPTH(MNODE)
10125 DIM BA(MNODE),DEN(MNODE),DENM(MNODE),WER(MNODE),WERM(MNODE),C(MNODE)
10126 DIM CUMDEMM(MNODE),FLOWM(MLINK),VELFULL(MLINK),GS(MLINK),STO(MLINK)
10127 DIM T(MLINK),IMIN(MLINK),A(MLINK),DEPTHM(MLINK),VELOCITYM(MLINK)
10130 DIM DEPTH(MLINK),DIAM(MLINK),DOWNCROWN(MLINK),DOWNINVERT(MLINK)
10140 DIM DROP(MNODE),ELEV(MNODE),FLOW(MLINK),FM$(6)
10150 DIM GROUNDSLOPE(MLINK),IMAX(MLINK),LINK(MLINK),NDEGREE(MNODE)
10160 DIM NFROM(MLINK),NODE(MNODE),NTO(MLINK),PIPESLOPE(MLINK)
10170 DIM SLOPEMAX(MLINK),SLOPEMIN(MLINK),SPAN(MLINK)
10180 DIM UNIT$(6),UPCROWN(MLINK),UPINVERT(MLINK),VELOCITY(MLINK)
10190 DIM XDOWN(MLINK),XNODE(MNODE),XUP(MLINK)
10200 CLS
10210 PRINT"COMBINED SEWER MENU"
10220 PRINT
10230 PRINT" 1. INPUT DATA FROM KEYBOARD"
10240 PRINT" 2. INPUT DATA FROM DISK FILE"
10250 PRINT" 3. LIST DATA"
10260 PRINT" 4. CHANGE SYSTEM CHARACTERISTICS"
10270 PRINT" 5. ADD NODES"
10280 PRINT" 6. DELETE NODES"
10290 PRINT" 7. CHANGE NODE DATA"
10300 PRINT" 8. ADD LINKS"
10310 PRINT" 9. DELETE LINKS"
10320 PRINT" 10. CHANGE LINK DATA"
10330 PRINT" 11. DESIGN SEWERS"
10340 PRINT" 12. SAVE DATA TO DISK"
10350 PRINT" 13. START A NEW RUN"
10360 PRINT" 14. END"
10370 PRINT
10380 INPUT "ENTER NUMBER OF DESIRED ACTION: ";IACT
10390 IF IACT<1 OR IACT>14 THEN PRINT"NOT WITHIN RANGE. PLEASE REENTER":GOTO 103
80
10400 ON IACT GOSUB 10690,11500,11820,12750,13440,13650,13950,14290,14560,14910,
15480,15950,16200,16290
10410 GOTO 10200
10420 REM -----
10430 REM **: ERROR TRAP **:

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10480 CLOSE
10490 CLS: CLOSE: PRINT:PRINT
10500 PRINT TAB(20);"WARNING !!      WARNING !!"
10510 PRINT"AN ERROR HAS OCCURED IN LINE ";ERL;" IN THE MAIN PROGRAM."
10520 PRINT"THE ERROR CODE IS ";ERR
10530 PRINT
10540 PRINT"AFter THIS MESSAGE, YOU WILL RETURNED TO THE MENU."
10550 PRINT"SAVE YOUR DATA TO DISK IF YOU HAVE NOT ALREADY DONE SO !!"
10560 GOSUB 21730
10570 RESUME 10200
10580 REM -----
10590 REM ** SUBROUTINE TO ENTER DATA FROM KEYBOARD **
10690 IF ISAVE =0 THEN GOSUB 16380
10700 ISAVE=0
10710 CLS
10720 LINE INPUT "ENTER TITLE FOR PROJECT: ";TITLE$
10730 PRINT"      a "
10740 PRINT" i =-----"
10750 PRINT"      (t+b)^k  ":PRINT
10755 PRINT" i = 14648/(t+48)^1.03 [ Rainfall intensity frequency in 100 years {
Bangkok } ]"
10756 PRINT" i = 12667/(t+45)^1.02 [ Rainfall intensity frequency in 50 years {
Bangkok } ]"
10757 PRINT" i = 10868/(t+42)^1.01 [ Rainfall intensity frequency in 25 years {
Bangkok } ]"
10760 PRINT" i = 8418/(t+37)^1.00 [ Rainfall intensity frequency in 10 years {
Bangkok } ]"
10770 PRINT" i = 6994/(t+34)^0.99 [ Rainfall intensity frequency in 5 years {
Bangkok } ]"
10775 PRINT" i = 4803/(t+28)^0.97 [ Rainfall intensity frequency in 2 years {
Bangkok } ]"
10780 INPUT " a = ";A:INPUT " b = ";B:INPUT " k = ";KK
10790 PRINT
10800 PRINT"      FLOW IN LITERS PER SECOND (LPS)"
10810 PRINT"      LENGTHS AND ELEVATIONS IN METERS (M)"
10820 PRINT"      DIAMETERS IN CENTIMETERS (CM)"
10830 PRINT
10840 INPUT "ENTER RATE OF I/I ; (CMD/ha) ";RO
10860 IUNITS = 2
10870 GOSUB 16560 : REM ASSIGN UNIT$( )
10880 INPUT "ENTER NUMBER OF THE OUTFALL NODE:";NREF
10890 PRINT"ENTER THE CROWN ELEVATION OF THE OUTFALL NODE:";UNIT$(3);
10900 INPUT ELEVEEF
10920 PRINT"ENTER MINIMUM SCOUR VELOCITY ALLOWABLE:";UNIT$(5);
10930 INPUT VELMIN
10940 PRINT"ENTER MAXIMUM VELOCITY ALLOWABLE:";UNIT$(5);
10950 INPUT VELMAX
10960 PRINT"ENTER DEFAULT MINIMUM COVER DEPTH";UNIT$(3);
10970 INPUT COVERMIN
10980 PRINT"ENTER MAXIMUM COVER DEPTH";UNIT$(3);
10990 INPUT COVERMAX
11000 INPUT "ENTER MANNING'S ROUGHNESS COEFFICIENT:";ROUGH

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11005 INPUT "TIME OF ENTRY (MIN)";TE
11010 CLS
11020 I=0 : GOTO 11240
11030 PRINT"BEGIN ENTERING LINK DATA"
11040 PRINT:PRINT"ENTER 'M' FOR LINK # TO DISCONTINUE.";TAB(65);"ENTRY #";I+1
11050 PRINT:INPUT "ENTER LINK NUMBER:";LN$
11060 IF LN$ = "M" OR LN$ = "m" THEN GOTO 11210
11070 I=I+1
11080 LINK(I) = VAL(LN$)
11090 INPUT " ENTER FROM NODE:";NFROM(I)
11100 INPUT " ENTER TO NODE:";NTO(I)
11110 PRINT" ENTER LENGTH OF LINK ";UNIT$(2);": ";
11120 INPUT SPAN(I)
11130 PRINT" ENTER LINK DIAMETER ";UNIT$(4);": ";
11140 INPUT DIAM(I)
11150 COVER$ = ""
11160 PRINT" ENTER MINIMUM COVER DEPTH (DEFAULT =";COVERMIN;"): ";
11170 INPUT COVER$
11180 IF COVER$ = "" THEN COVER(I) = COVERMIN ELSE COVER(I) = VAL (COVER$)
11190 IF I+1 > MLINK THEN PRINT"MAXIMUM NUMBER OF LINKS ENTERED.":GOSUB 21730:GOT
O 11210
11200 GOTO 11040
11210 MLINK = I:GOTO 11370
11220 CLS
11230 I = 0 : GOTO 11030
11240 PRINT"BEGIN ENTERING NODE DATA"
11250 PRINT:PRINT"ENTER 'M' FOR NODE # TO DISCONTINUE."; TAB(50);"ENTRY #"; I+1
11260 PRINT:INPUT "ENTER NODE NUMBER:";NN$
11270 IF NN$ = "M" OR NN$ = "m" THEN GOTO 11360
11280 I=I+1
11290 NODE(I)=VAL(NN$)
11300 INPUT " AREA (ba) ";BA(I)
11303 INPUT " MIN FACTOR = ";PEAK1(I)
11304 INPUT " PEAK FACTOR = ";PEAK(I)
11305 INPUT " POP. AT T = Te [ BEGIN TIME ] (CAPITA/ba) ";DENM(I)
11310 INPUT " POP. AT T = Tm [ END OF TIME ] (CAPITA/ba) ";DEN(I)
11315 INPUT " WASTE AT T = Te [LITERS PER CAPITA PER DAY ] ";WERM(I)
11316 INPUT " WASTE AT T = Tm [LITERS PER CAPITA PER DAY ] ";WER(I)
11317 INPUT " RUNOFF COE. ";C(I)
11320 PRINT" ENTER GROUND ELEVATION OF NODE "; UNIT$(3);": ";
11330 INPUT ELEV(I)
11340 IF I+1 > MNODE THEN PRINT "MAXIMUM NUMBER OF NODES ENTERED.":GOSUB 21730:GOT
O 11360
11350 GOTO 11250
11360 MNODE = I
11365 GOTO 11220
11370 RETURN
11380 REM -----
11390 REM ** SUBROUTINE TO ENTER DATA FROM DISK FILE **
11500 IF ISAVE = 0 THEN GOSUB 16380: REM TEST DATA SAVE
11510 ISAVE = 0
11520 CLS

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11525 FILES "b:*.s*"
11530 INPUT "ENTER NAME OF DISK FILE TO BE READ: "; AF$
11535 DF$ = "b:" + AF$
11540 OPEN "I", I, DF$
11550 PRINT "NOW READING DATA"
11560 LINE INPUT #1, TITLE$
11570 INPUT #1, NLINK, NNODE, A, B, KK, RO, MREF
11580 INPUT #1, ELEVREF, ROUGH, TE
11590 INPUT #1, COVERMIN, COVERMAX, VELMIN, VELMAX
11600 FOR I=1 TO NLINK
11610 INPUT #1, LINK(I), NFROM(I), NTO(I), SPAN(I), DIAM(I), COVER(I)
11620 NEXT I
11630 FOR I = 1 TO NNODE
11640 INPUT #1, NODE(I), BA(I), DENM(I), DEN(I), WERM(I), WER(I), C(I), ELEV(I), PEAK1(I)
, PEAK(I)
11650 NEXT I
11660 CLOSE
11670 GOSUB 16560: REM SET UNIT NAMES
11680 PRINT : PRINT "DATA READ." : PRINT " FILENAME : "; DF$
11690 PRINT " PROJECT TITLE : "; TITLE$
11700 GOSUB 21730: REM HOLD SCREEN
11710 RETURN
11720 REM -----
11730 REM ** SUBROUTINE TO LIST DATA **
11820 CLS
11830 OPEN "SCRN:" FOR OUTPUT AS #1
11840 IPAGE = 18
11850 GOSUB 12140
11860 CLOSE
11870 CLS
11880 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)"; ANS$
11890 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 12010
11900 OPEN "LPT1:" FOR OUTPUT AS #1
11910 IPAGE = MPAGE
11920 GOSUB 12140
11930 CLOSE
12010 RETURN
12020 REM -----
12030 REM ** SUBROUTINE TO PRINT OUT DATA **
12140 IF (IPAGE <> MPAGE) THEN CLS
12150 PRINT #1, "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12160 PRINT #1,
12170 PRINT #1, "PROJECT TITLE"; TAB(40); TITLE$
12171 PRINT #1, "      a "
12172 PRINT #1, "      i =-----"
12173 PRINT #1, "      (t+b)^k  ": PRINT
12174 PRINT #1, "      a = "; TAB(40); A
12175 PRINT #1, "      b = "; TAB(40); B
12176 PRINT #1, "      k = "; TAB(40); KK
12180 PRINT #1, " NUMBER OF NODES: "; TAB(40); NNODE
12190 PRINT #1, " NUMBER OF LINKS: "; TAB(40); NLINK
12200 PRINT #1, " RATE OF I/I: "; TAB(40); RO; " (CMD/ha)"

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12210 PRINT #1, " MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
12220 PRINT #1, " MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
12230 PRINT #1, " MANNING'S ROUGHNESS COEFFICIENT:";TAB(40);ROUGH
12231 PRINT #1, " TIME OF ENTRY:";TAB(40);TE
12240 PRINT #1, " SEWER OUTFALL NODE #:";TAB(40);NEEF
12250 PRINT #1, " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)
)
12260 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS: ELSE PRINT #1,"":PRINT #1,""
12270 GOSUB 12470
12280 FOR I = 1 TO NLINK
12290 PRINT #1,TAB(2);LINK(I);TAB(10);NFROM(I);TAB(18);NTO(I);
12300 PRINT #1,TAB(28);SPAN(I);TAB(43);DIAM(I);TAB(53);COVER(I)
- 12310 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 12470

12320 NEXT I
12330 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
12340 GOSUB 12610
12350 FOR I = 1 TO NNODE
12360 PRINT #1,TAB(2);NODE(I);TAB(7);PEAK1(I);TAB(12);PEAK(I);TAB(18);HA(I);TAB(
22);C(I);TAB(28);DENM(I);TAB(35);DEN(I);TAB(45);WERM(I);TAB(55);WER(I);TAB(65);E
LEV(I)
12370 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 126
10
12380 NEXT I
12390 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS: ELSE PRINT #1,"":PRINT #1,""
12400 RETURN
12410 REM -----
12420 REM ** SUBROUTINE TO PRINT LINK HEADING **
12470 PRINT #1,TAB(21); " L I N K   D A T A"
12480 PRINT #1,TAB(10); "FROM";TAB(19);"TO";TAB(51);"MIN COVER"
12490 PRINT #1, " LINK";TAB(10);"NODE";TAB(18);"NODE";
12500 PRINT #1,TAB(28);"LENGTH";TAB(41);"DIAMETER";TAB(53);"DEPTH"
12510 PRINT #1, " #";TAB(11);"#";TAB(19);"#";TAB(29);UNIT$(2);
12520 PRINT #1,TAB(43);UNIT$(4);TAB(53);UNIT$(3)
12530 PRINT #1,""
12540 RETURN
12550 REM -----
12560 REM ** SUBROUTINE TO PRINT NODE HEADING **
12610 PRINT #1,TAB(21);" N O D E   D A T A"
12620 PRINT #1,TAB(66);"GROUND"
12630 PRINT #1, " NODE FACTOR";TAB(17);"AREA";TAB(23);"R.O."TAB(27);"MIN POP";T
AB(35);"MAX POP";TAB(45);"MIN WASTE";TAB(55);"MAX WASTE";TAB(65);"ELEVATION"
12640 PRINT #1, " # MIN PEAK";TAB(17);"(ha)";TAB(23);"COE.";TAB(27);"(CAP/ha)
";TAB(35);"(CAP/ha)";TAB(45);"(L/CAP)";TAB(55);"(L/CAP)";TAB(67);UNIT$(3)
12650 PRINT #1,""
12660 RETURN
12670 REM -----
12680 REM ** SUBROUTINE TO CHANGE SYSTEM CHARACTERISTICS **
12750 ISAVE = 0
12760 CLS
12770 PRINT "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12780 PRINT

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12790 PRINT"PROJECT TITLE";TAB(40);TITLE$
12791 PRINT"      a "
12792 PRINT" i =-----"
12793 PRINT"      (t+b)^k  ":PRINT
12794 PRINT" a = ";TAB(40);A
12795 PRINT" b = ";TAB(40);B
12796 PRINT" k = ";TAB(40);KK
12800 PRINT" NUMBER OF NODES:";TAB(40);NNODE;TAB(45);" *"
12810 PRINT" NUMBER OF LINKS:";TAB(40);NLINK;TAB(45);" *"
12820 PRINT" RATE OF I/I:";TAB(40);RO;" (CMD/ba)"
12830 PRINT" MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
12840 PRINT" MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
12850 PRINT" MINIMUM COVER DEPTH (DEFAULT):";TAB(40);COVERMIN;" ";UNIT$(3)
12860 PRINT" MAXIMUM COVER DEPTH:";TAB(40);COVERMAX;" ";UNIT$(3)
12870 PRINT" SEWER OUTFALL NODE #:";TAB(40);NREF
12874 PRINT" MANNING' ROUGHNESS COEFFICIENT:";TAB(40);ROUGH
12877 PRINT" TIME OF ENTRY:";TAB(40);TE
12880 PRINT" CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ",UNIT$(3)
12890 PRINT" * UPDATED BY PROGRAM AS NEEDED. NOT USER EDITABLE."
12900 GOSUB 21730:REM HOLD SCREEN
12910 CLS
12920 PRINT"PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
12930 PRINT"PROJECT TITLE:";TAB(40);"DEFAULT = ";TITLE$;
12940 INPUT TEMP$
12941 IF TEMP$ <> "" THEN TITLE$ = TEMP$
12942 PRINT"      a "
12943 PRINT" i =-----"
12944 PRINT"      (t+b)^k  ":PRINT
12945 PRINT" i = 14648/(t+48)^1.03 [ Rainfall intensity frequency in 100 years {
Bangkok } ]":PRINT" i = 12667/(t+45)^1.02 [ Rainfall intensity frequency in 50
years { Bangkok } ]"
12946 PRINT" i = 10868/(t+42)^1.01 [ Rainfall intensity frequency in 25 years {
Bangkok } ]":PRINT" i = 8418/(t+37)^1.00 [ Rainfall intensity frequency in 10
years { Bangkok } ]"
12947 PRINT" i = 6994/(t+34)^0.99 [ Rainfall intensity frequency in 5 years {
Bangkok } ]":PRINT" i = 4803/(t+28)^0.97 [ Rainfall intensity frequency in 2
years { Bangkok } ]"
12948 PRINT" a = ";TAB(40);"DEFAULT =";A;:INPUT TEMP$
12949 IF TEMP$ <> "" THEN A = ABS(VAL(TEMP$))
12950 PRINT" b = ";TAB(40);"DEFAULT =";B;
12951 INPUT TEMP$
12952 IF TEMP$ <> "" THEN B = ABS(VAL(TEMP$))
12953 PRINT" k = ";TAB(40);"DEFAULT =";KK;
12954 INPUT TEMP$
12955 IF TEMP$ <> "" THEN KK = ABS(VAL(TEMP$))
12960 PRINT" RATE OF I/I:";TAB(40);"DEFAULT =";RO;
12965 INPUT TEMP$
12970 IF TEMP$ <> "" THEN RO = ABS(VAL(TEMP$))
12990 PRINT" MINIMUM SCOUR VELOCITY:";TAB(40);"DEFAULT =";VELMIN;
13000 INPUT TEMP$
13010 IF TEMP$ <> "" THEN VELMIN = ABS(VAL(TEMP$))
13020 PRINT" MAXIMUM VELOCITY:";TAB(40);"DEFAULT =";VELMAX;

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13030 INPUT TEMP$
13040 IF TEMP$ <> "" THEN VELMAX = ABS(VAL(TEMP$))
13050 PRINT " DEFAULT MINIMUM COVER DEPTH:";TAB(40);"DEFAULT =";COVERMIN;
13060 INPUT TEMP$
13070 IF TEMP$ <> "" THEN COVERMIN = ABS(VAL(TEMP$))
13080 PRINT " MAXIMUM COVER DEPTH:";TAB(40);"DEFAULT =";COVERMAX;
13090 INPUT TEMP$
13100 IF TEMP$ <> "" THEN COVERMAX = ABS(VAL(TEMP$))
13110 PRINT " SEWER OUTFALL NODE #:";TAB(40);"DEFAULT =";NREF;
13120 INPUT TEMP$
13130 IF TEMP$ <> "" THEN NREF = ABS(VAL(TEMP$))
13131 PRINT " MANNING ROUGHNESS COEFFICIENT:";TAB(40);"DEFAULT =";ROUGH;
13132 INPUT TEMP$
13133 IF TEMP$ <> "" THEN ROUGH = ABS(VAL(TEMP$))
13134 PRINT " TIME OF ENTRY:";TAB(40);"DEFAULT =";TE;
13135 INPUT TEMP$
13136 IF TEMP$ <> "" THEN TE = ABS(VAL(TEMP$))
13158 PRINT " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);"DEFAULT =";ELEVREF;
13159 INPUT TEMP$
13160 IF TEMP$ <> "" THEN ELEVREF = ABS(VAL(TEMP$))
13170 CLS
13180 PRINT " OPTIONS AVAILABLE FOR UNITS":PRINT
13220 PRINT " FLOW IN LITERS PER SECOND (LPS)"
13230 PRINT " LENGTHS AND ELEVATIONS IN METERS (M)"
13240 PRINT " DIAMETERS IN CENTIMETERS (CM)"
13250 PRINT
13310 IUNITS = 2
13340 GOSUB 16560: REM ASSIGN UNIT$()
13350 PRINT:PRINT"SYSTEM CHANGES COMPLETE."
13360 GOSUB 21730: REM SCREEN HOLD
13370 RETURN
13380 REM -----
13390 REM ** SUBROUTINE TO ADD NODES **
13440 ISAVE = 0
13450 CLS
13460 PRINT " THERE ARE CURRENTLY "; NNODE; "NODES IN THE NETWORK."
13470 IF NNODE +1 > NNODE THEN PRINT "MAXIMUM NUMBER OF NODES HAVE BEEN ENTERED.":G
OSUB 21730 :GOTO 13580
13480 PRINT"ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU"
13490 PRINT
13500 INPUT "ENTER NODE NUMBER:";NN$
13510 IF NN$="M"OR NN$="m" THEN GOTO 13580
13520 NNODE = NNODE+1
13530 NODE(NNODE)=VAL(NN$)
13535 INPUT " AREA (ha) ";HA(NNODE)
13539 INPUT " MIN FACTOR = ";PEAK1(NNODE)
13540 INPUT " PEAK FACTOR = ";PEAK(NNODE)
13541 INPUT " POP.AT T = Te [ BEGIN TIME ] (CAPITA/ha) ";DENM(NNODE)
13542 INPUT " POP.AT T = Tm [ END OF TIME ] (CAPITA/ha) ";DEN(NNODE)
13543 INPUT " WASTE AT T = Te [ LITERS PER CAPITA PER DAY ] ";WERM(NNODE)
13544 INPUT " WASTE AT T = Tm [ LITERS PER CAPITA PER DAY ] ";WER(NNODE)
13545 INPUT " RUNOFF COE. ";C(1)

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13550 PRINT " ENTER ELEVATION OF NODE ",UNIT$(3);": ";
13560 INPUT ELEV(NNODE)
13570 GOTO 13470
13580 RETURN
13590 REM -----
13600 REM ** SUBROUTINE TO DELETE NODES **
13650 ISAVE = 0
13660 CLS
13670 PRINT "ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU":PRINT
13680 INPUT "ENTER THE NUMBER OF THE NODE TO BE DELETED"; ND$
13690 IF ND$="M" OR ND$="m" THEN GOTO 13880
13700 ND = ABS(VAL(ND$))
13710 I=1
13720 IF I>NNODE THEN PRINT:PRINT "NODE NUMBER ENTERED NOT IN LIST PLEASE REENTER
":GOTO 13670
13730 IF NODE (I)<>ND THEN I=I+1:GOTO 13720
13740 PRINT "NODE $";ND;" HAS THE FOLLOWING DATA:"
13745 PRINT " AREA (ha) ";HA(I)
13749 PRINT " MIN FACTOR = ";PEAK1(I)
13750 PRINT " PEAK FACTOR = ";PEAK(I)
13751 PRINT " POP. AT T = Te [ BEGIN TIME ] (CAPITA/ha) ";DENM(I)
13752 PRINT " POP. AT T = Tm [ END OF TIME ] (CAPITA/ha) ";DEN(I)
13753 PRINT " WASTE AT T = Te [ LITERS PER CAPITA PER DAY ] ";WERM(I)
13754 PRINT " WASTE AT T = Tm [ LITERS PER CAPITA PER DAY ] ";WER(I)
13755 PRINT " RUNOFF COE. ";C(I)
13760 PRINT " ELEV ";UNIT$(3);" = ";ELEV(I)
13770 INPUT "IS THIS THE NODE TO BE DELETED (Y/N)";ANS$
13780 IF ANS$<>"Y" AND ANS$<>"y" THEN GOTO 13670
13790 FOR J=I TO NNODE-1
13800 NODE(J) = NODE(J+1)
13805 HA(J) = HA(J+1)
13809 PEAK1(J) = PEAK1(J+1)
13810 PEAK(J) = PEAK(J+1)
13811 DENM(J) = DENM(J+1)
13812 DEN(J) = DEN(J+1)
13813 WERM(J) = WERM(J+1)
13814 WER(J) = WER(J+1)
13815 C(J) = C(J+1)
13820 ELEV(J) = ELEV(J+1)
13830 NEXT J
13840 NNODE = NNODE-1
13850 PRINT "NODE HAS BEEN DELETED"
13860 PRINT
13870 GOTO 13670
13880 RETURN
13890 REM -----
13900 REM ** SUBROUTINE TO CHANGE NODE DATA **
13950 ISAVE = 0
13960 CLS
13970 PRINT "ENTER 'M' FOR NODE NUMBER TO RETURN TO MAIN MENU":PRINT
13980 INPUT "ENTER THE NUMBER OF THE NODE TO CHANGE":ND$
13990 IF ND$="M" OR ND$="m" THEN GOTO 14210

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14000 ND = ABS(VAL(ND$))
14010 I=1
14020 IF I>NND THEN PRINT :PRINT"NODE NUMBER ENTERED NOT IN LIST. PLEASE REENT
ER":GOTO 13970
14030 IF NODE(I)<>ND THEN I=I+1:GOTO 14020
14040 PRINT"NODE #";ND;"HAS THE FOLLOWING DATA:"
14045 PRINT" AREA (ba) ";TAB(20);BA(I)
14049 PRINT" MIN FACTOR = ";PEAK1(I)
14050 PRINT" PEAK FACTOR = ";PEAK(I)
14055 PRINT" POP.AT T = Te [ BEGIN TIME ] (CAPITA/ba) ";DENM(I)
14056 PRINT" POP.AT T = Tm [ END OF TIME ] (CAPITA/ba) ";DEN(I)
14057 PRINT" WASTE AT T = Te [LITERS PER CAPITA PER DAY] ";WERM(I)
14058 PRINT" WASTE AT T = Tm [LITERS PER CAPITA PER DAY] ";WER(I)
14059 PRINT" RUNOFF COE. ";C(I)
14060 PRINT" ELEV ";UNIT$(3);" = ";TAB(20);ELEV(I)
14070 INPUT "IS THIS THE NODE TO BE CHANGED (Y/N)";ANS$
14080 IF ANS$<>"Y" AND ANS$<>"y" THEN GOTO 13970
14090 PRINT"PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
14100 PRINT"NODE #";TAB(20);"DEFAULT = ";ND;
14110 INPUT TEMP$
14120 IF TEMP$<>" " THEN NODE(I) = ABS(VAL(TEMP$))
14130 PRINT" AREA (ba) ";TAB(20);"DEFAULT = ";BA(I);
14135 INPUT TEMP$
14140 IF TEMP$<>" " THEN BA(I) = VAL(TEMP$)
14141 PRINT" MIN FACTOR ";TAB(20);"DEFAULT = ";PEAK1(I);
14142 INPUT TEMP$
14143 IF TEMP$<>" " THEN PEAK1(I) = VAL(TEMP$)
14144 PRINT" PEAK FACTOR ";TAB(20);"DEFAULT = ";PEAK(I);
14145 INPUT TEMP$
14146 IF TEMP$<>" " THEN PEAK(I) = VAL(TEMP$)
14151 PRINT" POP.AT T = Te ";TAB(20);"DEFAULT = ";DENM(I);
14152 INPUT TEMP$
14153 IF TEMP$<>" " THEN DENM(I) = VAL(TEMP$)
14154 PRINT" POP.AT T = Tm ";TAB(20);"DEFAULT = ";DEN(I);
14155 INPUT TEMP$
14156 IF TEMP$<>" " THEN DEN(I) = VAL(TEMP$)
14157 PRINT" WASTE AT T = Te ";TAB(20);"DEFAULT = ";WERM(I);
14158 INPUT TEMP$
14159 IF TEMP$<>" " THEN WERM(I) = VAL(TEMP$)
14160 PRINT" WASTE AT T = Tm ";TAB(20);"DEFAULT = ";WER(I);
14161 INPUT TEMP$
14162 IF TEMP$<>" " THEN WER(I) = VAL(TEMP$)
14163 PRINT" RUNOFF COE. ";TAB(20);"DEFAULT = ";C(I);
14164 INPUT TEMP$
14165 IF TEMP$<>" " THEN C(I) = VAL(TEMP$)
14178 PRINT" ELEV ";UNIT$(3);TAB(20);"DEFAULT = ";ELEV(I);
14179 INPUT TEMP$
14180 IF TEMP$<>" " THEN ELEV(I) = VAL(TEMP$)
14190 PRINT"NODE CHANGE COMPLETE":PRINT
14200 GOTO 13970
14210 RETURN
14220 REM -----

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14230 REM ** SUBROUTINE TO ADD LINKS **
14290 ISAVE = 0
14300 CLS
14310 PRINT "THERE ARE CURRENTLY";NLINK;" LINK IN THE NETWORK."
14320 IF NLINK+1>NLINK THEN PRINT "MAXIMUM NUMBER OF LINKS HAVE BEEN ENTERED." :G
OSUB 21730:GOTO 14480
14330 PRINT "ENTER 'M' FOR LINK NUMBER AFTER LAST LINK HAS BEEN ENTERED."
14340 PRINT
14350 INPUT "ENTER LINK NUMBER:";LN$
14360 IF LN$="M" OR LN$="m" THEN GOTO 14480
14370 NLINK=NLINK+1
14380 LINK(NLINK)=VAL(LN$)
14390 INPUT "ENTER FROM NODE:";NFROM(NLINK)
14400 INPUT "ENTER TO NODE:";NTO(NLINK)
14410 PRINT "ENTER LENGTH OF LINK ";UNIT$(2);":":INPUT SPAN(NLINK)
14420 PRINT "ENTER DIAMETER OF LINK ";UNIT$(4);":":INPUT DIAM(NLINK)
14430 COVER$=""
14440 PRINT "ENTER MINIMUM COVER DEPTH (DEFAULT="";COVERMIN;")":INPUT COVER$
14450 IF COVER$="" THEN COVER(NLINK)=COVERMIN ELSE COVER(NLINK)=VAL(COVER$)
14460 PRINT
14470 GOTO 14320
14480 RETURN
14490 REM -----
14500 REM ** SUBROUTINE TO DELETED LINKS **
14560 ISAVE = 0
14570 CLS
14580 PRINT "ENTER 'M' TO RETURN TO MAIN MENU":PRINT
14590 INPUT "ENTER THE NUMBER OF THE LINK TO BE DELETED";LN$
14600 IF LN$="M" OR LN$="m" THEN GOTO 14830
14610 LN = ABS(VAL(LN$))
14620 I=1
14630 IF I>NLINK THEN PRINT ":PRINT "LINK";LN;": NOT IN LIST. PLEASE REENTER":GOTO
14580
14640 IF LINK(I)<>LN THEN I=I+1:GOTO 14630
14650 PRINT "LINK #";LN;" HAS THE FOLLOWING DATA:"
14660 PRINT "FROM NODE = ";TAB(34);NFROM(I)
14670 PRINT "TO NODE = ";TAB(34);NTO(I)
14680 PRINT "LENGTH";UNIT$(2);" = ";TAB(34);SPAN(I)
14690 PRINT "DIAMETER";UNIT$(4);" = ";TAB(34);DIAM(I)
14700 PRINT "MINIMUM COVER DEPTH = ";TAB(34);COVER(I)
14710 INPUT "IS THIS THE LINK TO BE DELETED (Y/N)";ANS$
14720 IF ANS$<>"Y" AND ANS$<>"y" THEN PRINT :GOTO 14580
14730 FOR J=1 TO NLINK-1
14740 LINK(J) = LINK(J+1)
14750 SPAN(J) = SPAN(J+1)
14760 DIAM(J) = DIAM(J+1)
14770 NFROM(J) = NFROM(J+1)
14780 NTO(J) = NTO(J+1)
14790 COVER(J) = COVER(J+1)
14800 NEXT J
14810 NLINK = NLINK-1
14820 GOTO 14580

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14830 RETURN
14840 REM -----
14850 REM ** SUBROUTINE TO CHANGE LINK DATA **
14910 ISAVE = 0
14920 CLS
14930 PRINT "ENTER 'M' FOR THE LINK # TO RETURN TO MAIN MENU":PRINT
14940 INPUT "ENTER THE NUMBER OF THE LINK TO BE CHANGED";LN$
14950 IF LN$="M" OR LN$="" THEN GOTO 15290
14960 LN = ABS(VAL(LN$))
14970 I=1
14980 IF I>NLINK THEN PRINT :PRINT "LINK";LN;" NOT IN LIST. PLEASE REENTER":GOTO
14930
14990 IF LINK(I)<>LN THEN I=I+1:GOTO 14980
15000 PRINT "LINK #";LN;" HAS THE FOLLOWING DATA:"
15010 PRINT " FROM NODE = ";TAB(37);NFROM(I)
15020 PRINT " TO NODE = ";TAB(37);NTO(I)
15030 PRINT " LENGTH";UNIT$(2);" = ";TAB(37);SPAN(I)
15040 PRINT " DIAMETER";UNIT$(4);" = ";TAB(37);DIAM(I)
15050 PRINT " MINIMUM COVER DEPTH = ";TAB(37);COVER(I)
15060 INPUT "IS THIS THE LINK TO BE CHANGED (Y/N)";ANS$
15070 IF ANS$<>"Y" AND ANS$<>"N" THEN PRINT :GOTO 14930
15080 PRINT "PRESS 'RETURN' IF DEFAULT IS ACCEPTABLE, OTHERWISE ENTER NEW VALUE"
15090 PRINT "LINK #";TAB(30);"DEFAULT =";LN;
15100 INPUT TEMP$
15110 IF TEMP$<>" " THEN LINK(I) = ABS(VAL(TEMP$))
15120 PRINT "FROM NODE";TAB(30);"DEFAULT =";NFROM(I);
15130 INPUT TEMP$
15140 IF TEMP$<>" " THEN NFROM(I) = ABS(VAL(TEMP$))
15150 PRINT "TO NODE";TAB(30);"DEFAULT =";NTO(I);
15160 INPUT TEMP$
15170 IF TEMP$<>" " THEN NTO(I) = ABS(VAL(TEMP$))
15180 PRINT "LENGTH ";UNIT$(2);TAB(30);"DEFAULT =";SPAN(I);
15190 INPUT TEMP$
15200 IF TEMP$<>" " THEN SPAN(I) = ABS(VAL(TEMP$))
15210 PRINT "DIAMETER ";UNIT$(4);TAB(30);"DEFAULT =";DIAM(I);
15220 INPUT TEMP$
15230 IF TEMP$<>" " THEN DIAM(I) = ABS(VAL(TEMP$))
15240 PRINT "MINIMUM COVER DEPTH";TAB(30);"DEFAULT =";COVER(I);
15250 INPUT TEMP$
15260 IF TEMP$<>" " THEN COVER(I) = ABS(VAL(TEMP$))
15270 PRINT "LINK CHANGE COMPLETE":PRINT
15280 GOTO 14930
15290 RETURN
15300 REM -----
15310 REM ** SUBROUTINE TO PERFORM SEWER DESIGN **
15480 CLS
15490 FULLTHETA = 4.3
15500 FLAT = .0008
15510 NDIGIT = 5
15520 IF NLINK = NNODE-1 THEN GOTO 15660
15530 PRINT "NETWORK IS NOT BRANCHED."
15540 PRINT "NUMBER OF LINKS MUST EQUAL NUMBER OF NODES - 1"

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15550 GOSUB 21730
15560 GOTO 15840
15660 COLOR 31,0:PRINT TAB(25);"COMBINED SEWERS SYSTEM WORKING":COLOR 7,0:PRINT
15670 GOSUB 16960:REM RENUMBER NODES
15680 IF IERROR = 1 THEN GOSUB 19820:GOSUB 21730:GOTO 15840
15690 GOSUB 17400:REM FLOWS DETERMINED
15700 IF IERROR = 1 THEN GOSUB 19820:GOSUB 21730:GOTO 15840
15740 GOSUB 17870:REM FIND MAX & MIN SLOPES
15750 IF IERROR = 1 THEN GOSUB 21730:GOTO 15790
15760 GOSUB 18300:REM SET PIPE SLOPES
15770 GOSUB 19400:REM FIND VELOCITIES AND WATER DEPTES
15780 GOSUB 19700:REM CHECK MAXIMUM COVER DEPTH AND OUTFALL ELEVATION
15790 GOSUB 19820:REM REASSIGN ORIGINAL NODE NUMBERS
15800 GOSUB 20060:REM LIST DATA
15810 FOR I=1 TO NLINK
15830 NEXT I
15840 RETURN
15850 REM -----
15860 REM ** SUBROUTINE TO SAVE DATA TO DISK **
15950 CLS
15960 INPUT "ENTER NAME OF DISK FILE TO BE SAVED: ";AF$
15965 DF$ = "b:"+AF$+".sss"
15970 OPEN "O",1,DF$
15980 PRINT"NOW SAVING DATA"
15990 PRINT #1,TITLE$
16000 PRINT #1,NLINK;NNODE;A;B;KE;RO;NREF
16010 PRINT #1,ELEVREF;ROUGH;TE
16020 PRINT #1,COVERMIN;COVERMAX;VELMIN;VELMAX
16030 FOR I=1 TO NLINK
16040 PRINT #1,LINK(I);NFROM(I);NTO(I);SPAN(I);DIAM(I);COVER(I)
16050 NEXT I
16060 FOR I=1 TO NNODE
16070 PRINT #1,NODE(I);HA(I);DENM(I);DEN(I);WERM(I);WER(I);C(I);ELEV(I);PEAK1(I)
;PEAK(I)
16080 NEXT I
16090 CLOSE
16100 ISAVE = 1
16110 PRINT"DATA NOW SAVED IN FILE: ";DF$
16120 GOSUB 21730:REM SCREEN HOLD
16130 RETURN
16140 REM -----
16150 REM ** SUBROUTINE TO START A NEW RUN **
16200 CLS
16210 IF ISAVE = 0 THEN GOSUB 16380
16220 RUN
16230 REM -----
16240 REM ** SUBROUTINE TO END PROGRAM **
16290 CLS
16300 IF ISAVE = 0 THEN GOSUB 16380
16310 CHAIN "SELECT1"
16320 REM -----
16330 REM ** SUBROUTINE TO TEST FOR DATA SAVE **

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16380 INPUT "SAVE CURRENT DATA TO DISK (Y/N)";ANS$
16390 IF ANS$(<>"N" AND ANS$(<>"n" THEN GOSUB 15950
16400 RETURN
16410 REM -----
16420 REM ** SUBROUTINE TO SET UNIT NAMES **
16560 ON IUNITS GOTO 16660
16660 COEF(1) = .01
16670 COEF(2) = 80!
16680 COEF(3) = 4343.06
16690 UNIT$(1) = "(LPS)"
16700 UNIT$(2) = "(M)"
16710 UNIT$(3) = "(M)"
16720 UNIT$(4) = "(CM)"
16730 UNIT$(5) = "(MPS)"
16740 GOTO 16830
16830 FM$(1) = "###"
16840 FM$(2) = "##.###"
16850 FM$(3) = "###.##"
16860 FM$(4) = ".###"
16870 FM$(5) = "##.##"
16880 FM$(6) = "####.##"
16890 RETURN
16900 REM -----
16910 REM ** SUBROUTINE TO RENUMBER NODES AND LINKS **
16960 IERROR = 0
16970 FOR I=1 TO NLINK
16980 KTO = 0
16990 KFROM = 0
17000 FOR J=1 TO NNODE
17010 IF KFROM = 1 THEN GOTO 17060
17020 IF NFROM(I) <> NODE(J) THEN GOTO 17060
17030 NFROM(I) = J
17040 KFROM = 1
17050 GOTO 17100
17060 IF KTO = 1 THEN GOTO 17100
17070 IF NTO(I) <> NODE(J) THEN GOTO 17100
17080 NTO(I) = J
17090 KTO = 1
17100 NEXT J
17110 IF KTO = 1 AND KFROM = 1 THEN GOTO 17150
17120 IF KFROM <> 1 THEN PRINT "NODE";NFROM(I);" NOT IN 'FROM NODE #' LIST"
17130 IF KTO <> 1 THEN PRINT "NODE";NTO(I);" NOT IN 'TO NODE #' LIST"
17140 IERROR = 1
17150 NEXT I
17160 IF IERROR <> 1 THEN GOTO 17210
17170 PRINT"PLEASE CHECK TO AND FROM NODE NUMBERS AND REFERENCE NODE NUMBER."
17180 PRINT"THEY MAY HAVE BEEN CHANGED INCORRECTLY BECAUSE OF THIS ERROR."
17190 GOSUB 21730: REM SCREEN HOLD
17200 GOTO 17330
17210 KNODE = 0
17220 FOR I=1 TO NNODE
17230 IF (KNODE=0) AND (NODE(I) = NREF) THEN NREF = I:KNODE = 1

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17240 NEXT I
17250 IF KNODE=1 THEN GOTO 17320
17260 PRINT"REFERENCE NODE #";NREF;" IS NOT IN 'NODE #' LIST"
17270 PRINT"PLEASE CHECK TO AND FROM NODE NUMBERS AND REFERENCE NODE NUMBER."
17280 PRINT"THEY MAY HAVE BEEN CHANGED INCORRECTLY BECAUSE OF THIS ERROR."
17290 IERROR = 1
17300 GOSUB 21730: REM SCREEN HOLD
17310 GOTO 17330
17320 PRINT
17330 RETURN
17340 REM -----
17350 REM ** SUBROUTINE TO ASSIGN INITIAL FLOWS **
17400 FOR I=1 TO NNODE
17410 NDEGREE(I) = 0
17420 CUMDEM(I) = (BA(I)*DEN(I)*WER(I)*PEAK(I)/86400!) + (BA(I)*RO/86.4)
17425 CUMDEMM(I) = (BA(I)*DENM(I)*WERM(I)*PEAK1(I)/86400!) + (BA(I)*RO/86.4)
17430 NEXT I
17440 FOR I=1 TO NLINK
17450 FLOW(I) = 0
17455 FLOWM(I) = 0
17460 NEXT I
17470 REM FIND DEGREE OF ALL NODES
17480 FOR I=1 TO NLINK
17490 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
17500 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
17510 NEXT I
17520 REM SET FLOWS
17525 H = 0 : TF = 0 : HP = 0
17530 FOR I=1 TO NLINK
17531 GS(I) = (ELEV(NFROM(I))-ELEV(NTO(I)))/SPAN(I)
17532 IF GS(I) < .0008 THEN GS(I) = FLAT
17534 VELFULL(I) = (DIAM(I)/400)^(2/3)*GS(I)^(.5/ROUGH)
17540 IF (NDEGREE(NFROM(I)) <> 1) OR (NDEGREE(NTO(I)) = 0) THEN GOTO 17600
17544 IF I=1 THEN GOTO 17546
17545 T(I)=SPAN(I-1)/VELFULL(I-1)/60: TF=TF+T(I)
17546 TC=TF+TF : INTEN = A/((TC+B)^KK) : HP = HP+BA(I) : PP = (72*(TC^.105))/((BP
+68158!)^(LOG (BP/96)/LOG (10))/60))/100 : IF PP > 1 THEN PP = 1
17547 H = HP*PP : STO(I) = (INTEN*B*C(I)*25/9)
17549 FLOW(I) = CUMDEM(NFROM(I))+STO(I)
17555 FLOWM(I) = CUMDEMM(NFROM(I))
17560 CUMDEM(NTO(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17565 CUMDEMM(NTO(I)) = CUMDEMM(NTO(I)) + CUMDEMM(NFROM(I))
17570 NDEGREE(NFROM(I)) = 0
17580 NDEGREE(NTO(I)) = NDEGREE(NTO(I))-1
17590 GOTO 17650
17600 IF (NDEGREE(NTO(I)) <> 1) OR (NDEGREE(NFROM(I)) = 0) THEN GOTO 17650
17610 FLOW(I) = -CUMDEM(NTO(I))
17615 FLOWM(I) = -CUMDEMM(NTO(I))
17620 CUMDEM(NFROM(I)) = CUMDEM(NTO(I)) + CUMDEM(NFROM(I))
17625 CUMDEMM(NFROM(I)) = CUMDEMM(NTO(I)) + CUMDEMM(NFROM(I))
17630 NDEGREE(NTO(I)) = 0
17640 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))-1

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17650 NEXT I
17660 NSUM = 0
17670 FOR I=1 TO NNODE
17680 NSUM = NSUM+NDEGREE(I)
17690 NEXT I
17700 IF NSUM > 0 THEN GOTO 17530
17710 IERROR = 0
17720 FOR I=1 TO NLINK
17730 IF FLOW(I) >0! THEN GOTO 17770
17735 IF FLOWM(I) >0! THEN GOTO 17770
17740 PRINT"THE CALCULATED FLOW IN LINK";LINK(I);"IS NEGATIVE."
17750 PRINT"PLEASE CHECK THAT THE FROM AND TO NODES ARE ASSIGNED CORRECTLY."
17760 IERROR = 1
17770 NEXT I
17780 PRINT"  FLOWS DETERMINED."
17790 RETURN
17800 REM -----
17810 REM ** SUBROUTINE TO FIND MIN AND MAX ALLOWABLE SLOPES **
17870 FOR J=1 TO NLINK
17880 CONST = COEF(2)*FLOWM(J)/(VELMIN*DIAM(J)^2)
17890 THETA = 0!
17900 FOR K=1 TO NDIGIT
17910 FOR I=1 TO 10
17920 TEMP = THETA+(I*10!^(1-K))
17930 IF (TEMP-SIN(TEMP)) > CONST THEN GOTO 17950
17940 NEXT I
17950 THETA = TEMP-(10!^(1-K))
17960 NEXT K
17970 IF THETA >FULLTBETA THEN THETA = FULLTBETA
17980 SLOPEMIN(J) = (COEF(3)*ROUGH*FLOWM(J)*THETA^(2!/3!)/(DIAM(J)^(8!/3!))*(THETA-SIN(THETA))^(5!/3!))^2
17990 IF SLOPEMIN(J) < FLAT THEN SLOPEMIN(J) = FLAT
18000 NEXT J
18010 IERROR = 0
18020 FOR J=1 TO NLINK
18030 THETA = 0!
18040 CONST = COEF(2)*FLOW(J)/(VELMAX*DIAM(J)^2)
18050 FOR K=1 TO NDIGIT
18060 FOR I=1 TO 10
18070 TEMP = THETA+(I*10!^(1-K))
18080 IF (TEMP-SIN(TEMP)) >CONST THEN GOTO 18100
18090 NEXT I
18100 THETA = TEMP-(10!^(1-K))
18110 NEXT K
18120 IF THETA <= FULLTBETA THEN GOTO 18150
18130 IERROR = 1
18140 PRINT"LINK ";LINK(J);" TOO SMALL TO CARRY THE FLOW."
18150 SLOPEMAX(J)=(COEF(3)*ROUGH*FLOW(J)*THETA^(2!/3!)/(DIAM(J)^(8!/3!))*(THETA-SIN(THETA))^(5!/3!))^2
18160 IF SLOPEMAX(J) < FLAT THEN SLOPEMAX(J) = FLAT
18170 NEXT J
18180 PRINT"  MINIMUM AND MAXIMUM ALLOWABLE SLOPES FOUND "

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18190 RETURN
18200 REM -----
18210 REM ** SUBROUTINE TO ASSIGN PIPE SIZE AND ELEVATION **
18300 FOR I=1 TO NLINK
18310 GROUND Slope = (Elev(NFROM(I)) - Elev(NTO(I))) / SPAN(I)
18320 NEXT I
18330 FOR I=1 TO NLINK
18340 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
18350 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
18360 NEXT I
18410 FOR I=1 TO NLINK
18420 IF NDEGREE(NFROM(I)) = 1 THEN CUMDEPTH(NFROM(I)) = Elev(NFROM(I))-COVER(I)

18430 NEXT I
18440 FOR I=1 TO NLINK
18450 IF NDEGREE(NFROM(I)) <> 1 THEN GOTO 18820
18460 IF GROUND Slope(I) > SlopeMIN(I) THEN GOTO 18520
18465 IF SlopeMIN(I) < SlopeMAX(I) THEN GOTO 18470
18466 PipeSlope(I) = SlopeMAX(I)
18467 GOTO 18480
18470 PipeSlope(I) = SlopeMIN(I)
18480 TempCrown = Elev(NFROM(I))-COVER(I)
18490 IF TempCrown < CUMDEPTH(NFROM(I)) THEN UPCROWN(I) = TempCrown ELSE UPCROWN(I) = CUMDEPTH(NFROM(I))
18500 DownCrown(I) = UPCROWN(I)-SPAN(I)*PipeSlope(I)
18510 GOTO 18790
18520 IF GROUND Slope(I) < SlopeMAX(I) THEN GOTO 18700
18530 TempDown = Elev(NTO(I))-COVER(I)
18540 TempUp = TempDown+SPAN(I)*SlopeMAX(I)
18550 IF TempUp > CUMDEPTH(NFROM(I)) THEN GOTO 18600
18560 PipeSlope(I) = SlopeMAX(I)
18570 UPCROWN(I) = TempUp
18580 DownCrown(I) = TempDown
18590 GOTO 18790
18600 TempSlope = (CUMDEPTH(NFROM(I))-(Elev(NTO(I))-COVER(I)))/SPAN(I)
18610 IF TempSlope > SlopeMAX(I) THEN GOTO 18660
18620 IF TempSlope > SlopeMIN(I) THEN PipeSlope(I) = TempSlope ELSE PipeSlope(I) = SlopeMIN(I)
18630 UPCROWN(I) = CUMDEPTH(NFROM(I))
18640 DownCrown(I) = UPCROWN(I)-SPAN(I)*PipeSlope(I)
18650 GOTO 18790
18660 PipeSlope(I) = SlopeMAX(I)
18670 DownCrown(I) = Elev(NTO(I))-COVER(I)
18680 UPCROWN(I) = DownCrown(I)+SPAN(I)*PipeSlope(I)
18690 GOTO 18790
18700 IF CUMDEPTH(NFROM(I)) < (Elev(NFROM(I))-COVER(I)) THEN GOTO 18750
18710 PipeSlope(I) = GROUND Slope(I)
18720 UPCROWN(I) = Elev(NFROM(I))-COVER(I)

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18730 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18740 GOTO 18790
18750 TEMPSLOPE = (CUMDEPTH(NFROM(I))-(ELEV(NTO(I))-COVER(I)))/SPAN(I)
18760 IF TEMPSLOPE > SLOPEMIN(I) THEN PIPESLOPE(I) = TEMPSLOPE ELSE PIPESLOPE(I)
    = SLOPEMIN(I)
18770 UPCROWN(I) = CUMDEPTH(NFROM(I))
18780 DOWNCROWN(I) = UPCROWN(I)-SPAN(I)*PIPESLOPE(I)
18790 IF DOWNCROWN(I) < CUMDEPTH(NTO(I)) THEN CUMDEPTH(NTO(I)) = DOWNCROWN(I)
18800 NDEGREE(NTO(I)) = NDEGREE(NTO(I))-1
18810 NDEGREE(NFROM(I)) = 0
18820 NEXT I
18830 NSUM = 0
18840 FOR I=1 TO NNODE
18850 NSUM = NSUM+NDEGREE(I)
18860 NEXT I
18870 IF NSUM > 0 THEN GOTO 18440
18880 OUTCROWN = CUMDEPTH(NREF)
18890 FOR I=1 TO NLINK
18900 UPINVERT(I) = UPCROWN(I)-DIAM(I)*COEF(1)
18910 DOWNINVERT(I) = DOWNCROWN(I)-DIAM(I)*COEF(1)
18920 XOP(I) = ELEV(NFROM(I))-UPINVERT(I)
18930 XDOWN(I) = ELEV(NTO(I))-DOWNINVERT(I)
18940 NEXT I
18950 FOR I=1 TO NNODE
18960 NDEGREE(I) = 0
18970 NEXT I
18980 FOR I=1 TO NLINK
18990 NDEGREE(NFROM(I)) = NDEGREE(NFROM(I))+1
19000 NDEGREE(NTO(I)) = NDEGREE(NTO(I))+1
19010 NEXT I
19020 FOR I=1 TO NLINK
19030 TOP = DOWNINVERT(I)
19040 BOTTOM = DOWNINVERT(I)
19050 FOR J=1 TO NLINK
19060 IF (NTO(I) = NTO(J)) AND (DOWNINVERT(J) > TOP) THEN TOP = DOWNINVERT(J)
19070 IF (NTO(I) = NFROM(J)) AND (UPINVERT(J) < BOTTOM) THEN BOTTOM = UPINVERT(J)
)
19080 NEXT J
19090 DROP(NTO(I)) = TOP - BOTTOM
19100 XNODE(NTO(I)) = ELEV(NTO(I))-BOTTOM
19110 IF NDEGREE(NTO(I)) <> 1 THEN GOTO 19140
19120 DROP(NTO(I)) = 0!
19130 XNODE(NTO(I)) = ELEV(NTO(I))-DOWNINVERT(I)
19140 IF NDEGREE(NFROM(I)) <> 1 THEN GOTO 19170
19150 DROP(NFROM(I)) = 0!
19160 XNODE(NFROM(I)) = ELEV(NFROM(I))-UPINVERT(I)
19170 NEXT I
19180 SLENGTH = 0!
19190 SDEPTH = 0!
19200 SAREA = 0!
19210 SDIAM = 0!
19220 FOR I=1 TO NLINK

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19230 SLENGTB = SLENGTB+SPAN(I)
19240 XDEPTH = .5*(XUP(I)+XDOWN(I))
19250 SDEPTH = SDEPTH+XDEPTH*SPAN(I)
19260 SAREA = SAREA+XDEPTH*SPAN(I)*DIAM(I)*COEF(1)
19270 SDIAM = SDIAM+DIAM(I)*SPAN(I)
19280 NEXT I
19290 AVGDEPTH = SDEPTH/SLENGTB
19300 AVGAREA = SAREA/SLENGTB
19310 AVGDIAM = SDIAM/SLENGTB
19320 PRINT " PIPE SLOPES AND ELEVATIONS FOUND."
19330 RETURN
19340 REM -----
19350 REM ** SUBROUTINE TO FIND WATER DEPTHS AND VELOCITIES **
19400 FOR J=1 TO NLINK
19410 CONST = COEF(3)*ROUGH*FLOW(J)/(DIAM(J)^(8!/3!)*SQR(PIPESLOPE(J)))
19420 THETA = 0!
19430 FOR K=1 TO NDIGIT
19440 FOR I=1 TO 10
19450 TEMP = THETA+(I*10!^(1-K))
19460 COMPAR = (TEMP-SIN(TEMP))^(5!/3!)/(TEMP^(2!/3!))
19470 IF COMPAR > CONST THEN GOTO 19490
19480 NEXT I
19490 THETA = TEMP-(10!^(1-K))
19500 NEXT K
19510 ANGLE(J) = THETA
19520 NEXT J
19530 FOR I=1 TO NLINK
19540 VELOCITY(I)=COEF(2)*FLOW(I)/(DIAM(I)^2*(ANGLE(I)-SIN(ANGLE(I))))
19545 DEPTH(I) = (1!-COS(ANGLE(I)/2!))*DIAM(I)/2!
19550 NEXT I
19551 FOR J=1 TO NLINK
19552 CONST = COEF(3)*ROUGH*FLOW(J)/(DIAM(J)^(8!/3!)*SQR(PIPESLOPE(J)))
19553 THETA = 0!
19554 FOR K=1 TO NDIGIT
19555 FOR I=1 TO 10
19556 TEMP = THETA+(I*10!^(1-K))
19557 COMPAR = (TEMP-SIN(TEMP))^(5!/3!)/(TEMP^(2!/3!))
19558 IF COMPAR > CONST THEN GOTO 19560
19559 NEXT I
19560 THETA = TEMP-(10!^(1-K))
19561 NEXT K
19562 ANGLE(J) = THETA
19563 NEXT J
19564 FOR I=1 TO NLINK
19565 VELOCITY(I)=COEF(2)*FLOW(I)/(DIAM(I)^2*(ANGLE(I)-SIN(ANGLE(I))))
19566 DEPTH(I) = (1!-COS(ANGLE(I)/2!))*DIAM(I)/2!
19569 PIPESLOPE(I) = PIPESLOPE(I)*100!
19570 REM **          SLOPEMAX(),SLOPEMIN(),SPAN() **
19580 SLOPEMIN(I) = SLOPEMIN(I)*100!
19590 SLOPEMAX(I) = SLOPEMAX(I)*100!
19600 GROUNDSLOPE(I) = GROUNDSLOPE(I)*100!
19610 NEXT I

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19620 PRINT " VELOCITIES AND DEPTHS OF FLOW FOUND."
19630 RETURN
19640 REM -----
19650 REM ** SUBROUTINE TO CHECK MAX COVER CONSTRAINT **
19700 FOR I=1 TO NLINK
19710 IMAX(I)=0
19715 IMIN(I)=0
19716 A(I)=0
19720 IF ((ELEV(NFROM(I))-UPCROWN(I)) > COVERMAX) OR ((ELEV(NTO(I))-DOWNCROWN(I))
) > COVERMAX) THEN IMAX(I) = 1
19725 IF VELOCITYM(I) < VELMIN THEN IMIN(I) = 1
19726 IF SLOPEMIN(I) > SLOPEMAX(I) THEN A(I) = 1
19730 NEXT I
19740 PRINT " MAXIMUM COVER DEPTHS CHECKED."
19750 RETURN
19760 REM -----
19770 REM ** SUBROUTINE TO REASSIGN ORIGINAL NODE AND LINK NUMBERS **
19820 FOR I=1 TO NLINK
19830 NTO(I) = NODE(NTO(I))
19840 NFROM(I) = NODE(NFROM(I))
19850 NEXT I
19860 NREF = NODE(NREF)
19870 PRINT
19880 RETURN
19890 REM -----
19900 REM ** SUBROUTINE TO PRINT RESULTS **
20060 CLS
20070 OPEN "SCRN:" FOR OUTPUT AS #1
20080 IPAGE = 15
20090 GOSUB 20470
20100 CLOSE
20110 CLS
20120 INPUT "WOULD YOU LIKE TO REVIEW RESULTS AGAIN (Y/N)";ANS$
20130 IF ANS$ = "Y" OR ANS$ = "y" THEN GOTO 20060
20140 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)";ANS$
20150 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20200
20160 OPEN "LPT1:" FOR OUTPUT AS #1
20170 IPAGE = MPAGE
20180 GOSUB 20470
20190 CLOSE
20200 INPUT "DO YOU WANT A DISK COPY OF THE DATA (Y/N)";ANS$
20210 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20270
20220 GOSUB 22000
20270 RETURN
20280 REM -----
20290 REM ** SUBROUTINE TO PRINT OUT RESULTS DATA **
20470 IF (IPAGE <> MPAGE) THEN CLS
20480 IUNITS=2:PRINT #1,"PROJECT TITLE: ";TAB(17);TITLE$
20490 PRINT #1,"
20500 PRINT #1," NUMBER OF NODES: ";TAB(40);NNODE
20510 PRINT #1," NUMBER OF LINKS: ";TAB(40);NLINK
20530 PRINT #1," MINIMUM SCOUR VELOCITY: ";TAB(40);VELMIN; " ";UNIT$(5)

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20540 PRINT #1, " MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
20550 PRINT #1, " MAXIMUM COVER DEPTH:";TAB(40);COVERMAX;" ";UNIT$(3)
20560 PRINT #1, " SEWER OUTFALL NODE #:";TAB(40);NREF
20570 PRINT #1, " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)

20580 PRINT #1, ""
20590 PRINT #1, "TOTAL SYSTEM LENGTH:";TAB(40);SLENGTH
20600 PRINT #1, "AVERAGE WEIGHTED DIAMETER:";TAB(40);AVGDIA
20610 PRINT #1, "AVERAGE WEIGHTED EXCAVATION DEPTH:";TAB(40);AVGDEPTH
20620 PRINT #1, "AVERAGE WEIGHTED EXCAVATION AREA:";TAB(40);AVGAREA
20630 PRINT #1, ""
20640 IF OUTCROWN < ELEVREF THEN PRINT #1, "WARNING : ELEVATION OF LAST PIPE IS L
OWER THAN CROWN OF OUTFALL NODE."
20650 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20660 GOSUB 21160
20670 FOR I=1 TO NLINK
20680 IF IMAX(I) = 1 THEN PRINT #1, "*";
20685 IF IMIN(I) = 1 THEN PRINT #1, TAB(2);"-";
20686 IF A(I) = 1 THEN PRINT #1, TAB(3);"#";
20690 PRINT #1, TAB(4);USING FM$(1);LINK(I);
20700 PRINT #1, TAB(9);USING FM$(1);NFROM(I);
20710 PRINT #1, TAB(14);USING FM$(1);NTO(I);
20720 PRINT #1, TAB(17);USING FM$(2);FLOW(I)*.001;
20730 PRINT #1, TAB(23);USING FM$(2);FLOWM(I)*.001;
20740 PRINT #1, TAB(30);USING FM$(1);DIAM(I);
20750 PRINT #1, TAB(34);USING FM$(5);SLOPEMAX(I);
20760 PRINT #1, TAB(40);USING FM$(5);SLOPEMIN(I);
20765 PRINT #1, TAB(46);USING FM$(5);GROUNDSLOPE(I);
20770 PRINT #1, TAB(52);USING FM$(5);PIPESLOPE(I);
20775 PRINT #1, TAB(57);USING FM$(5);VELOCITY(I);
20780 PRINT #1, TAB(62);USING FM$(5);VELOCITYM(I);
20790 PRINT #1, TAB(67);USING FM$(3);DEPTH(I);
20800 PRINT #1, TAB(73);USING FM$(3);DEPTHM(I)
20810 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21160

20820 NEXT I
20830 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20840 GOSUB 21370
20850 FOR I=1 TO NLINK
20860 IF IMAX(I) = 1 THEN PRINT #1, "*";
20870 PRINT #1, TAB(2);USING FM$(1);LINK(I);
20875 PRINT #1, TAB(8);USING FM$(3);SPAN(I);
20880 PRINT #1, TAB(15);USING FM$(3);XUP(I)+UPINVERT(I);
20890 PRINT #1, TAB(23);USING FM$(3);XDOWN(I)+DOWNINVERT(I);
20900 PRINT #1, TAB(31);USING FM$(3);UPCROWN(I);
20910 PRINT #1, TAB(39);USING FM$(3);DOWNCROWN(I);
20920 PRINT #1, TAB(46);USING FM$(3);UPINVERT(I);
20930 PRINT #1, TAB(54);USING FM$(3);DOWNINVERT(I);
20940 PRINT #1, TAB(63);USING FM$(3);XUP(I);
20950 PRINT #1, TAB(72);USING FM$(3);XDOWN(I)
20960 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21370

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20970 NEXT I
20980 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20990 GOSUB 21560
21000 FOR I=1 TO NNODE
21010 PRINT #1,TAB(2);USING FM$(1);NODE(I);
21020 PRINT #1,TAB(9);USING FM$(5);BA(I);
21025 PRINT #1,TAB(18);USING FM$(5);C(I);
21030 PRINT #1,TAB(27);USING FM$(3);ELEV(I);
21040 PRINT #1,TAB(37);USING FM$(3);XNODE(I);
21050 PRINT #1,TAB(53);USING FM$(3);DROP(I)
21060 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21560

21070 NEXT I
21080 IF (IPAGE <> MPAGE) THEN GOSUB 21730:ELSE PRINT #1,"":PRINT #1,""
21090 RETURN
21100 REM -----
21110 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 1 **
21160 PRINT #1,"PROJECT TITLE:";TITLE$
21170 PRINT #1,TAB(20);" L I N K   D A T A";TAB(50);"* => MAX COVER DEPTH EXCEED
ED"
21175 PRINT #1,"                               - => MIN VELOCI
TY TOO LOW"
21176 PRINT #1,"                               # => MIN SLOPE
EXCEED"
21180 PRINT #1,""
21190 PRINT #1,"   LINK";TAB(10);"N O D E";
21200 PRINT #1,TAB(20);"F L O W";TAB(30);"DIAM";TAB(36);"S L O P E";
21210 PRINT #1,TAB(46);" S L O P E";
21220 PRINT #1,TAB(59);"VELOCITY";TAB(69);"D E P T H "
21230 PRINT #1,TAB(9);"FROM";TAB(15);"TO";TAB(19);"MAX";TAB(25);"MIN";TAB(36);"M
AX";TAB(42);"MIN";TAB(46);"GROUND";TAB(53);"PIPE";TAB(59);"MAX";TAB(64);"MIN";
21240 PRINT #1,TAB(69);"MAX";
21250 PRINT #1,TAB(75);"MIN"
21260 PRINT #1,"   #";TAB(11);"#";TAB(16);"#";TAB(19);"(cu.m/s)";TAB(30);"(CM
);TAB(37);"%";
21270 PRINT #1,TAB(43);"%";TAB(48);" %";TAB(54);" %";TAB(59);"(m/s)";TAB(72);"(C
M)"
21290 PRINT #1,""
21300 RETURN
21310 REM -----
21320 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 2 **
21370 PRINT #1,"PROJECT TITLE: ";TITLE$
21380 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"
21390 PRINT #1,""
21400 PRINT #1,TAB(15);"GROUND ELEV";TAB(31);"CROWN ELEV";
21410 PRINT #1,TAB(46);"INVERT ELEV";TAB(61);"EXCAVATION DEPTH"
21420 PRINT #1,TAB(2);"LINK";TAB(8);"LENGTH";TAB(15);"UPSTRM";TAB(23);"DNSTRM";
21430 PRINT #1,TAB(31);"UPSTRM";TAB(39);"DNSTRM";TAB(46);"UPSTRM";
21440 PRINT #1,TAB(54);"DNSTRM";TAB(63);"UPSTRM";TAB(72);"DNSTRM"
21450 PRINT #1,"   #";TAB(10);"(M)";TAB(17);DNIT$(3);TAB(25);"(M)";

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21460 PRINT #1,TAB(33);UNIT$(3);TAB(41);UNIT$(3);TAB(49);UNIT$(3);
21470 PRINT #1,TAB(55);UNIT$(3);TAB(64);UNIT$(3);TAB(73);UNIT$(3)
21480 PRINT #1,""
21490 RETURN
21500 REM -----
21510 REM ** SUBROUTINE TO PRINT NODE RESULTS HEADING **
21560 PRINT #1,"PROJECT TITLE: ";TITLE$
21570 PRINT #1,TAB(13);" N O D E  D A T A "
21580 PRINT #1,""
21590 PRINT #1,TAB(27);"GROUND";TAB(36);"EXCAVATION";
21600 PRINT #1,TAB(49);"DIST HIGH INVERT"
21610 PRINT #1," NODE";TAB(10);"AREA";TAB(18);"RUNOFF ";TAB(28);"ELEV";
21620 PRINT #1,TAB(38);"DEPTH";TAB(50);"TO LOW INVERT"
21630 PRINT #1," $";TAB(10);"(ha)";TAB(19);" COE. ";TAB(28);UNIT$(3);
21640 PRINT #1,TAB(38);UNIT$(3);TAB(55);UNIT$(3)
21650 PRINT #1,""
21660 RETURN
21670 REM -----
21680 REM ** SUBROUTINE TO HOLD SCREEN **
21730 LOCATE 24,1
21740 COLOR 0,7
21750 PRINT"PRESS ANY KEY TO CONTINUE";
21760 COLOR 7,0
21770 A$ = INKEY$:IF A$="" THEN GOTO 21770
21780 RETURN
22000 REM ** SUBROUTINE TO SAVE DATA TO DISK **
22010 CLS
22020 INPUT "ENTER NAME OF DISK FILE TO BE SAVED: ";AF$
22021 DF$ = "b:"+AF$+".com"
22030 OPEN "O",1,DF$
22040 PRINT"NOW SAVING DATA"
22050 PRINT #1,TITLE$
22060 PRINT #1,NLINK;NNODE;A;B;RK;EC;NREF
22070 PRINT #1,ELEVREF;ROUGH;TE
22080 PRINT #1,COVERMIN,COVERMAX,VELMIN,VELMAX,SLENGTH,AVGDIAM,AVGDEPTH,AVGAREA,
OUTCROWN
22090 FOR I=1 TO NLINK
22100 PRINT #1,LINK(I);NFROM(I);NTO(I);SPAN(I);DIAM(I);COVER(I);IMAX(I);IMIN(I);
FLOW(I);FLOWM(I);DEPTH(I);VELOCITY(I);VELOCITYM(I);PIPESLOPE(I);SLOPEMIN(I);SLOP
EMAX(I);GROUNDSLOPE(I);XUP(I);UPINVERT(I);XDOWN(I);DOWNINVERT(I);UPCROWN(I);DOWN
CROWN(I)
22105 PRINT #1,A(I);DEPTHM(I)
22110 NEXT I
22120 FOR I=1 TO NNODE
22130 PRINT #1,NODE(I);BA(I);DENM(I);DEN(I);WERM(I);WER(I);C(I);ELEV(I);XNODE(I)
;DROP(I);PEAK1(I);PEAK(I)
22140 NEXT I
22150 CLOSE
22170 PRINT"DATA NOW SAVED IN FILE: ";DF$
22180 GOSUB 21730: REM SCREEN HOLD
22190 RETURN

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Listing ของโปรแกรมการนิพนธ์ผลลัพธ์ของการออกแบบระบบระบายน้ำเสีย

```

10000 CLEAR
10010 CLS
10020 DEFINT I-J,L-N
10030 OPTION BASE 1
10040 IESC = 27
10060 KEY OFF
10070 MPAGE = 30000
10080 MLINK = 150
10090 MNODE = 151
10100 ISAVE = 1
10110 DIM ANGLE(MLINK)
10120 DIM COEF(3), COVER(MLINK), CUMDEM(MNODE), CUMDEPTH(MNODE), DEMAND(MNODE)
10125 DIM HA(MNODE), DEN(MNODE), DENM(MNODE), WER(MNODE), WERM(MNODE), C(MNODE)
10126 DIM CUMDEMM(MNODE), FLOWM(MLINK), VELFULL(MLINK), GS(MLINK), STO(MLINK)
10127 DIM T(MLINK), IMIN(MLINK), PEAK1(MNODE), PEAK(MNODE)
10130 DIM DEPTH(MLINK), DIAM(MLINK), DOWNCROWN(MLINK), DOWNINVERT(MLINK)
10140 DIM DROP(MNODE), ELEV(MNODE), FLOW(MLINK), FM$(6)
10150 DIM GROUNDSLOPE(MLINK), IMAX(MLINK), LINK(MLINK), NDEGREE(MNODE)
10160 DIM NFROM(MLINK), NODE(MNODE), NTO(MLINK), PIPESLOPE(MLINK)
10170 DIM SLOPEMAX(MLINK), SLOPEMIN(MLINK), SPAN(MLINK)
10180 DIM UNIT$(6), UPCROWN(MLINK), UPINVERT(MLINK), VELOCITY(MLINK)
10190 DIM XDOWN(MLINK), XNODE(MNODE), XUP(MLINK)
10200 CLS
11400 LOCATE 5,20:PRINT*PRINT DOMESTIC SEWERS SYSTEM RESULTS & DATA ":PRINT:PRIN
T
11500 GOSUB 22000
11720 REM -----
11730 REM ** SUBROUTINE TO LIST DATA **
11820 CLS
11830 OPEN "SCRN:" FOR OUTPUT AS #1
11840 IPAGE = 18
11850 GOSUB 12140
11860 CLOSE
11870 CLS
11880 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)"; ANS$
11890 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 11935
11900 OPEN "LPT1:" FOR OUTPUT AS #1
11910 IPAGE = MPAGE
11920 GOSUB 12140
11930 CLOSE
11935 GOSUB 19890
11940 INPUT "DO YOU WANT ANOTHER PRINT (Y/N)";ANS$
11950 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 12000
11960 RUN
12000 CHAIN "SELECT2"
12020 REM -----
12030 REM ** SUBROUTINE TO PRINT OUT DATA **
12140 IF (IPAGE <>MPAGE) THEN CLS
12150 PRINT #1, "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12160 PRINT #1,

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12170 PRINT #1, "PROJECT TITLE";TAB(40);TITLE$
12180 PRINT #1, " NUMBER OF NODES:";TAB(40);NNODE
12190 PRINT #1, " NUMBER OF LINKS:";TAB(40);NLINK
12200 PRINT #1, " RATE OF I/I:";TAB(40);RO;" (CMD/ha)"
12210 PRINT #1, " MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
12220 PRINT #1, " MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
12230 PRINT #1, " MANNING'S ROUGHNESS COEFFICIENT:";TAB(40);ROUGH
12240 PRINT #1, " SEWER OUTFALL NODE #:";TAB(40);NREF
12250 PRINT #1, " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)
)
12260 IF IPAGE <> MPAGE THEN GOSUB 21730: CLS: ELSE PRINT #1,"":PRINT #1,""
12270 GOSUB 12470
12280 FOR I = 1 TO NLINK
12290 PRINT #1,TAB(2);LINK(I);TAB(10);NFROM(I);TAB(18);NTO(I);
12300 PRINT #1,TAB(28);SPAN(I);TAB(43);DIAM(I);TAB(53);COVER(I)
12310 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 12470

12320 NEXT I
12330 IF (IPAGE <> MPAGE) THEN GOSUB 21730: CLS:ELSE PRINT #1,"":PRINT #1,""
12340 GOSUB 12610
12350 FOR I = 1 TO NNODE
12360 PRINT #1,TAB(2);NODE(I);TAB(7);PEAK1(I);TAB(12);PEAK(I);TAB(19);HA(I);TAB(
25);DENM(I);TAB(35);DEN(I);TAB(45);WERM(I);TAB(55);WER(I);TAB(65);ELEV(I)
12370 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730: CLS: GOSUB 126
10
12380 NEXT I
12390 IF (IPAGE <> MPAGE) THEN GOSUB 21730: CLS: ELSE PRINT #1,"":PRINT #1,""
12400 RETURN
12410 REM -----
12420 REM ** SUBROUTINE TO PRINT LINK HEADING **
12470 PRINT #1,TAB(21); " L I N K   D A T A"
12480 PRINT #1,TAB(10); "FROM";TAB(19);"TO";TAB(51);"MIN COVER"
12490 PRINT #1, " LINE";TAB(10);"NODE";TAB(18);"NODE";
12500 PRINT #1,TAB(28);"LENGTH";TAB(41);"DIAMETER";TAB(53);"DEPTH"
12510 PRINT #1, " #";TAB(11);"#";TAB(19);"#";TAB(29);UNIT$(2);
12520 PRINT #1,TAB(43);UNIT$(4);TAB(53);UNIT$(3)
12530 PRINT #1,""
12540 RETURN
12550 REM -----
12560 REM ** SUBROUTINE TO PRINT NODE HEADING **
12610 PRINT #1,TAB(21);" N O D E   D A T A"
12620 PRINT #1,TAB(66);"GROUND"
12630 PRINT #1, " NODE F A C T O R";TAB(19);"AREA";TAB(25);"MIN POP";TAB(35);"MAX
POP";TAB(45);"MIN WASTE";TAB(55);"MAX WASTE";TAB(65);"ELEVATION"
12640 PRINT #1, " #   MIN PEAK";TAB(19);"(ha)";TAB(25);"(CAP/ha)";TAB(35);"(CA
P/ha)";TAB(45);"(L/CAP)";TAB(55);"(L/CAP)";TAB(67);UNIT$(3)
12650 PRINT #1,""
12660 RETURN
16680 REM ** UNIT **
16690 UNIT$(1) = "(LPS)"
16700 UNIT$(2) = "(M)"
16710 UNIT$(3) = "(M)"

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16720 UNIT$(4) = "(CM)"
16730 UNIT$(5) = "(MPS)"
16830 FM$(1) = "###"
16840 FM$(2) = "##.###"
16850 FM$(3) = "###.##"
16860 FM$(4) = ".###"
16870 FM$(5) = "##.##"
16880 FM$(6) = "###.##"
16890 RETURN
19890 REM -----
19900 REM ** SUBROUTINE TO PRINT RESULTS **
20060 CLS
20070 OPEN "SCRN:" FOR OUTPUT AS #1
20080 IPAGE = 15
20090 GOSUB 20470
20100 CLOSE
20110 CLS
20120 INPUT "WOULD YOU LIKE TO REVIEW RESULTS AGAIN (Y/N)";ANS$
20130 IF ANS$ = "Y" OR ANS$ = "y" THEN GOTO 20060
20140 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)";ANS$
20150 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20270
20160 OPEN "LPT1:" FOR OUTPUT AS #1
20170 IPAGE = MPAGE
20180 GOSUB 20470
20190 CLOSE
20270 RETURN
20280 REM -----
20290 REM ** SUBROUTINE TO PRINT OUT RESULTS DATA **
20470 IF (IPAGE <> MPAGE) THEN CLS
20480 PRINT #1,"PROJECT TITLE:";TAB(17);TITLE$
20490 PRINT #1,"
20500 PRINT #1," NUMBER OF NODES:";TAB(40);NNODE
20510 PRINT #1," NUMBER OF LINKS:";TAB(40);NLINK
20530 PRINT #1," MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
20540 PRINT #1," MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
20550 PRINT #1," MAXIMUM COVER DEPTH:";TAB(40);COVERMAX;" ";UNIT$(3)
20560 PRINT #1," SEWER OUTFALL NODE #:";TAB(40);NREF
20570 PRINT #1," CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)

20580 PRINT #1,"
20590 PRINT #1,"TOTAL SYSTEM LENGTH:";TAB(40);SLENGTH
20600 PRINT #1,"AVERAGE WEIGHTED DIAMETER:";TAB(40);AVGDIAM
20610 PRINT #1,"AVERAGE WEIGHTED EXCAVATION DEPTH:";TAB(40);AVGDEPTH
20620 PRINT #1,"AVERAGE WEIGHTED EXCAVATION AREA:";TAB(40);AVGAREA
20630 PRINT #1,"
20640 IF OUTCROWN < ELEVREF THEN PRINT #1,"WARNING : ELEVATION OF LAST PIPE IS L
OWER THAN CROWN OF OUTFALL NODE."
20650 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,"
20660 GOSUB 21160
20670 FOR I=1 TO NLINK
20680 IF IMAX(I) = 1 THEN PRINT #1,"*";
20685 IF IMIN(I) = 1 THEN PRINT #1,TAB(2);"-";

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20686 IF A(I) = 1 THEN PRINT #1,TAB(3);"*";
20690 PRINT #1,TAB(4);USING FM$(1);LINK(I);
20700 PRINT #1,TAB(9);USING FM$(1);NFROM(I);
20710 PRINT #1,TAB(14);USING FM$(1);NTO(I);
20720 PRINT #1,TAB(17);USING FM$(2);FLOW(I)*.001;
20730 PRINT #1,TAB(23);USING FM$(2);FLOWM(I)*.001;
20740 PRINT #1,TAB(30);USING FM$(1);DIAM(I);
20750 PRINT #1,TAB(34);USING FM$(5);SLOPEMAX(I);
20760 PRINT #1,TAB(40);USING FM$(5);SLOPEMIN(I);
20765 PRINT #1,TAB(46);USING FM$(5);GROUNDSLOPE(I);
20770 PRINT #1,TAB(52);USING FM$(5);PIPESLOPE(I);
20775 PRINT #1,TAB(57);USING FM$(5);VELOCITY(I);
20780 PRINT #1,TAB(62);USING FM$(5);VELOCITYM(I);
20790 PRINT #1,TAB(67);USING FM$(3);DEPTH(I);
20800 PRINT #1,TAB(73);USING FM$(3);DEPTHM(I)
20810 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21160

20820 NEXT I
20830 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20840 GOSUB 21370
20850 FOR I=1 TO NLINK
20860 IF IMAX(I) = 1 THEN PRINT #1,"*";
20870 PRINT #1,TAB(2);USING FM$(1);LINK(I);
20875 PRINT #1,TAB(8);USING FM$(3);SPAN(I);
20880 PRINT #1,TAB(15);USING FM$(3);XUP(I)+UPINVERT(I);
20890 PRINT #1,TAB(23);USING FM$(3);XDOWN(I)+DOWNINVERT(I);
20900 PRINT #1,TAB(31);USING FM$(3);UPCROWN(I);
20910 PRINT #1,TAB(39);USING FM$(3);DOWNCROWN(I);
20920 PRINT #1,TAB(46);USING FM$(3);UPINVERT(I);
20930 PRINT #1,TAB(54);USING FM$(3);DOWNINVERT(I);
20940 PRINT #1,TAB(63);USING FM$(3);XUP(I);
20950 PRINT #1,TAB(72);USING FM$(3);XDOWN(I)
20960 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21370

20970 NEXT I
20980 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20990 GOSUB 21560
21000 FOR I=1 TO NNODE
21010 PRINT #1,TAB(2);USING FM$(1);NODE(I);
21020 PRINT #1,TAB(12);USING FM$(5);HA(I);
21030 PRINT #1,TAB(25);USING FM$(3);ELEV(I);
21040 PRINT #1,TAB(37);USING FM$(3);XNODE(I);
21050 PRINT #1,TAB(53);USING FM$(3);DROP(I)
21060 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21560

21070 NEXT I
21080 IF (IPAGE <> MPAGE) THEN GOSUB 21730:ELSE PRINT #1,"":PRINT #1,""
21090 RETURN
21100 REM -----
21110 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 1 **
21160 PRINT #1,"PROJECT TITLE:";TITLE$
21170 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"

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21175 PRINT #1, "          - => MIN VELOC
ITY TOO LOW"
21176 PRINT #1, "          # => MIN SLOPE
EXCEED"
21180 PRINT #1, ""
21190 PRINT #1, "  LINK";TAB(10);"N O D E";
21200 PRINT #1,TAB(20);"F L O W";TAB(30);"DIAM";TAB(36);"S L O P E";
21210 PRINT #1,TAB(46);" S L O P E";
21220 PRINT #1,TAB(59);"VELOCITY";TAB(69);"D E P T H "
21230 PRINT #1,TAB(9);"FROM";TAB(15);"TO";TAB(19);"MAX";TAB(25);"MIN";TAB(36);"M
AX";TAB(42);"MIN";TAB(46);"GROUND";TAB(53);"PIPE";TAB(59);"MAX";TAB(64);"MIN";
21240 PRINT #1,TAB(69);"MAX";
21250 PRINT #1,TAB(75);"MIN"
21260 PRINT #1, "      #";TAB(11);"#";TAB(16);"#";TAB(19);"(cu.m/s)";TAB(30);"(CM
";TAB(37);"X";
21270 PRINT #1,TAB(43);"X";TAB(48);" X";TAB(54);" X";TAB(59);"(m/s)";TAB(72);"(C
M)"
21290 PRINT #1, ""
21300 RETURN
21310 REM -----
21320 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 2 **
21370 PRINT #1,"PROJECT TITLE: ";TITLE$
21380 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"
21390 PRINT #1, ""
21400 PRINT #1,TAB(15);"GROUND ELEV";TAB(31);"CROWN ELEV";
21410 PRINT #1,TAB(46);"INVERT ELEV";TAB(61);"EXCAVATION DEPTH"
21420 PRINT #1,TAB(2);"LINK";TAB(8);"LENGTH";TAB(15);"UPSTRM";TAB(23);"DNSTRM";
21430 PRINT #1,TAB(31);"UPSTRM";TAB(39);"DNSTRM";TAB(46);"UPSTRM";
21440 PRINT #1,TAB(54);"DNSTRM";TAB(63);"UPSTRM";TAB(72);"DNSTRM"
21450 PRINT #1, "  #";TAB(10);"(M)";TAB(17);UNIT$(3);TAB(25);"(M)";
21460 PRINT #1,TAB(33);UNIT$(3);TAB(41);UNIT$(3);TAB(49);UNIT$(3);
21470 PRINT #1,TAB(55);UNIT$(3);TAB(64);UNIT$(3);TAB(73);UNIT$(3)
21480 PRINT #1, ""
21490 RETURN
21500 REM -----
21510 REM ** SUBROUTINE TO PRINT NODE RESULTS HEADING **
21560 PRINT #1,"PROJECT TITLE: ";TITLE$
21570 PRINT #1,TAB(13);" N O D E   D A T A "
21580 PRINT #1, ""
21590 PRINT #1,TAB(25);"GROUND";TAB(36);"EXCAVATION";
21600 PRINT #1,TAB(49);"DIST HIGH INVERT"
21610 PRINT #1, "  NODE";TAB(13);"AREA";TAB(25);"ELEV";
21620 PRINT #1,TAB(38);"DEPTH";TAB(50);"TO LOW INVERT"
21630 PRINT #1, "  #";TAB(13);"(ha)";TAB(26);UNIT$(3);
21640 PRINT #1,TAB(38);UNIT$(3);TAB(55);UNIT$(3)
21650 PRINT #1, ""
21660 RETURN
21670 REM -----
21680 REM ** SUBROUTINE TO HOLD SCREEN **
21730 LOCATE 24,1
21740 COLOR 0,7

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21750 PRINT "PRESS ANY KEY TO CONTINUE";
21760 COLOR 7,0
21770 A$ = INKEY$:IF A$="" THEN GOTO 21770
21780 RETURN
22000 REM ** SUBROUTINE TO READ DATA **
22005 ON ERROR GOTO 11940
22010 FILES "b:*.dom"
22020 INPUT "ENTER NAME OF DISK FILE TO BE READ:";AF$
22021 IF AF$ = "" THEN 12000
22025 DF$ = "b:"+AF$+".dom"
22030 OPEN "I",1,DF$
22040 PRINT "NOW READING DATA"
22050 LINE INPUT #1,TITLE$
22060 INPUT #1,NLINK,NNODE,A,B,KK,RO,NREF
22070 INPUT #1,ELEVREF,ROUGH,TE
22080 INPUT #1,COVERMIN,COVERMAX,VELMIN,VELMAX,SLENGTH,AVGDIA,AVGDEPTH,AVGAREA,
OUTCROWN
22090 FOR I=1 TO NLINK
22100 INPUT #1,LINK(I),NFROM(I),NTO(I),SPAN(I),DIAM(I),COVER(I),IMAX(I),IMIN(I),
FLOW(I),FLOWM(I),DEPTH(I),VELOCITY(I),VELOCITYM(I),PIPESLOPE(I),SLOPEMIN(I),SLOPE
EMAX(I),GROUNDSLOPE(I),XUP(I),UPINVERT(I),XDOWN(I),DOWNINVERT(I),UPCROWN(I),DOWN
CROWN(I)
22105 INPUT #1,A(I),DEPTHM(I)
22110 NEXT I
22120 FOR I=1 TO NNODE
22130 INPUT #1,NODE(I),HA(I),DENM(I),DEN(I),WERM(I),WER(I),C(I),ELEV(I),XNODE(I),
,DROP(I),PEAK1(I),PEAK(I)
22140 NEXT I
22150 CLOSE
22160 GOSUB 16690 : REM SET UNIT NAMES
22170 PRINT:PRINT "DATA READ:";PRINT "FILENAME : ";AF$
22175 PRINT "PROJECT TITLE : ";TITLE$
22180 GOSUB 21780: REM SCREEN HOLD
22200 RETURN

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Listing ของโปรแกรมการนิมน์ผลลัพธ์ของการออกแบบระบบระบายน้ำฝน

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10000 CLEAR
10010 CLS
10020 DEFINT I-J,L-N
10030 OPTION BASE 1
10040 IESC = 27
10060 KEY OFF
10070 MPAGE = 30000
10080 MLINK = 150
10090 MNODE = 151
10100 ISAVE = 1
10110 DIM ANGLE(MLINK),PEAK1(MNODE),PEAK(MNODE)
10120 DIM COEF(3),COVER(MLINK),CUMDEM(MNODE),CUMDEPTH(MNODE),DEMAND(MNODE)
10125 DIM BA(MNODE),DEN(MNODE),DENM(MNODE),WER(MNODE),WERM(MNODE),C(MNODE)
10126 DIM CUMDEMM(MNODE),FLOWM(MLINK),VELFULL(MLINK),GS(MLINK),STO(MLINK)
10127 DIM T(MLINK),IMIN(MLINK)
10130 DIM DEPTH(MLINK),DIAM(MLINK),DOWNCROWN(MLINK),DOWNINVERT(MLINK)
10140 DIM DROP(MNODE),ELEV(MNODE),FLOW(MLINK),FM$(6)
10150 DIM GROUNDSLOPE(MLINK),IMAX(MLINK),LINK(MLINK),NDEGREE(MNODE)
10160 DIM NFROM(MLINK),NODE(MNODE),NTO(MLINK),PIPESLOPE(MLINK)
10170 DIM SLOPEMAX(MLINK),SLOPEMIN(MLINK),SPAN(MLINK)
10180 DIM UNIT$(6),UPCROWN(MLINK),UPINVERT(MLINK),VELOCITY(MLINK)
10190 DIM XDOWN(MLINK),XNODE(MNODE),XUP(MLINK)
10200 CLS
11400 LOCATE 5,22:PRINT*PRINT STORM SEWERS SYSTEM RESULTS & DATA ":PRINT:PRINT
11500 GOSUB 22000
11720 REM -----
11730 REM ** SUBROUTINE TO LIST DATA **
11820 CLS
11830 OPEN "SCRN:" FOR OUTPUT AS #1
11840 IPAGE = 18
11850 GOSUB 12140
11860 CLOSE
11870 CLS
11880 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)"; ANS$
11890 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 11935
11900 OPEN "LPT1:" FOR OUTPUT AS #1
11910 IPAGE = MPAGE
11920 GOSUB 12140
11930 CLOSE
11935 GOSUB 19890
11940 INPUT "DO YOU WANT ANOTHER PRINT (Y/N)";ANS$
11950 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 12000
11960 RUN
12000 CHAIN "SELECT2"
12020 REM -----
12030 REM ** SUBROUTINE TO PRINT OUT DATA **
12140 IF (IPAGE <>MPAGE) THEN CLS
12150 PRINT #1, "THE CURRENT SYSTEM CHARACTERISTICS ARE:"
12160 PRINT #1,

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12170 PRINT #1, "PROJECT TITLE";TAB(40);TITLE$
12180 PRINT #1, " NUMBER OF NODES:";TAB(40);NNODE
12190 PRINT #1, " NUMBER OF LINKS:";TAB(40);NLINK
12191 PRINT #1, "          a "
12192 PRINT #1, " i =-----"
12193 PRINT #1, "      (t+b)*k  ":PRINT #1,
12194 PRINT #1, " a = ";TAB(40);A:PRINT #1, " b = ";TAB(40);B:PRINT #1, " k
= ";TAB(40);KK
12200 PRINT #1, " RATE OF I/I:";TAB(40);RO;" (CMD/5a)"
12210 PRINT #1, " MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
12220 PRINT #1, " MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
12230 PRINT #1, " MANNING'S ROUGHNESS COEFFICIENT:";TAB(40);ROUGH
12235 PRINT #1, " TIME OF ENTRY:";TAB(40);TE
12240 PRINT #1, " SEWER OUTFALL NODE #:";TAB(40);NREF
12250 PRINT #1, " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)
)
12260 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS: ELSE PRINT #1,"":PRINT #1,""
12270 GOSUB 12470
12280 FOR I = 1 TO NLINK
12290 PRINT #1,TAB(2);LINK(I);TAB(10);NFROM(I);TAB(18);NTO(I);
12300 PRINT #1,TAB(28);SPAN(I);TAB(43);DIAM(I);TAB(53);COVER(I)
12310 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 12470

12320 NEXT I
12330 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
12340 GOSUB 12610
12350 FOR I = 1 TO NNODE
12360 PRINT #1,TAB(2);NODE(I);TAB(17);HA(I);TAB(34);C(I);TAB(52);ELEV(I)
12370 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 126
10
12380 NEXT I
12390 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS: ELSE PRINT #1,"":PRINT #1,""
12400 RETURN
12410 REM -----
12420 REM ** SUBROUTINE TO PRINT LINK HEADING **
12470 PRINT #1,TAB(21); " L I N K   D A T A "
12480 PRINT #1,TAB(10); "FROM";TAB(19);"TO";TAB(51);"MIN COVER"
12490 PRINT #1, " LINK";TAB(10);"NODE";TAB(18);"NODE";
12500 PRINT #1,TAB(28);"LENGTH";TAB(41);"DIAMETER";TAB(53);"DEPTH"
12510 PRINT #1, " #";TAB(11);"#";TAB(19);"#";TAB(29);UNIT$(2);
12520 PRINT #1,TAB(43);UNIT$(4);TAB(53);UNIT$(3)
12530 PRINT #1,""
12540 RETURN
12550 REM -----
12560 REM ** SUBROUTINE TO PRINT NODE HEADING **
12610 PRINT #1,TAB(21);" N O D E   D A T A "
12620 PRINT #1,TAB(51);"GROUND"
12630 PRINT #1, " NODE";TAB(17);"AREA";TAB(30);"RUNOFF COE.";TAB(50);"ELEVATION"

12640 PRINT #1, " #";TAB(17);"(ha)";TAB(53);UNIT$(3)
12650 PRINT #1,""
12660 RETURN

```

```

16680 REM ** UNIT **
16690 UNIT$(1) = "(LPS)"
16700 UNIT$(2) = "(M)"
16710 UNIT$(3) = "(M)"
16720 UNIT$(4) = "(CM)"
16730 UNIT$(5) = "(MPS)"
16830 FM$(1) = "###"
16840 FM$(2) = "##.###"
16850 FM$(3) = "###.##"
16860 FM$(4) = ".###"
16870 FM$(5) = "##.##"
16880 FM$(6) = "#####.##"
16890 RETURN
19890 REM -----
19900 REM ** SUBROUTINE TO PRINT RESULTS **
20060 CLS
20070 OPEN "SCRN:" FOR OUTPUT AS #1
20080 IPAGE = 15
20090 GOSUB 20470
20100 CLOSE
20110 CLS
20120 INPUT "WOULD YOU LIKE TO REVIEW RESULTS AGAIN (Y/N)";ANS$
20130 IF ANS$ = "Y" OR ANS$ = "y" THEN GOTO 20060
20140 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)";ANS$
20150 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20270
20160 OPEN "LPT1:" FOR OUTPUT AS #1
20170 IPAGE = MPAGE
20180 GOSUB 20470
20190 CLOSE
20270 RETURN
20280 REM -----
20290 REM ** SUBROUTINE TO PRINT OUT RESULTS DATA **
20470 IF (IPAGE <> MPAGE) THEN CLS
20480 PRINT #1, "PROJECT TITLE:";TAB(17);TITLE$
20490 PRINT #1, ""
20500 PRINT #1, " NUMBER OF NODES:";TAB(40);NNODE
20510 PRINT #1, " NUMBER OF LINKS:";TAB(40);NLINK
20530 PRINT #1, " MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN; " ";UNIT$(5)
20540 PRINT #1, " MAXIMUM VELOCITY:";TAB(40);VELMAX; " ";UNIT$(5)
20550 PRINT #1, " MAXIMUM COVER DEPTH:";TAB(40);COVERMAX; " ";UNIT$(3)
20560 PRINT #1, " SEWER OUTFALL NODE #:";TAB(40);NREF
20570 PRINT #1, " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF; " ";UNIT$(3)
20580 PRINT #1, ""
20590 PRINT #1, "TOTAL SYSTEM LENGTH:";TAB(40);SLENGTH
20600 PRINT #1, "AVERAGE WEIGHTED DIAMETER:";TAB(40);AVGDIAM
20610 PRINT #1, "AVERAGE WEIGHTED EXCAVATION DEPTH:";TAB(40);AVGDEPTH
20620 PRINT #1, "AVERAGE WEIGHTED EXCAVATION AREA:";TAB(40);AVGAREA
20630 PRINT #1, ""
20640 IF OUTCROWN < ELEVREF THEN PRINT #1, "WARNING : ELEVATION OF LAST PIPE IS LOWER THAN CROWN OF OUTFALL NODE."
20650 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""

```

```

20660 GOSUB 21160
20670 FOR I=1 TO NLINK
20680 IF IMAX(I) = 1 THEN PRINT #1,"*";
20690 PRINT #1,TAB(2);USING FM$(1);LINK(I);
20700 PRINT #1,TAB(7);USING FM$(1);NFROM(I);
20710 PRINT #1,TAB(12);USING FM$(1);NTO(I);
20720 PRINT #1,TAB(16);USING FM$(2);FLOW(I)*.001;
20730 PRINT #1,TAB(25);USING FM$(6);SPAN(I);
20740 PRINT #1,TAB(33);USING FM$(3);DIAM(I);
20750 PRINT #1,TAB(40);USING FM$(5);SLOPEMIN(I);
20760 PRINT #1,TAB(47);USING FM$(5);SLOPEMAX(I);
20770 PRINT #1,TAB(53);USING FM$(5);GROUNDSLOPE(I);
20780 PRINT #1,TAB(59);USING FM$(5);PIPESLOPE(I);
20790 PRINT #1,TAB(65);USING FM$(3);DEPTH(I);
20800 PRINT #1,TAB(72);USING FM$(4);VELOCITY(I)
20810 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21160

20820 NEXT I
20830 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20840 GOSUB 21370
20850 FOR I=1 TO NLINK
20860 IF IMAX(I) = 1 THEN PRINT #1,"*";
20870 PRINT #1,TAB(2);USING FM$(1);LINK(I);
20880 PRINT #1,TAB(9);USING FM$(3);XUP(I)+UPINVERT(I);
20890 PRINT #1,TAB(18);USING FM$(3);XDOWN(I)+DOWNINVERT(I);
20900 PRINT #1,TAB(27);USING FM$(3);UPCROWN(I);
20910 PRINT #1,TAB(36);USING FM$(3);DOWNCROWN(I);
20920 PRINT #1,TAB(45);USING FM$(3);UPINVERT(I);
20930 PRINT #1,TAB(54);USING FM$(3);DOWNINVERT(I);
20940 PRINT #1,TAB(63);USING FM$(3);XUP(I);
20950 PRINT #1,TAB(72);USING FM$(3);XDOWN(I)
20960 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21370

20970 NEXT I
20980 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
20990 GOSUB 21560
21000 FOR I=1 TO NNODE
21010 PRINT #1,TAB(2);USING FM$(1);NODE(I);
21020 PRINT #1,TAB(9);USING FM$(5);HA(I);
21025 PRINT #1,TAB(18);USING FM$(5);C(I);
21030 PRINT #1,TAB(27);USING FM$(3);ELEV(I);
21040 PRINT #1,TAB(37);USING FM$(3);XNODE(I);
21050 PRINT #1,TAB(53);USING FM$(3);DROP(I)
21060 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21560

21070 NEXT I
21080 IF (IPAGE <> MPAGE) THEN GOSUB 21730:ELSE PRINT #1,"":PRINT #1,""
21090 RETURN
21100 REM -----
21110 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 1 **
21160 PRINT #1,"PROJECT TITLE:";TITLE$
21170 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"

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21180 PRINT #1, ""
21190 PRINT #1, TAB(7); "FROM"; TAB(13); "TO"; TAB(41); " MIN"; TAB(48); "MAX";
21200 PRINT #1, TAB(53); "GROUND"; TAB(60); "PIPE"; TAB(65); " WATER"
21220 PRINT #1, " LINK"; TAB(7); "MODE"; TAB(12); "MODE";
21230 PRINT #1, TAB(19); "FLOW"; TAB(26); "LENGTH"; TAB(35); "DIAM";
21240 PRINT #1, TAB(41); "SLOPE"; TAB(47); "SLOPE"; TAB(53); "SLOPE";
21250 PRINT #1, TAB(59); "SLOPE"; TAB(65); " DEPTH"; TAB(73); "VEL"
21260 PRINT #1, " #"; TAB(9); "#"; TAB(14); "#"; TAB(18); " (CMS)";
21270 PRINT #1, TAB(27); "(M)"; TAB(35); "(CM)"; TAB(42); " X"; TAB(49); "X";
21280 PRINT #1, TAB(55); "X"; TAB(61); "X"; TAB(67); "(CM)"; TAB(73); "m/s"
21290 PRINT #1, ""
21300 RETURN
21310 REM -----
21320 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 2 **
21370 PRINT #1, "PROJECT TITLE: "; TITLE$
21380 PRINT #1, TAB(20); " L I N K   D A T A"; TAB(51); "* => MAX COVER DEPTH EXCEED
ED"
21390 PRINT #1, ""
21400 PRINT #1, TAB( 9); "GROUND ELEV"; TAB(27); "CROWN ELEV";
21410 PRINT #1, TAB(45); "INVERT ELEV"; TAB(61); "EXCAVATION DEPTH"
21420 PRINT #1, TAB(2); "LINK"; TAB(9); "UPSTRM"; TAB(18); "DNSTRM";
21430 PRINT #1, TAB(27); "UPSTRM"; TAB(36); "DNSTRM"; TAB(45); "UPSTRM";
21440 PRINT #1, TAB(54); "DNSTRM"; TAB(63); "UPSTRM"; TAB(72); "DNSTRM"
21450 PRINT #1, " #"; TAB(10); UNIT$(3); TAB(19); UNIT$(3);
21460 PRINT #1, TAB(28); UNIT$(3); TAB(37); UNIT$(3); TAB(46); UNIT$(3);
21470 PRINT #1, TAB(55); UNIT$(3); TAB(64); UNIT$(3); TAB(73); UNIT$(3)
21480 PRINT #1, ""
21490 RETURN
21500 REM -----
21510 REM ** SUBROUTINE TO PRINT NODE RESULTS HEADING **
21560 PRINT #1, "PROJECT TITLE: "; TITLE$
21570 PRINT #1, TAB(13); " N O D E   D A T A "
21580 PRINT #1, ""
21590 PRINT #1, TAB(27); "GROUND"; TAB(36); "EXCAVATION";
21600 PRINT #1, TAB(49); "DIST HIGH INVERT"
21610 PRINT #1, " NODE"; TAB(10); "AREA"; TAB(18); "RUNOFF "; TAB(28); "ELEV";
21620 PRINT #1, TAB(38); "DEPTH"; TAB(50); "TO LOW INVERT"
21630 PRINT #1, " #"; TAB(10); "(ha)"; TAB(19); " COE."; TAB(28); UNIT$(3);
21640 PRINT #1, TAB(38); UNIT$(3); TAB(55); UNIT$(3)
21650 PRINT #1, ""
21660 RETURN
21670 REM -----
21680 REM ** SUBROUTINE TO HOLD SCREEN **
21730 LOCATE 24, 1
21740 COLOR 0, 7
21750 PRINT "PRESS ANY KEY TO CONTINUE";
21760 COLOR 7, 0
21770 A$ = INKEY$: IF A$="" THEN GOTO 21770
21780 RETURN
22000 REM ** SUBROUTINE TO READ DATA **
22005 ON ERROR GOTO 11940
22010 FILES "b:*.sto

```

```
22020 INPUT "ENTER NAME OF DISK FILE TO BE READ: ";AF$
22021 IF AF$ = "" THEN 12000
22025 DF$ = "b:"+AF$+".sto"
22030 OPEN "I",1,DF$
22040 PRINT"NOW READING DATA"
22050 LINE INPUT #1,TITLE$
22060 INPUT #1,NLINK,WNODE,A,B,KK,RO,NREF
22070 INPUT #1,ELEVREF,ROUGH,TE
22080 INPUT #1,COVERMIN,COVERMAX,VELMIN,VELMAX,SLENGTH,AVGDIAM,AVGDEPTH,AVGAREA,
OUTCROWN
22090 FOR I=1 TO NLINK
22100 INPUT #1,LINK(I),NFROM(I),NTO(I),SPAN(I),DIAM(I),COVER(I),IMAX(I),IMIN(I),
FLOW(I),FLOWM(I),DEPTH(I),VELOCITY(I),VELOCITYM(I),PIPESLOPE(I),SLOPEMIN(I),SLOP
EMAX(I),GROUNDSLOPE(I),XUP(I),UPINVERT(I),XDOWN(I),DOWNINVERT(I),UPCROWN(I),DOWN
CROWN(I)
22105 INPUT #1,A(I),DEPTHM(I)
22110 NEXT I
22120 FOR I=1 TO NNODE
22130 INPUT #1,NODE(I),BA(I),DENM(I),DEN(I),WERM(I),WER(I),C(I),ELEV(I),XNODE(I)
,DROP(I),PEAK1(I),PEAK(I)
22140 NEXT I
22150 CLOSE
22160 GOSUB 16690 : REM SET UNIT NAMES
22170 PRINT:PRINT "DATA READ.":PRINT" FILENAME : ";DF$
22175 PRINT" PROJECT TITLE : "; TITLE$
22180 GOSUB 21730: REM SCREEN BOLD
22200 RETURN
```

Listing ของโปรแกรมการพิมพ์ผลลัพธ์ของการออกแบบระบบระบายน้ำร่วม

```

10000 CLEAR
10010 CLS
10020 DEFINT I-J,L-N
10030 OPTION BASE 1
10040 IESC = 27
10060 KEY OFF
10070 MPAGE = 30000
10080 MLINK = 150
10090 MNODE = 151
10100 ISAVE = 1
10110 DIM ANGLE(MLINK),PEAK1(MNODE),PEAK(MNODE)
10120 DIM COEF(3),COVER(MLINK),CUMDEM(MNODE),CUMDEPTH(MNODE),A(MLINK)
10125 DIM BA(MNODE),DEN(MNODE),DENH(MNODE),WER(MNODE),WERM(MNODE),C(MNODE)
10126 DIM CUMDEMH(MNODE),FLOWH(MLINK),VELFULL(MLINK),GS(MLINK),STO(MLINK)
10127 DIM T(MLINK),IMIN(MLINK),DEPTHM(MLINK),VELOCITYM(MLINK)
10130 DIM DEPTH(MLINK),DIAM(MLINK),DOWNCROWN(MLINK),DOWNINVERT(MLINK)
10140 DIM DROP(MNODE),ELEV(MNODE),FLOW(MLINK),FM$(6)
10150 DIM GROUNDSLOPE(MLINK),IMAX(MLINK),LINK(MLINK),NDEGREE(MNODE)
10160 DIM NFROM(MLINK),NODE(MNODE),NTO(MLINK),PIPESLOPE(MLINK)
10170 DIM SLOPEMAX(MLINK),SLOPEMIN(MLINK),SPAN(MLINK)
10180 DIM UNIT$(6),UPCROWN(MLINK),UPINVERT(MLINK),VELCCITY(MLINK)
10190 DIM XDOWN(MLINK),XNODE(MNODE),XUP(MLINK)
10200 CLS
11400 LOCATE 5,20:PRINT"PRINT COMBINED SEWERS SYSTEM RESULTS & DATA ":PRINT:PRIN
T
11500 GOSUB 22000
11720 REM -----
11730 REM ** SUBROUTINE TO LIST DATA **
11820 CLS
11830 OPEN "SCRN:" FOR OUTPUT AS #1
11840 IPAGE = 18
11850 GOSUB 12140
11860 CLOSE
11870 CLS
11880 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)";ANS$
11890 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 11935
11900 OPEN "LPT1:" FOR OUTPUT AS #1
11910 IPAGE = MPAGE
11920 GOSUB 12140
11930 CLOSE
11935 GOSUB 19890
11940 INPUT "DO YOU WANT ANOTHER PRINT (Y/N)";ANS$
11950 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 12000
11960 RUN
12000 CHAIN "SELECT2"
12020 REM -----
12030 REM ** SUBROUTINE TO PRINT OUT DATA **
12140 IF (IPAGE <>MPAGE) THEN CLS

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12150 PRINT #1, "THE CORRENT SYSTEM CHARACTERISTICS ARE:"
12160 PRINT #1,
12170 PRINT #1, "PROJECT TITLE";TAB(40);TITLE$
12180 PRINT #1, " NUMBER OF NODES:";TAB(40);NNODE
12190 PRINT #1, " NUMBER OF LINKS:";TAB(40);NLINK
12191 PRINT #1,
12192 PRINT #1, "STORM FACTOR"
12193 PRINT #1,
12196 PRINT #1, "          a"
12197 PRINT #1, "          i =-----"
12198 PRINT #1, "          (t+b)^k  " :PRINT #1,
12199 PRINT #1, "          a = ";TAB(40);A:PRINT #1, "          b = ";TAB(40);B:PRINT #1, "          k = "
;TAB(40);KK
12200 PRINT #1, " TIME OF ENTRY:";TAB(40);TE
12201 PRINT #1,
12202 PRINT #1, "DOMESTIC FACTOR"
12203 PRINT #1,
12209 PRINT #1, " RATE OF I/I:";TAB(40);RO;" (CMD/ha)"
12210 PRINT #1, " MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
12220 PRINT #1, " MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
12230 PRINT #1, " MANNING'S ROUGHNESS COEFFICIENT:";TAB(40);ROUGH
12240 PRINT #1, " SEWER OUTFALL NODE #:";TAB(40);NREF
12250 PRINT #1, " CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)
)
12260 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS: ELSE PRINT #1,"":PRINT #1,""
12270 GOSUB 12470
12280 FOR I = 1 TO NLINK
12290 PRINT #1,TAB(2);LINK(I);TAB(10);NFROM(I);TAB(18);NTO(I);
12300 PRINT #1,TAB(28);SPAN(I);TAB(43);DIAM(I);TAB(53);COVER(I)
12310 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 12470

12320 NEXT I
12330 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1,"":PRINT #1,""
12340 GOSUB 12610
12350 FOR I = 1 TO NNODE
12360 PRINT #1,TAB(2);NODE(I);TAB(7);PEAK1(I);TAB(12);PEAK(I);TAB(18);HA(I);TAB(
22);C(I);TAB(28);DENM(I);TAB(35);DEN(I);TAB(45);WERM(I);TAB(55);WER(I);TAB(65);E
LEV(I)
12370 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 126
10
12380 NEXT I
12390 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS: ELSE PRINT #1,"":PRINT #1,""
12400 RETURN
12410 REM -----
12420 REM ** SUBROUTINE TO PRINT LINK HEADING **
12470 PRINT #1,TAB(21); " L I N K   D A T A"
12480 PRINT #1,TAB(10); "FROM";TAB(19);"TO";TAB(51);"MIN COVER"
12490 PRINT #1, " LINK";TAB(10);"NODE";TAB(18);"NODE";
12500 PRINT #1,TAB(28);"LENGTH";TAB(41);"DIAMETER";TAB(53);"DEPTH"
12510 PRINT #1, " #";TAB(11);"#";TAB(19);"#";TAB(29);UNIT$(2);
12520 PRINT #1,TAB(43);UNIT$(4);TAB(53);UNIT$(3)
12530 PRINT #1,""

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```

12540 RETURN
12550 REM -----
12560 REM ** SUBROUTINE TO PRINT NODE HEADING **
12610 PRINT #1,TAB(21);" N O D E   D A T A"
12620 PRINT #1,TAB(66);"GROUND"
12630 PRINT #1," NODE   FACTOR";TAB(17);"AREA";TAB(23);"R.O.";TAB(27);"MIN POP";
TAB(35);"MAX POP";TAB(45);"MIN WASTE";TAB(55);"MAX WASTE";TAB(65);"ELEVATION"
12640 PRINT #1," #   MIN PEAK";TAB(17);"(ha)";TAB(23);"COE.";TAB(27);"(CAP/ha)
";TAB(35);"(CAP/ha)";TAB(45);"(L/CAP)";TAB(55);"(L/CAP)";TAB(67);UNIT$(3)
12650 PRINT #1,""
12660 RETURN
16680 REM ** UNIT **
16690 UNIT$(1) = "(LPS)"
16700 UNIT$(2) = "(M)"
16710 UNIT$(3) = "(H)"
16720 UNIT$(4) = "(CM)"
16730 UNIT$(5) = "(MPS)"
16830 FM$(1) = "###"
16840 FM$(2) = "##.###"
16850 FM$(3) = "###.##"
16860 FM$(4) = "#.###"
16870 FM$(5) = "##.##"
16880 FM$(6) = "####.##"
16890 RETURN
19890 REM -----
19900 REM ** SUBROUTINE TO PRINT RESULTS **
20060 CLS
20070 OPEN "SCRN:" FOR OUTPUT AS #1
20080 IPAGE = 15
20090 GOSUB 20470
20100 CLOSE
20110 CLS
20120 INPUT "WOULD YOU LIKE TO REVIEW RESULTS AGAIN (Y/N)";ANS$
20130 IF ANS$ = "Y" OR ANS$ = "y" THEN GOTO 20060
20140 INPUT "DO YOU WANT A HARDCOPY OF THE DATA (Y/N)";ANS$
20150 IF ANS$ <> "Y" AND ANS$ <> "y" THEN GOTO 20270
20160 OPEN "LPT1:" FOR OUTPUT AS #1
20170 IPAGE = MPAGE
20180 GOSUB 20470
20190 CLOSE
20270 RETURN
20280 REM -----
20290 REM ** SUBROUTINE TO PRINT OUT RESULTS DATA **
20470 IF (IPAGE <> MPAGE) THEN CLS
20480 PRINT #1,"PROJECT TITLE:";TAB(17);TITLE$
20490 PRINT #1,""
20500 PRINT #1," NUMBER OF NODES:";TAB(40);NNODE
20510 PRINT #1," NUMBER OF LINES:";TAB(40);NLINK
20530 PRINT #1," MINIMUM SCOUR VELOCITY:";TAB(40);VELMIN;" ";UNIT$(5)
20540 PRINT #1," MAXIMUM VELOCITY:";TAB(40);VELMAX;" ";UNIT$(5)
20550 PRINT #1," MAXIMUM COVER DEPTH:";TAB(40);COVERMAX;" ";UNIT$(3)
20560 PRINT #1," SEWER OUTFALL NODE #:";TAB(40);NREF
20570 PRINT #1," CROWN ELEVATION OF OUTFALL NODE:";TAB(40);ELEVREF;" ";UNIT$(3)

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20580 PRINT #1, ""
20590 PRINT #1, "TOTAL SYSTEM LENGTH: "; TAB(40); SLENGTH
20600 PRINT #1, "AVERAGE WEIGHTED DIAMETER: "; TAB(40); AVGDIA
20610 PRINT #1, "AVERAGE WEIGHTED EXCAVATION DEPTH: "; TAB(40); AVGDEPTH
20620 PRINT #1, "AVERAGE WEIGHTED EXCAVATION AREA: "; TAB(40); AVGAREA
20630 PRINT #1, ""
20640 IF OUTCROWN < ELEVREF THEN PRINT #1, "WARNING : ELEVATION OF LAST PIPE IS LOWER THAN CROWN OF OUTFALL NODE."
20650 IF IPAGE <> MPAGE THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20660 GOSUB 21160
20670 FOR I=1 TO NLINK
20680 IF IMAX(I) = 1 THEN PRINT #1, "*";
20685 IF IMIN(I) = 1 THEN PRINT #1, TAB(2); "-";
20686 IF A(I) = 1 THEN PRINT #1, TAB(3); "#";
20690 PRINT #1, TAB(4); USING FM$(1); LINK(I);
20700 PRINT #1, TAB(9); USING FM$(1); NFROM(I);
20710 PRINT #1, TAB(14); USING FM$(1); NTO(I);
20720 PRINT #1, TAB(17); USING FM$(2); FLOW(I)*.001;
20730 PRINT #1, TAB(23); USING FM$(2); FLOWM(I)*.001;
20740 PRINT #1, TAB(30); USING FM$(1); DIAM(I);
20750 PRINT #1, TAB(34); USING FM$(5); SLOPEMAX(I);
20760 PRINT #1, TAB(40); USING FM$(5); SLOPEMIN(I);
20765 PRINT #1, TAB(46); USING FM$(5); GROUNDSLOPE(I);
20770 PRINT #1, TAB(52); USING FM$(5); PIPESLOPE(I);
20775 PRINT #1, TAB(57); USING FM$(5); VELOCITY(I);
20780 PRINT #1, TAB(62); USING FM$(5); VELOCITYM(I);
20790 PRINT #1, TAB(67); USING FM$(3); DEPTH(I);
20800 PRINT #1, TAB(73); USING FM$(3); DEPTHM(I)
20810 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21160

20820 NEXT I
20830 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20840 GOSUB 21370
20850 FOR I=1 TO NLINK
20860 IF IMAX(I) = 1 THEN PRINT #1, "*";
20870 PRINT #1, TAB(2); USING FM$(1); LINK(I);
20875 PRINT #1, TAB(8); USING FM$(3); SPAN(I);
20880 PRINT #1, TAB(15); USING FM$(3); XUP(I)+UPINVERT(I);
20890 PRINT #1, TAB(23); USING FM$(3); XDOWN(I)+DOWNINVERT(I);
20900 PRINT #1, TAB(31); USING FM$(3); UPCROWN(I);
20910 PRINT #1, TAB(39); USING FM$(3); DOWNCROWN(I);
20920 PRINT #1, TAB(46); USING FM$(3); UPINVERT(I);
20930 PRINT #1, TAB(54); USING FM$(3); DOWNINVERT(I);
20940 PRINT #1, TAB(63); USING FM$(3); XUP(I);
20950 PRINT #1, TAB(72); USING FM$(3); XDOWN(I)
20960 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21370

20970 NEXT I
20980 IF (IPAGE <> MPAGE) THEN GOSUB 21730:CLS:ELSE PRINT #1, "":PRINT #1, ""
20990 GOSUB 21560
21000 FOR I=1 TO NNODE
21010 PRINT #1, TAB(2); USING FM$(1); NODE(I);

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21020 PRINT #1,TAB(9);USING FM$(5);BA(I);
21025 PRINT #1,TAB(18);USING FM$(5);C(I);
21030 PRINT #1,TAB(27);USING FM$(3);ELEV(I);
21040 PRINT #1,TAB(37);USING FM$(3);XNODE(I);
21050 PRINT #1,TAB(53);USING FM$(3);DROP(I)
21060 IF (IPAGE <> MPAGE) AND (I MOD IPAGE = 0) THEN GOSUB 21730:CLS:GOSUB 21560

21070 NEXT I
21080 IF (IPAGE <> MPAGE) THEN GOSUB 21730:ELSE PRINT #1,"":PRINT #1,""
21090 RETURN
21100 REM -----
21110 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 1 **
21160 PRINT #1,"PROJECT TITLE: ";TITLE$
21170 PRINT #1,TAB(20);" L I N K   D A T A";TAB(50);"* => MAX COVER DEPTH EXCEED
ED"
21175 PRINT #1,"                                - => MIN VELOCIT
TY TOO LOW"
21176 PRINT #1,"                                # => MIN SLOPE
EXCEED"
21180 PRINT #1,""
21190 PRINT #1,"   LINK";TAB(10);"N O D E";
21200 PRINT #1,TAB(20);"F L O W";TAB(30);"DIAM";TAB(36);"S L O P E";
21210 PRINT #1,TAB(46);" S L O P E";
21220 PRINT #1,TAB(59);"VELOCITY";TAB(69);"D E P T H "
21230 PRINT #1,TAB(9);"FROM";TAB(15);"TO";TAB(19);"MAX";TAB(25);"MIN";TAB(36);"M
AX";TAB(42);"MIN";TAB(46);"GROUND";TAB(53);"PIPE";TAB(59);"MAX";TAB(64);"MIN";
21240 PRINT #1,TAB(69);"MAX";
21250 PRINT #1,TAB(75);"MIN"
21260 PRINT #1,"   #";TAB(11);"#";TAB(16);"#";TAB(19);"(cu. m/s)";TAB(30);"(CM
";TAB(37);"X";
21270 PRINT #1,TAB(43);"%";TAB(48);" X";TAB(54);" X";TAB(59);"(m/s)";TAB(72);"(C
M)"
21290 PRINT #1,""
21300 RETURN
21310 REM -----
21320 REM ** SUBROUTINE TO PRINT LINK RESULTS HEADING 2 **
21370 PRINT #1,"PROJECT TITLE: ";TITLE$
21380 PRINT #1,TAB(20);" L I N K   D A T A";TAB(51);"* => MAX COVER DEPTH EXCEED
ED"
21390 PRINT #1,""
21400 PRINT #1,TAB(15);"GROUND ELEV";TAB(31);"CROWN ELEV";
21410 PRINT #1,TAB(46);"INVERT ELEV";TAB(61);"EXCAVATION DEPTH"
21420 PRINT #1,TAB(2);"LINK";TAB(8);"LENGTH";TAB(15);"UPSTRM";TAB(23);"DNSTRM";
21430 PRINT #1,TAB(31);"UPSTRM";TAB(39);"DNSTRM";TAB(46);"OPSTRM";
21440 PRINT #1,TAB(54);"DNSTRM";TAB(63);"UPSTRM";TAB(72);"DNSTRM"
21450 PRINT #1," #";TAB(10);"(M)";TAB(17);UNIT$(3);TAB(25);"(M)";
21460 PRINT #1,TAB(33);UNIT$(3);TAB(41);UNIT$(3);TAB(49);UNIT$(3);
21470 PRINT #1,TAB(55);UNIT$(3);TAB(64);UNIT$(3);TAB(73);UNIT$(3)
21480 PRINT #1,""
21490 RETURN
21500 REM -----
21510 REM ** SUBROUTINE TO PRINT NODE RESULTS HEADING **

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21560 PRINT #1, "PROJECT TITLE: "; TITLE$
21570 PRINT #1, TAB(13); " N O D E   D A T A "
21580 PRINT #1, ""
21590 PRINT #1, TAB(27); "GROUND"; TAB(36); "EXCAVATION";
21600 PRINT #1, TAB(49); "DIST HIGH INVERT"
21610 PRINT #1, " NODE"; TAB(10); "AREA"; TAB(18); "RUNOFF "; TAB(28); "ELEV";
21620 PRINT #1, TAB(38); "DEPTH"; TAB(50); "TO LOW INVERT"
21630 PRINT #1, " #"; TAB(10); "(ha)"; TAB(19); " COE. "; TAB(28); UNIT$(3);
21640 PRINT #1, TAB(38); UNIT$(3); TAB(55); UNIT$(3)
21650 PRINT #1, ""
21660 RETURN
21670 REM -----
21680 REM ** SUBROUTINE TO HOLD SCREEN **
21730 LOCATE 24,1
21740 COLOR 0,7
21750 PRINT "PRESS ANY KEY TO CONTINUE";
21760 COLOR 7,0
21770 A$ = INKEY$: IF A$="" THEN GOTO 21770
21780 RETURN
22000 REM ** SUBROUTINE TO READ DATA **
22005 ON ERROR GOTO 11940
22010 FILES "b:* .com"
22020 INPUT "ENTER NAME OF DISK FILE TO BE READ: "; AF$
22021 IF AF$ = "" THEN 12000
22025 DF$ = "b:" + AF$ + ".com"
22030 OPEN "I", 1, DF$
22040 PRINT "NOW READING DATA"
22050 LINE INPUT #1, TITLE$
22060 INPUT #1, NLINK, NNODE, A, B, KK, RO, NEEF
22070 INPUT #1, ELEVREF, ROUGH, TE
22080 INPUT #1, COVERMIN, COVERMAX, VELMIN, VELMAX, SLENGTH, AVGDIAH, AVGDPTB, AVGBAEA,
OUTCROWN
22090 FOR I=1 TO NLINK
22100 INPUT #1, LINE(I), NFROM(I), NTO(I), SPAN(I), DIAM(I), COVER(I), IMAX(I), IMIN(I),
FLOW(I), FLOWM(I), DEPTH(I), VELOCITY(I), VELOCITYM(I), PIPESLOPE(I), SLOPEMIN(I), SLOP
EMAX(I), GROUNDSLOPE(I), XUP(I), UPINVERT(I), XDOWN(I), DOWNINVERT(I), UPCROWN(I), DOWN
CROWN(I)
22105 INPUT #1, A(I), DEPTEN(I)
22110 NEXT I
22120 FOR I=1 TO NNODE
22130 INPUT #1, NODE(I), HA(I), DENH(I), DEN(I), WERM(I), WER(I), C(I), ELEV(I), XNODE(I)
, DROP(I), PEAK1(I), PEAK(I)
22140 NEXT I
22150 CLOSE
22160 GOSUB 16690 : REM SET UNIT NAMES
22170 PRINT:PRINT "DATA READ. ":PRINT " FILENAME : "; DF$
22175 PRINT " PROJECT TITLE : "; TITLE$
22180 GOSUB 21730: REM SCREEN HOLD
22200 RETURN

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ต้นฉบับ หน้าขาดหาย