

SECTION 8

REFERENCES



REFERENCE




**HYDROLOGY STUDIES
FOR
PORTOLA HILLS WESTSIDE
The Baldwin Company**

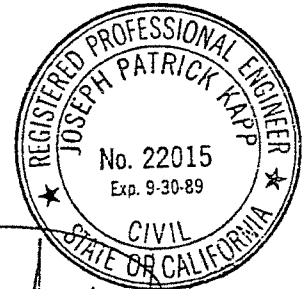
**Tract 13156(Final & Tentative)
Tract 13310
Tract 13311
Tract 13334
Tract 13335
Tract 13523
Tract 13524**

PREPARED BY

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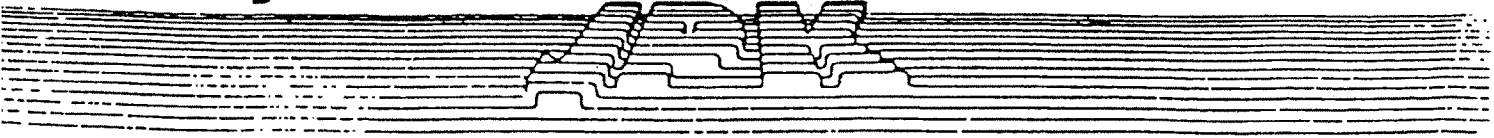
**MARCH 15, 1988
REVISED MAY 31, 1988**

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TR 13156

Handwritten signature and date: J.P. Kapp, 9/30/88

J.R KAPP & ASSOCIATES, INC.



REFERENCE
HYDROLOGY CALCULATIONS
By J.P. KAPP & ASSOCIATES, INC.
100-YEAR

Pages 1 thru 51 are missing.

 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
 (Reference: 1986 OCEMA HYDROLOGY CRITERION)
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 Ver. 4.1C Release Date: 5/12/87 Serial # 100990

Especially prepared for:

J. F. KAPP & ASSOCIATES, INC.

 ***** DESCRIPTION OF STUDY *****
 SADDLEBACK TRAIL SADDLEBACK RANCH ROAD, 3100 (WITH TENT TR. 13489, 13490 &
 13491 TRIBUTARY)

FILE NAME: RPT1130.DAT
 TIME DATE OF STUDY: 12/18 3/13/1988

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION

---*TIME-OF-CONCENTRATION MODEL*---

USER SPECIFIED STORM EVENT (YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE (INCH) = 18.00
 SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = .85
 DATA BANK RAINFALL USED

 FLOW PROCESS FROM NODE 201.00 TO NODE 202.00 IS CODE = 2

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TC = $K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** .20$
 INITIAL SUBAREA FLOW-LENGTH = 700.00
 UPSTREAM ELEVATION = 1368.00
 DOWNSTREAM ELEVATION = 1350.00
 ELEVATION DIFFERENCE = 18.00
 $TC = .412 * [(700.00 ** 3.00) / (18.00)] ** .20 = 11.773$
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.805
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL-> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_m (INCH/HR) = .1500
 SUBAREA RUNOFF (CFS) = 8.62
 TOTAL AREA (ACRES) = 2.60 PEAK FLOW RATE (CFS) = 8.62

 FLOW PROCESS FROM NODE 202.00 TO NODE 203.00 IS CODE = 6

>>>>COMPUTE STREETFLOW TRAVELTIME THRU SUBAREA<<<<<

UPSTREAM ELEVATION = 1350.00 DOWNSTREAM ELEVATION = 1348.00

STREET LENGTH (FEET) = 100.00 TO EIGHT INCHES
STREET FLOODWIDTH (FEET) = 15.99

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK = 18.33
INTERIOR STREET CROSSFALL (DECIMAL) = .017
OUTSIDE STREET CROSSFALL (DECIMAL) = .017

DESIGNATED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

++ TRAVELTIME COMPUTED USING MEAN FLOW (CFS) = 5.77
STREETFLOW MODEL RESULTS:
STREET FLOWDEPTH (FEET) = .40
HALFSTREET FLOODWIDTH (FEET) = 15.99
AVERAGE FLOW VELOCITY (FEET/SEC.) = 3.83
PRODUCT OF DEPTH*VELOCITY = 1.54
STREETFLOW TRAVELTIME (MIN) = .44 TO MIN) = 13.01

100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.713
SOIL CLASSIFICATION IS "D"
COMMERCIAL SUBAREA LOSS RATE, Fm (INCH/HR) = .0000
SUBAREA AREA (ACRES) = .10 SUBAREA RUNOFF (CFS) = .33
EFFECTIVE AREA (ACRES) = 2.70
AVERAGED Fm (INCH/HR) = .116
TOTAL AREA (ACRES) = 2.70 PEAK FLOW RATE (CFS) = 8.75
END OF SUBAREA STREETFLOW HYDRAULICS:
DEPTH (FEET) = .40 HALFSTREET FLOODWIDTH (FEET) = 15.99
FLOW VELOCITY (FEET/SEC.) = 3.81 DEPTH*VELOCITY = 1.54

FLOW PROCESS FROM NODE 202.00 TO NODE 203.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION (MINUTES) = 12.21
RAINFALL INTENSITY (INCH./HR) = 3.72
EFFECTIVE STREAM AREA (ACRES) = 2.70
TOTAL STREAM AREA (ACRES) = 2.70
PEAK FLOW RATE (CFS) AT CONFLUENCE = 8.75

FLOW PROCESS FROM NODE 204.00 TO NODE 203.00 IS CODE = 2

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TC = K*[(LENGTH** 3.00) / (ELEVATION CHANGE)]** .20
INITIAL SUBAREA FLOW-LENGTH = 640.00
UPSTREAM ELEVATION = 1400.00
DOWNSTREAM ELEVATION = 1348.00
ELEVATION DIFFERENCE = 52.00
TC = .412*[(640.00** 3.00) / (52.00)]** .20 = 5.02

1.00 INCH RAINFALL INTENSITY (INCH/HOUR) = 4.47
 SOIL CLASSIFICATION IS "B"
 RESIDENTIAL-2 3-4 DWELLINGS (ACRE SUBAREA) LOSS RATE, PAVING
 SUBAREA RUNOFF (CFS) = 12.47
 TOTAL AREA (ACRES) = 3.20 PEAK FLOW RATE (CFS) = 12.47

 FLOW PROCESS FROM NODE 204.00 TO NODE 205.00 IS CODE =

>>>>COMPUTE INDEPENDENT STREAM FOR CONFLUENCE(1,2)
 <<<<< AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES(1,2)

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE
 TIME OF CONCENTRATION (MINUTES) = 9.02
 RAINFALL INTENSITY (INCH/HOUR) = 4.47
 EFFECTIVE STREAM AREA (ACRES) = 3.20
 TOTAL STREAM AREA (ACRES) = 3.20
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 12.47

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	SM (IN/HR)	EFFECTIVE AREA (ACRES)
1	8.75	12.21	3.718	.12	2.70
2	12.47	9.02	4.449	.12	3.20

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	19.12	5.90
2	20.25	5.20

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 20.25 TIME (MINUTES) = 9.024
 EFFECTIVE AREA (ACRES) = 5.20
 TOTAL AREA (ACRES) = 5.90

 FLOW PROCESS FROM NODE 203.00 TO NODE 205.00 IS CODE = 6

>>>>COMPUTE STREETFLOW TRAVELTIME THRU SUBAREA<<<<<

UPSTREAM ELEVATION = 1348.00 DOWNSTREAM ELEVATION = 1322.70
 STREET LENGTH (FEET) = 1025.00 CURB HEIGHT (INCHES) = 3.
 STREET HALFWIDTH (FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK = 18.33
 INTERIOR STREET CROSSFALL (DECIMAL) = .017
 OUTSIDE STREET CROSSFALL (DECIMAL) = .017

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

TRAVEL TIME COMPUTED USING MEAN FLOW(CFS) = 74.07
 STREETFLOW SPLITS OVER STREET-CROWN
 FULL DEPTH(FEET) = .47 FLOODWIDTH(FEET) = 20.00
 FULL HALF-STREET VELOCITY(FEET/SEC.) = 4.81
 SPLIT DEPTH(FEET) = .38 SPLIT FLOODWIDTH(FEET) = 17.04
 SPLIT VELOCITY(FEET/SEC.) = 3.81
 STREETFLOW MODEL RESULTS:
 STREET FLOWDEPTH(FEET) = .47
 HALFSTREET FLOODWIDTH(FEET) = 20.00
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 4.81
 PRODUCT OF DEPTH&VELOCITY = 2.26
 TIME OF TRAVEL(MIN) = 7.37 TC(MIN) = 12.58

100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.645
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL-> 1-4 DWELLINGS/ACRE SUBAREA LOSS RATE, Fm INC (IN/HR) = 0.12
 SUBAREA AREA(ACRES) = 2.70 SUBAREA RUNOFF(CFS) = 0.58
 EFFECTIVE AREA(ACRES) = 7.90
 AVERAGED Fm INCH/HR = 0.12
 TOTAL AREA(ACRES) = 3.60 PEAK FLOW RATE(CFS) = 25.08
 END OF SUBAREA STREETFLOW HYDRAULICS:
 DEPTH(FEET) = .47 HALFSTREET FLOODWIDTH(FEET) = 20.00
 FLOW VELOCITY(FEET/SEC.) = 4.81 DEPTH*VELOCITY = 2.26

 FLOW PROCESS FROM NODE 203.00 TO NODE 205.00 IS CODE = 1

>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MINUTES) = 12.58
 RAINFALL INTENSITY (INCH./HOUR) = 3.65
 EFFECTIVE STREAM AREA(ACRES) = 7.90
 TOTAL STREAM AREA(ACRES) = 8.60
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 25.08

 FLOW PROCESS FROM NODE 207.00 TO NODE 208.00 IS CODE = 7

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) = 17.17 RAIN INTENSITY(INCH/HOUR) = 3.06
 EFFECTIVE AREA(ACRES) = 5.10
 TOTAL AREA(ACRES) = 5.10 PEAK FLOW RATE(CFS) = 10.48
 AVERAGED LOSS RATE, Fm(IN/HR) = 0.12
 ***ERROR; SPECIFIED LOSS RATE, Fm IS LESS THAN MINIMUM
 POSSIBLE VALUE OF .12(INCHES/HOUR)

 FLOW PROCESS FROM NODE 208.00 TO NODE 205.00 IS CODE = 3

COMPUTE STREETFLOW TRAVELTIME THRU SUBAREA
USING COMPUTER-ESTIMATED PIPE SIZE (NOW FREEBASE FLOW)

ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 7.2 INCHES
PIPEFLOW VELOCITY(Feet/Sec.) = 20.3
UPSTREAM NODE ELEVATION = 1340.00
DOWNSTREAM NODE ELEVATION = 1322.70
LENGTH(FEET) = 130.00 MANNINGS N = 0.143
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES =
INFEET TO THRU SUBAREA(CFS) = 13.48
TRAVEL TIME(MIN.) = 17.10 TC(MIN.) = 17.09

FLOW PROCESS FROM NODE 208.00 TO NODE 205.00 IS CODE = 1

UNDESIGNATED INDEPENDENT STREAM FOR CONFLUENCE <<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
1. TIME OF CONCENTRATION(MINUTES) = 17.09
2. RAINFALL INTENSITY (INCH./HOUR) = 3.04
3. EFFECTIVE STREAM AREA(ACRES) = 5.10
TOTAL STREAM AREA(ACRES) = 5.10
PEAK FLOW RATE(CFS) AT CONFLUENCE = 13.48

FLOW PROCESS FROM NODE 209.00 TO NODE 202.00 IS CODE = 2

COMBINATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TC = K*(LENGTH** 3.00)/(ELEVATION CHANGE)** .20
INITIAL SUBAREA FLOW-LENGTH = 825.00
UPSTREAM ELEVATION = 1363.80
DOWNSTREAM ELEVATION = 1350.00
ELEVATION DIFFERENCE = 13.80
TC = .412*[(825.00** 3.00)/(13.80)]** .20 = 13.702
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.487
SOIL CLASSIFICATION IS "D"
RESIDENTIAL-> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_s(INCH/HR) = 1.200
SUBAREA RUNOFF(CFS) = 6.06
TOTAL AREA(ACRES) = 2.00 PEAK FLOW RATE(CFS) = 6.06

FLOW PROCESS FROM NODE 202.00 TO NODE 205.00 IS CODE = 5

>>>>COMPUTE STREETFLOW TRAVELTIME THRU SUBAREA<<<<<

UPSTREAM ELEVATION = 1350.00 DOWNSTREAM ELEVATION = 1322.70
STREET LENGTH(FEET) = 130.00 CURB HEIGHT(INCHES) = 6.

STREAM WIDTH (FEET) = 12.0

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK = 10.00
INTERIOR STREET CROSSFALL (DECIMAL) = .017
OUTSIDE STREET CROSSFALL (DECIMAL) = .017

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

++TRAVELTIME COMPUTED USING MEAN FLOW QFS = 6.77
STREETFLOW MODEL RESULTS:
STREET FLOWDEPTH (FEET) = .36
HALFSTREET FLOODWIDTH (FEET) = 13.70
AVERAGE FLOW VELOCITY (FEET/SEC.) = 3.91
PRODUCT OF DEPTH*VELOCITY = 1.41
STREETFLOW TRAVELTIME (MIN) = 4.01 TCONIN = 18.52

RAINFALL INTENSITY (INCH/HOUR) = 3.771
SFC CLASSIFICATION IS "D"
COMMERCIAL SUBAREA LOSS RATE, Fm (INCH/HR) = .0000
SUBAREA AREA (ACRES) = .50 SUBAREA RUNOFF (CFS) = 1.31
EFFECTIVE AREA (ACRES) = 2.50
AVERAGED Fm (INCH/HR) = .100
TOTAL AREA (ACRES) = 2.50 PEAK FLOW RATE (CFS) = 6.37
END OF SUBAREA STREETFLOW HYDRAULICS:
DEPTH (FEET) = .36 HALFSTREET FLOODWIDTH (FEET) = 13.70
FLOW VELOCITY (FEET/SEC.) = 3.71 DEPTH*VELOCITY = 1.35

FLOW PROCESS FROM NODE 202.00 TO NODE 205.00 IS CODE = 1

=====
>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<<
>>>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES <<<<<
=====

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
TIME OF CONCENTRATION (MINUTES) = 18.52
RAINFALL INTENSITY (INCH./HOUR) = 2.93
EFFECTIVE STREAM AREA (ACRES) = 2.50
TOTAL STREAM AREA (ACRES) = 2.50
PEAK FLOW RATE (CFS) AT CONFLUENCE = 6.37

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	25.08	12.58	3.649	.12	7.90
2	13.48	17.29	3.043	.12	5.10
3	6.37	18.52	2.931	.10	2.50

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 3 STREAMS.

SUMMARY RESULTS:

STREAM CONFLUENCE EFFECTIVE
NUMBER Q (CFS) AREA (ACRES)

1	47.75	15.00
2	11.21	13.00
3	29.01	13.50

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE (CFS) = 42.34 TIME (MINUTES) = 12.577
 EFFECTIVE AREA (ACRES) = 13.30
 TOTAL AREA (ACRES) = 16.20

 FLOW PROCESS FROM NODE 205.00 TO NODE 210.00 IS CODE = 7

=====
 >>>>DESIGNATE PIPEFLOW TRAVEL TIME THRU SUBAREA<<<<
 >>>>DESIGNATE COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)

=====
 LENGTH OF FLOW IN 24.0 INCH PIPE IS 14.9 INCHES
 TRAVEL VELOCITY (FEET/SEC.) = 20.7
 UPSTREAM NODE ELEVATION = 1322.70
 DOWNSTREAM NODE ELEVATION = 1300.00
 FLOWLENGTH (FEET) = 375.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 24.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 42.34
 TRAVEL TIME (MIN.) = .22 TC (MIN.) = 12.80

 FLOW PROCESS FROM NODE 205.00 TO NODE 210.00 IS CODE = 1

=====
 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

=====
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 12.80
 RAINFALL INTENSITY (INCH./HOUR) = 3.62
 EFFECTIVE STREAM AREA (ACRES) = 13.30
 TOTAL STREAM AREA (ACRES) = 16.20
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 42.34

 FLOW PROCESS FROM NODE 211.00 TO NODE 212.00 IS CODE = 7

=====
 >>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

=====
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC (MIN) = 12.02 RAIN INTENSITY (INCH/HOUR) = 3.76
 EFFECTIVE AREA (ACRES) = 4.60
 TOTAL AREA (ACRES) = 4.60 PEAK FLOW RATE (CFS) = 15.05
 AVERAGED LOSS RATE, Fm (IN/HR) = .120
 ***ERROR; SPECIFIED LOSS RATE, FM IS LESS THAN MINIMUM
 POSSIBLE VALUE OF .12 (INCHES/HOUR)

 FLOW PROCESS FROM NODE 212.00 TO NODE 210.00 IS CODE = 3

ESTIMATE PIPE FLOW, TRAVELTIME THRU SUBAREA
USING COMPUTER ESTIMATED PIPESIZE (NON-PRESSURE FLOW)

ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 8.0 INCHES
PIPEFLOW VELOCITY (FEET/SEC.) = 19.9
UPSTREAM NODE ELEVATION = 1300.50
DOWNSTREAM NODE ELEVATION = 1300.00
PIPE LENGTH (FEET) = 160.00 MANNINGS N = .015
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
TOTAL FLOW THRU SUBAREA (CFS) = 15.05
TRAVEL TIME (MIN.) = .13 TD (MIN.) = 12.15

FLOW PROCESS FROM NODE 212.00 TO NODE 210.00 IS CODE =

1) DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE
2) COMPUTE VARIOUS CONFLUENCED STREAM VALUES

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION (MINUTES) = 12.15
RAINFALL INTENSITY (INCH./HOUR) = 3.73
EFFECTIVE STREAM AREA (ACRES) = 4.60
TOTAL STREAM AREA (ACRES) = 4.60
PEAK FLOW RATE (CFS) AT CONFLUENCE = 15.05

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH./HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	42.34	12.80	3.617	.12	13.30
2	15.05	12.15	3.729	.12	4.60

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	56.92	17.90
2	56.55	17.23

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 56.92 TIME (MINUTES) = 12.799
EFFECTIVE AREA (ACRES) = 17.90
TOTAL AREA (ACRES) = 20.80

FLOW PROCESS FROM NODE 210.00 TO NODE 262.00 IS CODE = 3

>>>> COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>> USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 27.0 INCH PIPE IS 17.3 INCHES

UPSTREAM VELOCITY (FEET/SEC) = 12.8
 UPSTREAM NODE ELEVATION = 1325.40
 DOWNSTREAM NODE ELEVATION = 1281.50
 FLOWLENGTH (FEET) = 285.00 MANNINGS N = .015
 ESTIMATED PIPE DIAMETER (INCH) = 27.00 NUMBER OF PIPES =
 PIPEFLOW THRU SUBAREA (CFS) = 56.92
 TRAVEL TIME (MIN.) = 13.00 TC (MIN.) = 13.00

 FLOW PROCESS FROM NODE 260.00 TO NODE 261.00 IS CODE =

=====
 >>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 13.00
 RAINFALL INTENSITY (INCH./HOUR) = 3.57
 EFFECTIVE STREAM AREA (ACRES) = 17.90
 TOTAL STREAM AREA (ACRES) = 20.50
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 56.92

 FLOW PROCESS FROM NODE 260.00 TO NODE 261.00 IS CODE = 2

=====
 >>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS <<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

$TC = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** .20$
 INITIAL SUBAREA FLOW-LENGTH = 460.00
 UPSTREAM ELEVATION = 1325.40
 DOWNSTREAM ELEVATION = 1297.30
 ELEVATION DIFFERENCE = 28.10
 $TC = .412 * [(460.00 ** 3.00) / (28.10)] ** .20 = 8.372$
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.642
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL -> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_p (INCH/HR) = .1300
 SUBAREA RUNOFF (CFS) = 2.56
 TOTAL AREA (ACRES) = .63 PEAK FLOW RATE (CFS) = 2.56

 FLOW PROCESS FROM NODE 261.00 TO NODE 262.00 IS CODE = 3

=====
 >>>> COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA <<<<<
 >>>> USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<

ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 3.1 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 12.8
 UPSTREAM NODE ELEVATION = 1297.30
 DOWNSTREAM NODE ELEVATION = 1281.50
 FLOWLENGTH (FEET) = 90.00 MANNINGS N = .015
 ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1

PIPEFLOW THRU SUBAREA(CFS) = 1.56
 TRAVEL TIME(MIN.) = 1.15 TO MIN. = 8.49

 FLOW PROCESS FROM NODE 262.00 TO NODE 262.00 IS CODE = 1

=====
 (X) DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE (X) (X)
 (X) AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES (X) (X)
 =====

NO. OF PIPES USED FOR INDEPENDENT STREAM TO AREA
 TIME OF CONCENTRATION (MINUTES) = 8.49
 RAINFALL INTENSITY (INCH./HOUR) = 4.61
 EFFECTIVE STREAM AREA (ACRES) = 1.60
 TOTAL STREAM AREA (ACRES) = 1.63
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.86

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH./HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	38.70	13.00	3.588	.12	17.90
2	2.86	8.49	4.607	.12	1.63

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	38.91	18.53
2	50.65	12.32

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 58.91 TIME(MINUTES) = 13.000
 EFFECTIVE AREA(ACRES) = 18.53
 TOTAL AREA(ACRES) = 21.43

 FLOW PROCESS FROM NODE 262.00 TO NODE 213.00 IS CODE = 3

=====
 (X) COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA (X) (X) (X) (X)
 (X) USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) (X) (X) (X)
 =====

DEPTH OF FLOW IN 27.0 INCH PIPE IS 17.4 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 21.8
 UPSTREAM NODE ELEVATION = 1281.50
 DOWNSTREAM NODE ELEVATION = 1270.00
 FLOWLENGTH (FEET) = 150.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 27.00 - NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 58.91
 TRAVEL TIME (MIN.) = .11 TC (MIN.) = 13.11

FLOW PROCESS FROM NODE 217.00 TO NODE 217.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MINUTES) = 13.11
RAINFALL INTENSITY (INCH./HOUR) = 3.57
EFFECTIVE STREAM AREA(ACRES) = 18.53
TOTAL STREAM AREA(ACRES) = 18.53
PEAK FLOW RATE(CFS) AT CONFLUENCE = 58.91

FLOW PROCESS FROM NODE 218.00 TO NODE 217.00 IS CODE = 1

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TC = K*(LENGTH** 3.00)/(ELEVATION CHANGE)** .20
INITIAL SUBAREA FLOW-LENGTH = 670.00
UPSTREAM ELEVATION = 1349.50
DOWNSTREAM ELEVATION = 1270.00
ELEVATION DIFFERENCE = 79.50
TC = .412*[(670.00** 3.00)/(79.50)]** .20 = 8.672
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.553
SOIL CLASSIFICATION IS "D"
RESIDENTIAL-> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, Fm(INCH/HR) = .1200
SUBAREA RUNOFF(CFS) = 3.99
TOTAL AREA(ACRES) = 1.00 PEAK FLOW RATE(CFS) = 3.99

FLOW PROCESS FROM NODE 213.00 TO NODE 213.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MINUTES) = 8.67
RAINFALL INTENSITY (INCH./HOUR) = 4.55
EFFECTIVE STREAM AREA(ACRES) = 1.00
TOTAL STREAM AREA(ACRES) = 1.00
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.99

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE(CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA(ACRES)
1	58.91	13.11	3.572	.12	18.53
2	3.99	8.67	4.553	.12	1.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.
SUMMARY RESULTS:

STREAM NUMBER	INFLUENT AREA (ACRES)	EFFECTIVE AREA (ACRES)
1	62.01	17.53
2	54.01	13.25

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 62.01 TIME (MINUTES) = 17.114
 EFFECTIVE AREA (ACRES) = 17.53
 TOTAL AREA (ACRES) = 22.43

 FLOW PROCESS FROM NODE 213.00 TO NODE 215.00 IS CODE = 1

1) COMPLETE PIPEFLOW TRAVELTIME THRU SUBAREA 11
 USING COMPUTER ESTIMATED PIPESIZE (MIN-PRESSURE FLOW)

DEPTH OF FLOW IN 27.0 INCH PIPE IS 13.0 INCHES
 FLOW VELOCITY (FEET/SEC) = 21.8
 UPSTREAM NODE ELEVATION = 1370.00
 DOWNSTREAM NODE ELEVATION = 1261.00
 FLOWLENGTH (FEET) = 120.00 MANNINGS N = .015
 ESTIMATED PIPE DIAMETER (INCH) = 27.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 62.01
 TRAVEL TIME (MIN.) = .09 TC (MIN.) = 13.21

 FLOW PROCESS FROM NODE 216.00 TO NODE 217.00 IS CODE = 2

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

$TC = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** .20$
 INITIAL SUBAREA FLOW-LENGTH = 1020.00
 UPSTREAM ELEVATION = 1350.00
 DOWNSTREAM ELEVATION = 1266.00
 ELEVATION DIFFERENCE = 84.00
 $TC = .412 * [(1020.00 ** 3.00) / (84.00)] ** .20 = 10.844$
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.991
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL -> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_p (INCH/HR) = .1200
 SUBAREA RUNOFF (CFS) = 10.45
 TOTAL AREA (ACRES) = 3.00 PEAK FLOW RATE (CFS) = 10.45

 FLOW PROCESS FROM NODE 217.00 TO NODE 217.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 10.84
 RAINFALL INTENSITY (INCH./HR) = 3.99

EFFECTIVE STREAM AREA (ACRES) = 3.00
 TOTAL STREAM AREA (ACRES) = 7.00
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 10.45

 FLOW PROCESS FROM NODE 218.00 TO NODE 217.00 IS CODE = 2

 RATIONAL METHOD INITIAL SUBAREA ANALYSIS

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL - 3-4 DWELLINGS/ACRE

$T_c = 0.47 / (LENGTH^{.0167} * (ELEVATION CHANGE)^{.0167})$
 INITIAL SUBAREA FLOW LENGTH = 1140.00
 UPSTREAM ELEVATION = 1316.00
 DOWNSTREAM ELEVATION = 1266.00
 ELEVATION DIFFERENCE = 60.00
 $T_c = 0.47 * (1140.00^{.0167} * (60.00)^{.0167})^{-1} = 12.400$
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.680
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL - 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, Fm (INCH/HR) = .1200
 SUBAREA RUNOFF (CFS) = 14.42
 TOTAL AREA (ACRES) = 4.50 PEAK FLOW RATE (CFS) = 14.42

 FLOW PROCESS FROM NODE 217.00 TO NODE 217.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<<<
 >>>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES <<<<<<

 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MINUTES) = 12.40
 RAINFALL INTENSITY (INCH./HOUR) = 3.68
 EFFECTIVE STREAM AREA (ACRES) = 4.50
 TOTAL STREAM AREA (ACRES) = 4.50
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 14.42

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	Fm (IN/HR)	EFFECTIVE AREA (ACRES)
1	10.45	10.84	3.991	.12	3.00
2	14.42	12.40	3.680	.12	4.50

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	24.16	6.94
2	24.03	7.50

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 24.16 TIME (MINUTES) = 10.844

EFFECTIVE AREA(ACRES) =
TOTAL AREA(ACRES) =

FLOW PROCESS FROM NODE 217.00 TO NODE 215.00 IS CODE = 7

>>>>COMPUTE PIPEFLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<

DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.8 INCHES
PIPEFLOW VELOCITY(FEET/SEC.) = 16.6
UPSTREAM NODE ELEVATION = 1258.00
DOWNSTREAM NODE ELEVATION = 1261.00
FLOW LENGTH(FEET) = 70.00 MANNING'S N = .017
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF FEET
PIPEFLOW THRU SUBAREA DFO) = 24.16
TRAVEL TIME(MIN.) = .97 TC(MIN.) = 10.91

FLOW PROCESS FROM NODE 215.00 TO NODE 215.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MINUTES) = 10.91
RAINFALL INTENSITY (INCH./HOUR) = 3.98
EFFECTIVE STREAM AREA(ACRES) = 6.94
TOTAL STREAM AREA(ACRES) = 7.50
PEAK FLOW RATE(CFS) AT CONFLUENCE = 24.16

FLOW PROCESS FROM NODE 215.00 TO NODE 215.00 IS CODE = 7

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<

USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 13.11 RAIN INTENSITY(INCH/HOUR) = 3.57
EFFECTIVE AREA(ACRES) = 19.53
TOTAL AREA(ACRES) = 22.43 PEAK FLOW RATE(CFS) = 62.01
AVERAGED LOSS RATE, Fm(IN/HR) = .120

FLOW PROCESS FROM NODE 215.00 TO NODE 215.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MINUTES) = 13.11
RAINFALL INTENSITY (INCH./HOUR) = 3.57
EFFECTIVE STREAM AREA(ACRES) = 19.53

TOTAL STREAM AREA (ACRES) = 29.93
PEAK FLOW RATE (CFS) AT CONFLUENCE = 83.64

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH./HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	24.16	10.91	3.977	.12	6.94
2	62.01	13.11	3.572	.12	19.33

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	31.64	25.17
2	33.64	26.47

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 83.64 TIME (MINUTES) = 13.110
EFFECTIVE AREA (ACRES) = 26.47
TOTAL AREA (ACRES) = 29.93

FLOW PROCESS FROM NODE 215.00 TO NODE 219.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 30.0 INCH PIPE IS 20.5 INCHES
PIPEFLOW VELOCITY (FEET/SEC.) = 23.4
UPSTREAM NODE ELEVATION = 1261.00
DOWNSTREAM NODE ELEVATION = 1253.60
FLOWLENGTH (FEET) = 100.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER (INCH) = 30.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA (CFS) = 83.64
TRAVEL TIME (MIN.) = .07 TC (MIN.) = 13.18

FLOW PROCESS FROM NODE 219.00 TO NODE 219.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION (MINUTES) = 13.18
RAINFALL INTENSITY (INCH./HOUR) = 3.56
EFFECTIVE STREAM AREA (ACRES) = 26.47
TOTAL STREAM AREA (ACRES) = 29.93
PEAK FLOW RATE (CFS) AT CONFLUENCE = 83.64

FLOW PROCESS FROM NODE 270.00 TO NODE 219.00 IS CODE = 2

RATIONAL METHOD INITIAL SUBAREA ANALYSIS

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TD = K*(LENGTH** 3.00)/(ELEVATION CHANGE)**.20
INITIAL SUBAREA FLOW-LENGTH = 1460.00
UPSTREAM ELEVATION = 1000.70
DOWNSTREAM ELEVATION = 1000.60
ELEVATION DIFFERENCE = 80.10
TD = (4.10*(1460.00** 3.00)/(80.10)**.20) = 13.57
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.505
SUDS CLASSIFICATION IS "D"
RESIDENTIAL -> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, Fm, INC (HR)
SUBAREA RUNOFF (CFS) = 9.75
TOTAL AREA (ACRES) = 3.20 PEAK FLOW RATE (CFS) = 9.75

FLOW PROCESS FROM NODE 219.00 TO NODE 219.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION (MINUTES) = 13.58
RAINFALL INTENSITY (INCH./HOUR) = 3.51
EFFECTIVE STREAM AREA (ACRES) = 3.20
TOTAL STREAM AREA (ACRES) = 3.20
PEAK FLOW RATE (CFS) AT CONFLUENCE = 9.75

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	83.64	13.18	3.562	.12	26.47
2	9.75	13.58	3.505	.12	3.20

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	93.26	29.57
2	92.00	29.67

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 93.26 TIME (MINUTES) = 17.181
EFFECTIVE AREA (ACRES) = 29.57
TOTAL AREA (ACRES) = 33.13

FLOW PROCESS FROM NODE 219.00 TO NODE 220.00 IS CODE = 5

***** COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA *****
***** USING COMPUTER-ESTIMATED PIPESIZE (NON-RECURSIVE FLW) *****

DEPTH OF FLOW IN 30.0 INCH PIPE IS 21.3 INCHES
PIPEFLOW VELOCITY (FEET/SEC.) = 23.8
UPSTREAM NODE ELEVATION = 1253.50
DOWNSTREAM NODE ELEVATION = 1248.00
PIPELENGTH (FEET) = 75.00 MANNINGS N = .017
ESTIMATED PIPE DIAMETER (INCH) = 70.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA (CFS) = 73.24
TRAVEL TIME (MIN.) = 1.05 TO (MIN.) = 1.17 IS

FLOW PROCESS FROM NODE 219.00 TO NODE 220.00 IS CODE =

***** DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE *****

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION (MINUTES) = 13.00
RAINFALL INTENSITY (INCH./HOUR) = 3.55
EFFECTIVE STREAM AREA (ACRES) = 29.57
TOTAL STREAM AREA (ACRES) = 33.13
PEAK FLOW RATE (CFS) AT CONFLUENCE = 93.26

FLOW PROCESS FROM NODE 309.00 TO NODE 220.00 IS CODE = 7

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC (MIN) = 23.24 RAIN INTENSITY (INCH/HOUR) = 2.57
EFFECTIVE AREA (ACRES) = 26.00
TOTAL AREA (ACRES) = 26.00 PEAK FLOW RATE (CFS) = 57.91
AVERAGED LOSS RATE, Fm (IN/HR) = .120

FLOW PROCESS FROM NODE 309.00 TO NODE 220.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION (MINUTES) = 23.24
RAINFALL INTENSITY (INCH./HOUR) = 2.57
EFFECTIVE STREAM AREA (ACRES) = 26.00
TOTAL STREAM AREA (ACRES) = 26.00
PEAK FLOW RATE (CFS) AT CONFLUENCE = 57.91

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	93.26	13.00	3.55		33.13
2	57.91	23.24	2.57	.120	26.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	139.57	44.38
2	104.32	35.37

1	139.57	44.38
2	104.32	35.37

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 179.57 TIME (MINUTES) = 13.274
EFFECTIVE AREA (ACRES) = 44.38
TOTAL AREA (ACRES) = 59.13

FLOW PROCESS FROM NODE 220.00 TO NODE 221.00 IS CODE = 3

>>>>COMPLETE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

DEPTH OF FLOW IN 36.0 INCH PIPE IS 25.1 INCHES
PIPEFLOW VELOCITY (FEET/SEC.) = 26.5
UPSTREAM NODE ELEVATION = 1248.00
DOWNSTREAM NODE ELEVATION = 1213.80
FLOWLENGTH (FEET) = 460.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER (INCH) = 36.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA (CFS) = 139.57
TRAVEL TIME (MIN.) = .29 TO (MIN.) = 13.52

FLOW PROCESS FROM NODE 220.00 TO NODE 221.00 IS CODE = 1

>>>>DECIANATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION (MINUTES) = 13.52
RAINFALL INTENSITY (INCH./HOUR) = 3.51
EFFECTIVE STREAM AREA (ACRES) = 44.38
TOTAL STREAM AREA (ACRES) = 59.13
PEAK FLOW RATE (CFS) AT CONFLUENCE = 139.57

FLOW PROCESS FROM NODE 213.00 TO NODE 221.00 IS CODE = 2

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TC = K*[L/LENGTH** 3.00]/(ELEVATION CHANGE)]** .20
INITIAL SUBAREA FLOW-LENGTH = 780.00

STREAM ELEVATION = 1213.30
 CONFLUENCE ELEVATION = 1208.50
 ELEVATION DIFFERENCE = 4.80
 $TC = .412 * [(780.00 * 3.00) / (36.70)] + .30 = 9.99$
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.164
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL -> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, FM (INCH/HR) = 1.12
 SUBAREA RUNOFF (CFS) = 6.55
 TOTAL AREA (ACRES) = 1.80 PEAK FLOW RATE (CFS) = 6.55

 FLOW PROCESS FROM NODE 210.00 TO NODE 221.00 IS CODE = 1

DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE: 1, 2
 AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES: 1, 2

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 9.99
 RAINFALL INTENSITY (INCH/HOUR) = 4.16
 EFFECTIVE STREAM AREA (ACRES) = 1.80
 TOTAL STREAM AREA (ACRES) = 1.80
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 6.55

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	139.37	13.52	3.513	.12	44.38
2	6.55	9.99	4.164	.12	1.80

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	145.07	46.18
2	139.41	34.58

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE (CFS) = 145.07 TIME (MINUTES) = 13.523
 EFFECTIVE AREA (ACRES) = 46.18
 TOTAL AREA (ACRES) = 60.93

 FLOW PROCESS FROM NODE 221.00 TO NODE 222.00 IS CODE = 3

>>>> COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA <<<<<
 >>>> USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<

DEPTH OF FLOW IN 36.0 INCH PIPE IS 25.1 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 27.5
 UPSTREAM NODE ELEVATION = 1213.30
 DOWNSTREAM NODE ELEVATION = 1208.50

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ESTIMATED PIPE DIAMETER (INCH) = 18.00 MANNINGS N = .013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.5 INCHES
PIPEFLOW THRU SUBAREA (CFS) = 9.67
TRAVEL TIME (MIN.) = .89 TD (MIN.) = 13.87

FLOW PROCESS FROM NODE 121.00 TO NODE 223.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

=====

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM (AREA):
TIME TO CONCENTRATION (MINUTES) = 13.56
RAINFALL INTENSITY (INCH./HOUR) = 3.51
EFFECTIVE STREAM AREA (ACRES) = 46.18
TOTAL STREAM AREA (ACRES) = 50.93
PEAK FLOW RATE (CFS) AT CONFLUENCE = 145.07

FLOW PROCESS FROM NODE 111.00 TO NODE 223.00 IS CODE = 7

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

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USER-SPECIFIED VALUES ARE AS FOLLOWS:
TD (MIN) = 13.00 RAIN INTENSITY (INCH/HOUR) = 3.59
EFFECTIVE AREA (ACRES) = 3.10
TOTAL AREA (ACRES) = 3.10 PEAK FLOW RATE (CFS) = 9.67
AVERAGED LOSS RATE, Fm (IN/HR) = .120
***ERROR: SPECIFIED LOSS RATE, FM IS LESS THAN MINIMUM
POSSIBLE VALUE OF .12 (INCHES/HOUR)

FLOW PROCESS FROM NODE 223.00 TO NODE 222.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.5 INCHES
PIPEFLOW VELOCITY (FEET/SEC.) = 16.9
UPSTREAM NODE ELEVATION = 1325.00
DOWNSTREAM NODE ELEVATION = 1208.50
FLOWLENGTH (FEET) = 900.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA (CFS) = 9.67
TRAVEL TIME (MIN.) = .89 TD (MIN.) = 13.87

FLOW PROCESS FROM NODE 223.00 TO NODE 222.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

PROFILE IS VALUE SET FOR INDEPENDENT STREAM CODE:
 TIME OF CONCENTRATION (MINUTES) = 10.89
 RAINFALL INTENSITY (INCH/HOUR) = 3.98
 EFFECTIVE STREAM AREA (ACRES) = 3.10
 TOTAL STREAM AREA (ACRES) = 3.10
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 9.67

 FLOW PROCESS FROM NODE 113.00 TO NODE 113.00 IS CODE = 2

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

L = .40 * LENGTH + 3.00 / (ELEVATION CHANGE) ** 1.25
 INITIAL SUBAREA FLOW-LENGTH = 900.00
 UPSTREAM ELEVATION = 1270.00
 DOWNSTREAM ELEVATION = 1270.00
 ELEVATION DIFFERENCE = 83.00
 LTD = .40 * 900.00 ** 3.00 / (83.00) ** 1.25 = 10.084
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.143
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL -> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_a (INCH/HR) = .1200
 SUBAREA RUNOFF (CFS) = 10.86
 TOTAL AREA (ACRES) = 3.00 PEAK FLOW RATE (CFS) = 10.86

 FLOW PROCESS FROM NODE 118.00 TO NODE 222.00 IS CODE = 6

>>>>COMPUTE STREETFLOW TRAVELTIME THRU SUBAREA<<<<

UPSTREAM ELEVATION = 1270.00 DOWNSTREAM ELEVATION = 1210.00
 STREET LENGTH (FEET) = 775.00 CURB HEIGHT (INCHES) = 6.
 STREET HALFWIDTH (FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK = 18.33
 INTERIOR STREET CROSSFALL (DECIMAL) = .017
 OUTSIDE STREET CROSSFALL (DECIMAL) = .017

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2

**TRAVELTIME COMPUTED USING MEAN FLOW (CFS) = 17.01

STREETFLOW MODEL RESULTS:
 STREET FLOWDEPTH (FEET) = .34
 HALFSTREET FLOODWIDTH (FEET) = 12.55
 AVERAGE FLOW VELOCITY (FEET/SEC.) = 3.82
 PRODUCT OF DEPTH&VELOCITY = 2.00
 STREETFLOW TRAVELTIME (MIN) = 2.22 TC (MIN) = 12.50

100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.700
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL -> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_a (INCH/HR) = .1200
 SUBAREA AREA (ACRES) = 3.80 SUBAREA RUNOFF (CFS) = 12.24

EFFICIENT AREA (ACRES) = 5.80
 PEAK FLOW RATE (CFS) = 145.37
 TOTAL AREA (ACRES) = 5.80 PEAK FLOW RATE (CFS) = 145.37
 END OF SUBAREA STREET FLOW HYDRAULICS
 DEPTH (FEET) = .36 HALF STREET FLOW WIDTH (FEET) = 13.70
 FLOW VELOCITY (FEET/SEC.) = 6.78 DEPTH*VELOCITY = 2.41

 FLOW PROCESS FROM NODE 222.00 TO NODE 225.00 IS CODE = 3

 3 STREAMS WERE INDEPENDENT STREAM FOR CONFLUENCE
 COMPUTE VARIOUS CONFLUENCE STREAM VALUES

 TIME OF CONCENTRATION (MINUTES) = 13.59
 RAINFALL INTENSITY (INCH/HOUR) = 3.507
 EFFECTIVE STREAM AREA (ACRES) = 56.01
 TOTAL STREAM AREA (ACRES) = 6.80
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 175.37

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	145.37	13.56	3.507	.12	46.16
2	9.67	13.89	3.460	.12	3.10
3	21.91	12.30	3.700	.12	6.80

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 3 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE (CFS)	EFFECTIVE AREA (ACRES)
1	175.37	56.01
2	175.14	56.08
3	170.17	51.44

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE (CFS) = 175.37 TIME (MINUTES) = 13.559
 EFFECTIVE AREA (ACRES) = 56.01
 TOTAL AREA (ACRES) = 70.83

 FLOW PROCESS FROM NODE 222.00 TO NODE 225.00 IS CODE = 3

>>>> COMPUTE PIPEFLOW TRAVEL TIME THRU SUBAREA <<<<<
 >>>> USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<

DEPTH OF FLOW IN 39.0 INCH PIPE IS 27.9 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 27.7
 UPSTREAM NODE ELEVATION = 1208.00
 DOWNSTREAM NODE ELEVATION = 1168.50
 FLOWLENGTH (FEET) = 350.00 MANNINGS N = .013

TRAVEL TIME (MIN.) = 1.00 TO (MIN.) = 1.00

 FLOW PROCESS FROM NODE 223.00 TO NODE 225.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE
 TIME OF CONCENTRATION (MINUTES) = 13.87
 RAINFALL INTENSITY (INCH./HOUR) = 3.46
 EFFECTIVE STREAM AREA (ACRES) = 59.01
 TOTAL STREAM AREA (ACRES) = 73.60
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 175.07

 FLOW PROCESS FROM NODE 219.00 TO NODE 225.00 IS CODE = 1

 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

 DEVELOPMENT IS COMMERCIAL
 TD = K*(LENGTH** 3.00)/(ELEVATION CHANGE)** .20
 INITIAL SUBAREA FLOW-LENGTH = 1100.00
 UPSTREAM ELEVATION = 1253.60
 DOWNSTREAM ELEVATION = 1172.50
 ELEVATION DIFFERENCE = 81.10
 TD = .304*[(1100.00** 3.00)/(81.10)** .20] = 9.400
 100 YEAR RAINFALL INTENSITY (INCH./HOUR) = 4.624
 SOIL CLASSIFICATION IS "D"
 COMMERCIAL SUBAREA LOSS RATE, Fm (INCH./HR) = .0200
 SUBAREA RUNOFF (CFS) = 7.87
 TOTAL AREA (ACRES) = 1.90 PEAK FLOW RATE (CFS) = 7.87

 FLOW PROCESS FROM NODE 219.00 TO NODE 225.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MINUTES) = 8.43
 RAINFALL INTENSITY (INCH./HOUR) = 4.62
 EFFECTIVE STREAM AREA (ACRES) = 1.90
 TOTAL STREAM AREA (ACRES) = 1.90
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 7.87

 FLOW PROCESS FROM NODE 227.00 TO NODE 227.00 IS CODE = 7

 >>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

LEFT DESIGNATED VALUES ARE AS FOLLOWS:
 TIME OF CONCENTRATION (MIN.) = 7.94
 RAINFALL INTENSITY (INCH/HOUR) = 4.15
 EFFECTIVE AREA (ACRES) = 14.10
 TOTAL AREA (ACRES) = 14.10 PEAK FLOW RATE (CFS) = 51.32
 AVERAGED LOSS RATE, F_m (INCH/HR) = .0104

 FLOW PROCESS FROM NODE 207.00 TO NODE 208.00 IS CODE = 7

>>>> COMPLETE PIPEFLOW TRAVEL TIME THRU SUBAREA
 INCLUDING COMPUTER-ESTIMATED PIPEFLOE (NON-PRESSURE FLOW)

DEPTH OF FLOW IN 11.0 INCH PIPE IS 12.5 INCHES
 FLOW VELOCITY (FEET/SEC.) = 34.0
 UPSTREAM NODE ELEVATION = 1224.00
 DOWNSTREAM NODE ELEVATION = 1168.50
 FLOWLENGTH (FEET) = 200.00 MANNINGS N = .017
 ESTIMATED PIPE DIAMETER (INCH) = 21.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 51.32
 TRAVEL TIME (MIN.) = 10 TD (MIN.) = 10.04

 FLOW PROCESS FROM NODE 227.00 TO NODE 228.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
 TIME OF CONCENTRATION (MINUTES) = 10.04
 RAINFALL INTENSITY (INCH./HOUR) = 4.15
 EFFECTIVE STREAM AREA (ACRES) = 14.10
 TOTAL STREAM AREA (ACRES) = 14.10
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 51.32

 FLOW PROCESS FROM NODE 222.00 TO NODE 225.00 IS CODE = 2

>>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

DEVELOPMENT IS COMMERCIAL

$TC = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** .20$
 INITIAL SUBAREA FLOW-LENGTH = 560.00
 UPSTREAM ELEVATION = 1208.00
 DOWNSTREAM ELEVATION = 1172.50
 ELEVATION DIFFERENCE = 35.50
 $TC = .304 * [(560.00 ** 3.00) / (35.50)] ** .20 = 6.637$
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.347
 SOIL CLASSIFICATION IS "D"
 COMMERCIAL SUBAREA LOSS RATE, F_m (INCH/HR) = .0200
 SUBAREA RUNOFF (CFS) = 7.67
 TOTAL AREA (ACRES) = 1.60 PEAK FLOW RATE (CFS) = 7.67

FLOW PROCESS FROM NODE 222.00 TO NODE 225.00 IS CODE = 1

=====
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 4 ARE:
TIME OF CONCENTRATION(MINUTES) = 5.60
RAINFALL INTENSITY (INCH./HOUR) = 5.35
EFFECTIVE STREAM AREA(ACRES) = 1.80
TOTAL STREAM AREA(ACRES) = 1.40
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.67

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE(CFS)	TIME (MIN.)	INTENSITY INCH/4HOUR	FM (IN/HR)	EFFECTIVE AREA(ACRES)
1	173.37	13.89	3.460	.12	26.00
2	7.57	8.43	4.624	.02	1.80
3	51.32	10.04	4.153	.13	14.10
4	7.67	6.63	5.347	.02	1.80

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 4 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q(CFS)	EFFECTIVE AREA(ACRES)
1	228.68	73.61
2	206.24	49.34
3	217.35	58.07
4	189.92	39.16

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 228.68 TIME(MINUTES) = 13.99
EFFECTIVE AREA(ACRES) = 73.61
TOTAL AREA(ACRES) = 88.43

FLOW PROCESS FROM NODE 225.00 TO NODE 263.00 IS CODE = 3

=====
>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====

DEPTH OF FLOW IN 48.0 INCH PIPE IS 34.7 INCHES
PIPEFLOW VELOCITY(FEET/SEC.) = 23.5
UPSTREAM NODE ELEVATION = 1172.50
DOWNSTREAM NODE ELEVATION = 1167.00
FLOWLENGTH(FEET) = 140.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER(INCH) = 48.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA(CFS) = 228.68
TRAVEL TIME(MIN.) = .10 TC(MIN.) = 13.99

FLOW PROCESS FROM NODE 263.00 TO NODE 203.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MINUTES) = 15.99
RAINFALL INTENSITY (INCH./HOUR) = 3.43
EFFECTIVE STREAM AREA(ACRES) = 73.61
TOTAL STREAM AREA(ACRES) = 68.43
PEAK FLOW RATE(CFS) AT CONFLUENCE = 209.68

FLOW PROCESS FROM NODE 405.00 TO NODE 405.00 IS CODE = 7

>>>>USER-SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

USER-SPECIFIED VALUES ARE AS FOLLOWS:
TD(MIN) = 13.92 RAIN INTENSITY(INCH/HOUR) = 3.60
EFFECTIVE AREA(ACRES) = 30.53
TOTAL AREA(ACRES) = 36.80 PEAK FLOW RATE(CFS) = 99.33
AVERAGED LOSS RATE, Fm(IN/HR) = .127

FLOW PROCESS FROM NODE 405.00 TO NODE 263.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 42.0 INCH PIPE IS 29.2 INCHES
PIPEFLOW VELOCITY(FEET/SEC.) = 13.9
UPSTREAM NODE ELEVATION = 1168.00
DOWNSTREAM NODE ELEVATION = 1167.00
FLOWLENGTH(FEET) = 60.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER(INCH) = 42.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA(CFS) = 99.33
TRAVEL TIME(MIN.) = .07 TD(MIN.) = 13.00

FLOW PROCESS FROM NODE 263.00 TO NODE 263.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MINUTES) = 13.00
RAINFALL INTENSITY (INCH./HOUR) = 3.59
EFFECTIVE STREAM AREA(ACRES) = 30.53
TOTAL STREAM AREA(ACRES) = 36.80
PEAK FLOW RATE(CFS) AT CONFLUENCE = 99.33

HYDROLOGIC INFORMATION

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN)	INTENSITY (INCH/HOUR)	EFF. AREA (ACRES)
1	228.68	13.95	3.445	73.61
2	99.33	13.00	3.529	30.53

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE I (CFS)	EFFECTIVE AREA (ACRES)
---------------	--------------------	------------------------

1	323.90	104.14
2	323.90	93.91

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE (CFS) = 323.90 TIME (MINUTES) = 13.950
 EFFECTIVE AREA (ACRES) = 104.14
 TOTAL AREA (ACRES) = 125.23

 FLOW PROCESS FROM NODE 263.00 TO NODE 264.00 IS CODE = 5

=====
 >>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====
 DEPTH OF FLOW IN 48.0 INCH PIPE IS 33.7 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 34.3
 UPSTREAM NODE ELEVATION = 1167.00
 DOWNSTREAM NODE ELEVATION = 1140.00
 FLOWLENGTH (FEET) = 320.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 48.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 323.90
 TRAVEL TIME (MIN.) = .16 TC (MIN.) = 14.15

 FLOW PROCESS FROM NODE 264.00 TO NODE 264.00 IS CODE = 1

=====
 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 14.15
 RAINFALL INTENSITY (INCH./HOUR) = 3.42
 EFFECTIVE STREAM AREA (ACRES) = 104.14
 TOTAL STREAM AREA (ACRES) = 125.23
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 323.90

 FLOW PROCESS FROM NODE 229.00 TO NODE 230.00 IS CODE = 7

=====
 >>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<

RAIN INTENSITY (INCH/HR) = 3.54
 EFFECTIVE AREA (ACRES) = 17.90
 TOTAL AREA (ACRES) = 17.90 PEAK FLOW RATE (CFS) = 72.43
 AVERAGED LOSS RATE, F_m (IN/HR) = 0.40

FLOW PROCESS FROM NODE 200.00 TO NODE 234.00 IS CODE = 7

COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA 1
 USING COMPUTER-ESTIMATED PIPE SIZE (NON-RECTANGULAR FLOW)

PIPE-IF FLOW IN 24.0 INCH PIPE IS 17.1 INCHES
 FLOW VELOCITY (FEET/SEC) = 37.1
 PIPELINE GROUND ELEVATION = 1134.20
 DOWNSTREAM NODE ELEVATION = 1140.00
 PIPE LENGTH (FEET) = 430.00 MANNINGS N = 1.017
 ESTIMATED PIPE DIAMETER (INCH) = 24.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 72.43
 TRAVEL TIME (MIN.) = .27 TO (MIN.) = 9.00

FLOW PROCESS FROM NODE 264.00 TO NODE 264.00 IS CODE = 1

DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE
 AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MINUTES) = 9.00
 RAINFALL INTENSITY (INCH./HOUR) = 4.46
 EFFECTIVE STREAM AREA (ACRES) = 17.90
 TOTAL STREAM AREA (ACRES) = 17.90
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 72.43

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	F_m (IN/HR)	EFFECTIVE AREA (ACRES)
1	323.90	14.15	3.423	.12	104.14
2	72.43	9.00	4.457	.04	17.90

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	379.38	122.04
2	342.93	84.13

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE (CFS) = 379.38 TIME (MINUTES) = 14.143
 EFFECTIVE AREA (ACRES) = 122.04
 TOTAL AREA (ACRES) = 143.13

FLOW PROCESS FROM NODE 224.00 TO NODE 228.00 IS CODE = 1

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 31.0 INCH PIPE IS 37.7 INCHES
CUTTER VELOCITY(FEET/SEC.) = 33.3
UPSTREAM NODE ELEVATION = 1140.00
DOWNSTREAM NODE ELEVATION = 1128.90
PIPELENGTH(FEET) = 150.00 MANNINGS N = 1.415
ESTIMATED PIPE DIAMETER(INCH) = 31.00 NUMBER OF PIPES = 1
EFFLUENT THRU SUBAREA(CFS) = 379.38
TRAVEL TIME (MIN.) = 1.07 TO (MIN.) = 14.70

FLOW PROCESS FROM NODE 228.00 TO NODE 228.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MINUTES) = 14.22
RAINFALL INTENSITY (INCH./HOUR) = 3.41
EFFECTIVE STREAM AREA(ACRES) = 122.04
TOTAL STREAM AREA(ACRES) = 143.13
PEAK FLOW RATE(CFS) AT CONFLUENCE = 379.38

FLOW PROCESS FROM NODE 231.00 TO NODE 228.00 IS CODE = 2

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

DEVELOPMENT IS COMMERCIAL

TC = K*[L(LENGTH** 3.00)/(ELEVATION CHANGE)]** .20
INITIAL SUBAREA FLOW-LENGTH = 700.00
UPSTREAM ELEVATION = 1223.30
DOWNSTREAM ELEVATION = 1128.90
ELEVATION DIFFERENCE = 94.40
TC = .304*[(700.00** 3.00)/(94.40)]** .20 = 6.236
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.552
SOIL CLASSIFICATION IS "D"
COMMERCIAL SUBAREA LOSS RATE, Fm(INCH/HR) = .0200
SUBAREA RUNOFF(CFS) = 9.46
TOTAL AREA(ACRES) = 1.90 PEAK FLOW RATE(CFS) = 9.46

FLOW PROCESS FROM NODE 228.00 TO NODE 228.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 6.24
 RAINFALL INTENSITY (INCH./HOUR) = 3.55
 EFFECTIVE STREAM AREA (ACRES) = 1.90
 TOTAL STREAM AREA (ACRES) = 1.90
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 9.46

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH./HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	377.39	14.20	3.412	11	22.04
2	9.46	6.24	3.552	101	1.90

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER CONFLUENCE Q (CFS) EFFECTIVE AREA (ACRES)

1	385.18	123.94
2	283.62	33.42

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 385.18 TIME (MINUTES) = 14.319
 EFFECTIVE AREA (ACRES) = 123.94
 TOTAL AREA (ACRES) = 145.03

 FLOW PROCESS FROM NODE 328.00 TO NODE 237.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<

DEPTH OF FLOW IN 51.0 INCH PIPE IS 37.7 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 34.3
 UPSTREAM NODE ELEVATION = 1128.90
 DOWNSTREAM NODE ELEVATION = 1109.10
 FLOWLENGTH (FEET) = 260.00 MANNINGS N = 1.013
 ESTIMATED PIPE DIAMETER (INCH) = 51.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 385.18
 TRAVEL TIME (MIN.) = .13 TC (MIN.) = 14.35

 FLOW PROCESS FROM NODE 237.00 TO NODE 257.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 14.35
 RAINFALL INTENSITY (INCH./HOUR) = 3.39
 EFFECTIVE STREAM AREA (ACRES) = 123.94

TOTAL STREAM AREA(ACRES) = 143.07
PEAK FLOW RATE(CFS) AT CONFLUENCE = 194.12

FLOW PROCESS FROM NODE 121.00 TO NODE 233.00 IS CODE = 7

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

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USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 13.93 RAIN INTENSITY(INCH/HOUR) = 3.49
EFFECTIVE AREA(ACRES) = 6.40
TOTAL AREA(ACRES) = 6.40 PEAK FLOW RATE(CFS) = 19.42
AVERAGE LOSS RATE, Fm(IN/HR) = .100

FLOW PROCESS FROM NODE 233.00 TO NODE 237.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 8.3 INCHES
PIPEFLOW VELOCITY(FEET/SEC.) = 24.6
UPSTREAM NODE ELEVATION = 1179.50
DOWNSTREAM NODE ELEVATION = 1109.10
FLOWLENGTH(FEET) = 325.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA(CFS) = 19.42
TRAVEL TIME(MIN.) = .22 TC(MIN.) = 13.90

FLOW PROCESS FROM NODE 237.00 TO NODE 237.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

=====

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MINUTES) = 13.90
RAINFALL INTENSITY (INCH./HOUR) = 3.46
EFFECTIVE STREAM AREA(ACRES) = 6.40
TOTAL STREAM AREA(ACRES) = 6.40
PEAK FLOW RATE(CFS) AT CONFLUENCE = 19.42

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE(CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA(ACRES)
1	395.18	14.35	3.394	.11	123.94
2	19.42	13.90	3.458	.12	6.40

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

SEE HYDROLOGY STUDY
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STREAM NUMBER	CONFLUENCE (CFS)	EFFECTIVE AREA (ACRES)
1	404.23	130.34
2	399.93	126.49

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE (CFS) = 404.23 TIME (MINUTES) = 13.344
 EFFECTIVE AREA (ACRES) = 130.34
 TOTAL AREA (ACRES) = 151.43

 FLOW PROCESS FROM NODE 337.00 TO NODE 266.00 IS CODE = 7

>>>>DESIGNATE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 31.0 INCH PIPE IS 39.6 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 34.2
 UPSTREAM NODE ELEVATION = 1112.30
 DOWNSTREAM NODE ELEVATION = 1109.45
 FLOWLENGTH (FEET) = 38.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 51.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 404.23
 TRAVEL TIME (MIN.) = .02 TC (MIN.) = 14.36

 FLOW PROCESS FROM NODE 266.00 TO NODE 266.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 14.36
 RAINFALL INTENSITY (INCH./HOUR) = 3.39
 EFFECTIVE STREAM AREA (ACRES) = 130.34
 TOTAL STREAM AREA (ACRES) = 151.43
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 404.23

 FLOW PROCESS FROM NODE 239.00 TO NODE 266.00 IS CODE = 2

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

DEVELOPMENT IS COMMERCIAL

TC = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)]** .20
 INITIAL SUBAREA FLOW-LENGTH = 400.00
 UPSTREAM ELEVATION = 1181.00
 DOWNSTREAM ELEVATION = 1109.45
 ELEVATION DIFFERENCE = 71.55
 TC = .304 * [(400.00** 3.00) / (71.55)]** .20 = 4.712
 COMPUTED TIME OF CONCENTRATION INCREASED TO 5 MIN.

RAINFALL INTENSITY (INCH/HOUR) = 6.19
 COMMERCIAL SUBAREA LOSS RATE, P (INCH/HR) = .0200
 SUBAREA RUNOFF (CFS) = 4.44
 TOTAL AREA (ACRES) = 30 PEAK FLOW RATE (CFS) = 404.23

 FLOW PROCESS FROM NODE 266.00 TO NODE 268.00 IS CODE = 3

1) ASSUME AN INDEPENDENT STREAM FOR CONFLUENCE
 2) COMPUTE VARIABLE CONFLUENCED STREAM VALUES

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MINUTES) = 5.00
 RAINFALL INTENSITY (INCH/HOUR) = 6.19
 EFFECTIVE STREAM AREA (ACRES) = .80
 TOTAL STREAM AREA (ACRES) = .80
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 4.44

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	404.23	14.36	3.392	.11	130.74
2	4.44	5.00	6.190	.02	.80

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	406.65	131.14
2	265.07	46.17

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE (CFS) = 406.65 TIME (MINUTES) = 14.364
 EFFECTIVE AREA (ACRES) = 131.14
 TOTAL AREA (ACRES) = 152.23

 FLOW PROCESS FROM NODE 268.00 TO NODE 268.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

DEPTH OF FLOW IN 51.0 INCH PIPE IS 39.7 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 34.3
 UPSTREAM NODE ELEVATION = 1109.45
 DOWNSTREAM NODE ELEVATION = 1096.77
 FLOWLENGTH (FEET) = 168.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 51.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 406.65
 TRAVEL TIME (MIN.) = 1.08 TC (MIN.) = 14.45

```

*****
FLOW PROCESS FROM NODE 208.00 TO NODE 208.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
-----
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MINUTES) = 14.45
RAINFALL INTENSITY (INCH./HOUR) = 3.38
EFFECTIVE STREAM AREA(ACRES) = 131.14
TOTAL STREAM AREA(ACRES) = 132.23
PEAK FLOW RATE(CFS) AT CONFLUENCE = 406.65

```

```

*****
FLOW PROCESS FROM NODE 228.00 TO NODE 228.00 IS CODE = 2
-----
RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
-----
DEVELOPMENT IS COMMERCIAL

TC = .304 * [(LENGTH** 3.00)/(ELEVATION CHANGE)** .20]
INITIAL SUBAREA FLOW-LENGTH = 460.00
UPSTREAM ELEVATION = 1128.90
DOWNSTREAM ELEVATION = 1096.77
ELEVATION DIFFERENCE = 32.13
TC = .304 * [( 460.00** 3.00)/(( 32.13)** .20) = 6.014
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.667
SOIL CLASSIFICATION IS "D"
COMMERCIAL SUBAREA LOSS RATE, Fm(INCH/HR) = .0200
SUBAREA RUNOFF(CFS) = 3.56
TOTAL AREA(ACRES) = .70 PEAK FLOW RATE(CFS) = 3.56

```

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*****
FLOW PROCESS FROM NODE 238.00 TO NODE 238.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
-----
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MINUTES) = 6.01
RAINFALL INTENSITY (INCH./HOUR) = 5.67
EFFECTIVE STREAM AREA(ACRES) = .70
TOTAL STREAM AREA(ACRES) = .70
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.56

```

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE(CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA(ACRES)
1	406.65	14.45	3.380	.11	131.14
2	3.56	6.01	5.667	.02	.70

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	408.77	131.84
2	291.17	55.27

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 408.77 TIME (MINUTES) = 14.46
 EFFECTIVE AREA (ACRES) = 131.84
 TOTAL AREA (ACRES) = 152.93

 FLOW PROCESS FROM NODE 238.00 TO NODE 134.00 IS CODE = 0

>>>> COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
 INCLUDING COMPILER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

 DEPTH OF FLOW IN 54.0 INCH PIPE IS 39.9 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 32.4
 UPSTREAM NODE ELEVATION = 1091.90
 DOWNSTREAM NODE ELEVATION = 1090.00
 FLOWLENGTH (FEET) = 30.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 54.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 408.77
 TRAVEL TIME (MIN.) = .02 TC (MIN.) = 14.46

 FLOW PROCESS FROM NODE 238.00 TO NODE 134.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 14.46
 RAINFALL INTENSITY (INCH./HOUR) = 3.38
 EFFECTIVE STREAM AREA (ACRES) = 131.84
 TOTAL STREAM AREA (ACRES) = 152.93
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 408.77

 FLOW PROCESS FROM NODE 127.00 TO NODE 134.00 IS CODE = 7

>>>> USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC (MIN) = 17.20 RAIN INTENSITY (INCH/HOUR) = 3.05
 EFFECTIVE AREA (ACRES) = 56.52
 TOTAL AREA (ACRES) = 58.71 PEAK FLOW RATE (CFS) = 160.78
 AVERAGED LOSS RATE, Fm (IN/HR) = .120


```

*****
FLOW PROCESS FROM NODE 107.00 TO NODE 104.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MINUTES) = 17.00
RAINFALL INTENSITY (INCH./HOUR) = 3.05
EFFECTIVE STREAM AREA(ACRES) = 54.52
TOTAL STREAM AREA(ACRES) = 58.71
PEAK FLOW RATE(CFS) AT CONFLUENCE = 160.78

```

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*****
FLOW PROCESS FROM NODE 225.00 TO NODE 134.00 IS CODE = 1
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE
TC = [L*(LENGTH** 3.00)/(ELEVATION CHANGE)]** .20
INITIAL SUBAREA FLOW-LENGTH = 1100.00
UPSTREAM ELEVATION = 1190.00
DOWNSTREAM ELEVATION = 1090.00
ELEVATION DIFFERENCE = 90.00
TC = .412*(1100.00** 3.00)/(90.00)** .20 = 11.191
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.922
SOIL CLASSIFICATION IS "D"
RESIDENTIAL-> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, Fm(INCH/HR) = .1200
SUBAREA RUNOFF(CFS) = 9.24
TOTAL AREA(ACRES) = 2.70 PEAK FLOW RATE(CFS) = 9.24

```

```

*****
FLOW PROCESS FROM NODE 225.00 TO NODE 134.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
TIME OF CONCENTRATION(MINUTES) = 11.19
RAINFALL INTENSITY (INCH./HOUR) = 3.92
EFFECTIVE STREAM AREA(ACRES) = 2.70
TOTAL STREAM AREA(ACRES) = 2.70
PEAK FLOW RATE(CFS) AT CONFLUENCE = 9.24

```

```

*****
FLOW PROCESS FROM NODE 282.00 TO NODE 282.00 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 8.36 RAIN INTENSITY(INCH/HOUR) = 4.65
EFFECTIVE AREA(ACRES) = 11.70
TOTAL AREA(ACRES) = 11.70 PEAK FLOW RATE(CFS) = 48.72

```

AVERAGE LOSS RATE, T/IN. HR = 0.20

FLOW PROCESS FROM NODE 282.00 TO NODE 134.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.5 INCHES
PIPEFLOW VELOCITY (FEET/SEC.) = 34.3
UPSTREAM NODE ELEVATION = 1142.00
DOWNSTREAM NODE ELEVATION = 1093.00
FLOWLENGTH (FEET) = 170.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES =
PIPEFLOW THRU SUBAREA (CFS) = 48.72
TRAVEL TIME (MIN.) = 108 TD (MIN.) = 5.44

FLOW PROCESS FROM NODE 282.00 TO NODE 134.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 4 ARE:
TIME OF CONCENTRATION (MINUTES) = 8.44
RAINFALL INTENSITY (INCH./HOUR) = 4.62
EFFECTIVE STREAM AREA (ACRES) = 11.70
TOTAL STREAM AREA (ACRES) = 11.70
PEAK FLOW RATE (CFS) AT CONFLUENCE = 48.72

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	408.77	14.46	3.378	.11	131.84
2	160.78	17.20	3.054	.12	56.52
3	9.24	11.19	3.922	.12	2.70
4	48.72	8.44	4.622	.02	11.70

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 4 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	602.35	193.76
2	568.35	202.76
3	555.10	153.21
4	507.34	119.40

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 602.35 TIME (MINUTES) = 14.461
EFFECTIVE AREA (ACRES) = 193.76
TOTAL AREA (ACRES) = 226.04

FLOW PROCESS FROM NODE 134.00 TO NODE 265.00 IS CODE = 3

=====
>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====

DEPTH OF FLOW IN 60.0 INCH PIPE IS 47.1 INCHES
PIPE OR VELOCITY (FEET/SEC.) = 36.4
UPSTREAM NODE ELEVATION = 1090.00
DOWNSTREAM NODE ELEVATION = 1053.10
FLOWLENGTH (FEET) = 540.00 MANNINGS N = 1.015
ESTIMATED PIPE DIAMETER (INCH) = 60.00 NUMBER OF PIPES =
PIPEFLOW THRU SUBAREA (CFS) = 602.35
TRAVEL TIME (MIN.) = .25 TD (MIN.) = 14.71

FLOW PROCESS FROM NODE 265.00 TO NODE 265.00 IS CODE = 1

=====
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION (MINUTES) = 14.71
RAINFALL INTENSITY (INCH./HOUR) = 3.34
EFFECTIVE STREAM AREA (ACRES) = 193.76
TOTAL STREAM AREA (ACRES) = 226.04
PEAK FLOW RATE (CFS) AT CONFLUENCE = 602.35

FLOW PROCESS FROM NODE 134.00 TO NODE 265.00 IS CODE = 2

=====
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====

DEVELOPMENT IS COMMERCIAL

TD = N*(LENGTH** 3.00)/(ELEVATION CHANGE)** .20
INITIAL SUBAREA FLOW-LENGTH = 540.00
UPSTREAM ELEVATION = 1090.00
DOWNSTREAM ELEVATION = 1053.10
ELEVATION DIFFERENCE = 36.90
TD = .304*[(540.00** 3.00)/(36.90)]** .20 = 6.440
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.447
SOIL CLASSIFICATION IS "D"
COMMERCIAL SUBAREA LOSS RATE, Fm (INCH/HR) = .0200
SUBAREA RUNOFF (CFS) = 7.81
TOTAL AREA (ACRES) = 1.60 PEAK FLOW RATE (CFS) = 7.81

FLOW PROCESS FROM NODE 265.00 TO NODE 265.00 IS CODE = 1

=====
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MINUTES) = 6.44
 RAINFALL INTENSITY (INCH./HOUR) = 3.63
 EFFECTIVE STREAM AREA (ACRES) = 1.60
 TOTAL STREAM AREA (ACRES) = 1.60
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 7.81

 FLOW PROCESS FROM NODE 505.00 TO NODE 265.00 IS CODE = 2

 RATIONAL METHOD INITIAL SUBAREA ANALYSIS

 DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL - 3-4 DWELLINGS/ACRE

LE = 1.49 * (LENGTH** 3.00) / (ELEVATION CHANGE)** 1.49
 INITIAL SUBAREA FLOW-LENGTH = 1300.00
 UPSTREAM ELEVATION = 1173.00
 DOWNSTREAM ELEVATION = 1053.10
 ELEVATION DIFFERENCE = 79.90
 TO = 1.49 * (1300.00** 3.00) / (79.90)** 1.49 = 12.669
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.636
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL -> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_a (INCH/HR) = .1200
 SUBAREA RUNOFF (CFS) = 10.44
 TOTAL AREA (ACRES) = 3.30 PEAK FLOW RATE (CFS) = 10.44

 FLOW PROCESS FROM NODE 265.00 TO NODE 265.00 IS CODE = 1

 >>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<<<
 >>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES <<<<<<

 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:

TIME OF CONCENTRATION (MINUTES) = 12.67
 RAINFALL INTENSITY (INCH./HOUR) = 3.64
 EFFECTIVE STREAM AREA (ACRES) = 3.30
 TOTAL STREAM AREA (ACRES) = 3.30
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 10.44

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	F _a (IN/HR)	EFFECTIVE AREA (ACRES)
1	602.35	14.71	3.342	.11	193.76
2	7.81	6.44	3.447	.02	1.60
3	10.44	12.67	3.636	.12	3.30

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 3 STREAMS.

SUMMARY RESULTS:
 STREAM NUMBER CONFLUENCE Q (CFS) EFFECTIVE AREA (ACRES)

```

      431.11      68.12
      581.33      171.80

```

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 616.70 TIME(MINUTES) = 14.708
 EFFECTIVE AREA(ACRES) = 198.66
 TOTAL AREA(ACRES) = 270.94

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*****
FLOW PROCESS FROM NODE 265.00 TO NODE 137.00 IS CODE = 7

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>>>> COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>> USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)

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=====
DEPTH OF FLOW IN 63.0 INCH PIPE IS 51.2 INCHES
PIPEFLOW VELOCITY(FEET/SEC.) = 32.7
UPSTREAM NODE ELEVATION = 1053.10
DOWNSTREAM NODE ELEVATION = 1050.00
FLOWLENGTH( FEET) = 60.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER(INCH) = 63.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA(CFS) = 616.70
TRAVEL TIME(MIN.) = .03 WTC(MIN.) = 14.74

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*****
FLOW PROCESS FROM NODE 137.00 TO NODE 137.00 IS CODE = 1

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```

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

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=====
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MINUTES) = 14.74
RAINFALL INTENSITY (INCH./HOUR) = 3.34
EFFECTIVE STREAM AREA(ACRES) = 198.66
TOTAL STREAM AREA(ACRES) = 230.94
PEAK FLOW RATE(CFS) AT CONFLUENCE = 616.70

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*****
FLOW PROCESS FROM NODE 504.00 TO NODE 504.00 IS CODE = 7

```

```

>>>> USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

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=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 11.29 RAIN INTENSITY(INCH/HOUR) = 3.90
EFFECTIVE AREA(ACRES) = 31.90
TOTAL AREA(ACRES) = 31.90 PEAK FLOW RATE(CFS) = 112.52
AVERAGED LOSS RATE, Fm(IN/HR) = .020

```

```

*****
FLOW PROCESS FROM NODE 504.00 TO NODE 137.00 IS CODE = 3

```

```

>>>> COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<

```

USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)

DEPTH OF FLOW IN 36.0 INCH PIPE IS 27.4 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 19.3
 UPSTREAM NODE ELEVATION = 1053.00
 DOWNSTREAM NODE ELEVATION = 1050.00
 FLOWLENGTH (FEET) = 100.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 36.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 112.52
 TRAVEL TIME (MIN.) = .09 TC (MIN.) = 11.78

 FLOW PROCESS FROM NODE 137.00 TO NODE 137.00 IS CODE = 1

APPROXIMATE INDEPENDENT STREAM FOR CONFLUENCE

CONFLUENCE VALUE USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MINUTES) = 11.38
 RAINFALL INTENSITY (INCH./HOUR) = 3.88
 EFFECTIVE STREAM AREA (ACRES) = 31.90
 TOTAL STREAM AREA (ACRES) = 31.90
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 112.52

 FLOW PROCESS FROM NODE 512.00 TO NODE 512.00 IS CODE = 7

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC (MIN) = 6.85 RAIN INTENSITY (INCH/HOUR) = 5.24
 EFFECTIVE AREA (ACRES) = 14.10
 TOTAL AREA (ACRES) = 14.10 PEAK FLOW RATE (CFS) = 66.20
 AVERAGED LOSS RATE, Fm (IN/HR) = .020

 FLOW PROCESS FROM NODE 512.00 TO NODE 137.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 30.0 INCH PIPE IS 21.7 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 17.4
 UPSTREAM NODE ELEVATION = 1053.00
 DOWNSTREAM NODE ELEVATION = 1050.00
 FLOWLENGTH (FEET) = 75.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 30.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 66.20
 TRAVEL TIME (MIN.) = .07 TC (MIN.) = 6.92

 FLOW PROCESS FROM NODE 137.00 TO NODE 137.00 IS CODE = 1

DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE
AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
TIME OF CONCENTRATION (MINUTES) = 6.92
RAINFALL INTENSITY (INCH./HOUR) = 5.20
EFFECTIVE STREAM AREA (ACRES) = 14.10
TOTAL STREAM AREA (ACRES) = 14.10
PEAK FLOW RATE (CFS) AT CONFLUENCE = 66.20

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	613.70	14.74	3.353	.00	96.66
2	112.52	11.08	3.825	.02	21.76
3	66.20	6.92	5.198	.02	14.10

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 3 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	755.70	244.66
2	718.49	199.34
3	614.25	126.81

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 755.70 TIME (MINUTES) = 14.739
EFFECTIVE AREA (ACRES) = 244.66
TOTAL AREA (ACRES) = 276.94

FLOW PROCESS FROM NODE 137.00 TO NODE 138.00 IS CODE = 0

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

DEPTH OF FLOW IN 66.0 INCH PIPE IS 49.1 INCHES
PIPEFLOW VELOCITY (FEET/SEC.) = 39.9
UPSTREAM NODE ELEVATION = 1050.00
DOWNSTREAM NODE ELEVATION = 1020.00
FLOWLENGTH (FEET) = 410.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER (INCH) = 66.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA (CFS) = 755.70
TRAVEL TIME (MIN.) = .17 TC (MIN.) = 14.91

FLOW PROCESS FROM NODE 138.00 TO NODE 138.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MINUTES) = 14.91
 RAINFALL INTENSITY (INCH./HOUR) = 3.31
 EFFECTIVE STREAM AREA (ACRES) = 244.64
 TOTAL STREAM AREA (ACRES) = 276.74
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 755.70

 FLOW PROCESS FROM NODE 245.00 TO NODE 138.00 IS CODE = 1

=====
 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
 =====

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]** .20
 INITIAL SUBAREA FLOW-LENGTH = 440.00
 UPSTREAM ELEVATION = 1053.10
 DOWNSTREAM ELEVATION = 1000.00
 ELEVATION DIFFERENCE = 53.10
 TC = .412*[(440.00** 3.00)/(53.10)]** .20 = 8.102
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.722
 SOIL CLASSIFICATION IS "D"
 RESIDENTIAL-> 3-4 DWELLINGS/ACRE SUBAREA LOSS RATE, F_a (INCH/HR) = .1200
 SUBAREA RUNOFF (CFS) = 3.31
 TOTAL AREA (ACRES) = .80 PEAK FLOW RATE (CFS) = 3.31

 FLOW PROCESS FROM NODE 138.00 TO NODE 138.00 IS CODE = 1

=====
 >>>>DESTINATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
 =====

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MINUTES) = 8.10
 RAINFALL INTENSITY (INCH./HOUR) = 4.72
 EFFECTIVE STREAM AREA (ACRES) = .80
 TOTAL STREAM AREA (ACRES) = .80
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 3.31

 FLOW PROCESS FROM NODE 137.00 TO NODE 139.00 IS CODE = 1

=====
 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
 =====

DEVELOPMENT IS SINGLE FAMILY RESIDENTIAL -> 3-4 DWELLINGS/ACRE

TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]** .20
 INITIAL SUBAREA FLOW-LENGTH = 410.00
 UPSTREAM ELEVATION = 1050.00
 DOWNSTREAM ELEVATION = 1020.00
 ELEVATION DIFFERENCE = 30.00
 TC = .412*[(410.00** 3.00)/(30.00)]** .20 = 7.712
 100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.837

TITLE CLASSIFICATION IS "B"
 RESIDENTIAL-1 3-4 DWELLINGS/ACRE SUBAREA USE RATE, P6 INCH PIPE
 SUBAREA RUNOFF(CFS) = 7.22
 TOTAL AREA(ACRES) = 1.70 PEAK FLOW RATE(CFS) = 7.22

 FLOW PROCESS FROM NODE 138.00 TO NODE 138.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<<
 >>>> AND COMPUTE VARIOUS CONFLUENCE STREAM VALUES <<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
 TIME OF CONCENTRATION(MINUTES) = 7.71
 RAINFALL INTENSITY (INCH./HOUR) = 4.84
 EFFECTIVE STREAM AREA(ACRES) = 1.70
 TOTAL STREAM AREA(ACRES) = 1.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.22

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE(CFS)	TIME (MIN.)	INTENSITY (INCH./HOUR)	FM (IN/HR)	EFFECTIVE AREA(ACRES)
1	755.70	14.91	3.313	.09	244.66
2	3.31	3.10	4.722	.12	.80
3	7.22	7.71	4.837	.12	1.70

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 3 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q(CFS)	EFFECTIVE AREA(ACRES)
1	762.89	247.16
2	600.43	135.44
3	536.10	129.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 762.89 TIME(MINUTES) = 14.910
 EFFECTIVE AREA(ACRES) = 247.16
 TOTAL AREA(ACRES) = 279.44

 FLOW PROCESS FROM NODE 138.00 TO NODE 139.00 IS CODE = 3

>>>> COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA <<<<<
 >>>> USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<

DEPTH OF FLOW IN 84.0 INCH PIPE IS 63.2 INCHES
 PIPEFLOW VELOCITY(FEET/SEC.) = 24.5
 UPSTREAM NODE ELEVATION = 1020.00
 DOWNSTREAM NODE ELEVATION = 1016.60
 FLOWLENGTH(FEET) = 170.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER(INCH) = 84.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA(CFS) = 762.89

TRAVEL TIME(MIN.) = .17 TC(MIN.) = 15.03

FLOW PROCESS FROM NODE 139.00 TO NODE 139.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MINUTES) = 15.03
RAINFALL INTENSITY (INCH./HOUR) = 3.30
EFFECTIVE STREAM AREA(ACRES) = 247.16
TOTAL STREAM AREA(ACRES) = 279.44
PEAK FLOW RATE(CFS) AT CONFLUENCE = 762.37

FLOW PROCESS FROM NODE 603.00 TO NODE 603.00 IS CODE = 7

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<

USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 9.47 RAIN INTENSITY(INCH/HOUR) = 4.32
EFFECTIVE AREA(ACRES) = 6.40
TOTAL AREA(ACRES) = 6.40 PEAK FLOW RATE(CFS) = 24.76
AVERAGED LOSS RATE, Fm(IN/HR) = .020

FLOW PROCESS FROM NODE 603.00 TO NODE 139.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.6 INCHES
PIPEFLOW VELOCITY(Feet/Sec.) = 17.3
UPSTREAM NODE ELEVATION = 1022.80
DOWNSTREAM NODE ELEVATION = 1016.60
FLOWLENGTH(Feet) = 80.00 MANNINGS N = .013
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPEFLOW THRU SUBAREA(CFS) = 24.76
TRAVEL TIME(MIN.) = .08 TC(MIN.) = 9.55

FLOW PROCESS FROM NODE 139.00 TO NODE 139.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MINUTES) = 9.55
RAINFALL INTENSITY (INCH./HOUR) = 4.29
EFFECTIVE STREAM AREA(ACRES) = 6.40
TOTAL STREAM AREA(ACRES) = 6.40

PEAK FLOW RATE (CFS) AT CONFLUENCE = 24.76

CONFLUENCE INFORMATION:

STREAM NUMBER	PEAK FLOW RATE (CFS)	TIME (MIN.)	INTENSITY (INCH/HOUR)	FM (IN/HR)	EFFECTIVE AREA (ACRES)
1	762.89	15.03	3.297	.05	247.16
2	24.76	9.53	4.294	.02	6.40

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS.

SUMMARY RESULTS:

STREAM NUMBER	CONFLUENCE Q (CFS)	EFFECTIVE AREA (ACRES)
1	781.87	253.56
2	640.12	163.44

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 781.87 TIME (MINUTES) = 15.03
 EFFECTIVE AREA (ACRES) = 253.56
 TOTAL AREA (ACRES) = 285.84

 FLOW PROCESS FROM NODE 139.00 TO NODE 140.00 IS CODE = 3

>>>>COMPUTE PIPEFLOW TRAVELTIME THRU SUBAREA<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESURE FLOW)<<<<

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DEPTH OF FLOW IN 69.0 INCH PIPE IS 51.9 INCHES
 PIPEFLOW VELOCITY (FEET/SEC.) = 37.3
 UPSTREAM NODE ELEVATION = 1016.60
 DOWNSTREAM NODE ELEVATION = 1010.00
 FLOWLENGTH (FEET) = 110.00 MANNINGS N = .013
 ESTIMATED PIPE DIAMETER (INCH) = 69.00 NUMBER OF PIPES = 1
 PIPEFLOW THRU SUBAREA (CFS) = 781.87
 TRAVEL TIME (MIN.) = .05 TC (MIN.) = 15.07

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END OF STUDY SUMMARY:
 TOTAL AREA (ACRES) = 285.84
 EFFECTIVE AREA (ACRES) = 253.56
 PEAK FLOW RATE (CFS) = 781.87

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END OF RATIONAL METHOD ANALYSIS




**REFERENCE PORTOLA HILLS RETARDING
STUDY BY J.P. KAPP & ASSOCIATES, INC.**

PORTOLA HILLS RETARDING BASIN

Project of the Year Entry
(Engineering: Public Works category)

California Council
of **Civil Engineers**
& **Land Surveyors**

J.R KAPP & ASSOCIATES, INC.		
		
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J.P. KAPP	R.C.E. 22015	DATE

November 1989

PORTOLA HILLS RETARDING BASIN
PROJECT OF THE YEAR

The Baldwin Company Portola Hills Planned Community is located on 1,000 acres of land in the foothills of Orange County near Cooks Corner (junction of El Toro Road, Santiago Canyon Road and Live Oak Canyon Road). In its natural state, the site consisted of rolling hills covered in chaparral, several canyons with oak groves and bounded by Serrano Creek on the west and Aliso Creek on the east. Upon buildout, the community will contain 2,200 dwelling units, numerous recreational and municipal facilities (fire station, elementary school, etc.) and a commercial/industrial park.

The conditions of approval of the Area Plan required the preparation of a Runoff Management Plan meeting the following criteria:

"The objective of this plan is to ensure that the quality of runoff water into Serrano and Aliso Creeks is acceptable and peak runoff rates from the project during 10, 25 and 100 year flood conditions during and after development will be no greater than those currently experienced under natural condition."

During the development of the Runoff Management Plan this condition was further clarified by the agency staff to include:

- Developed peak flows to be limited to approximately 90% of peak runoff under natural conditions. This level was set to ameliorate the effects of higher flows for longer time periods during each design storm.
- An additional 10% storage volume in the basin between the calculated 100 year flood level and the emergency spillway elevation. The intent of this criteria was to provide a measure of safety for more significant storm events.
- The sediment bed load after development was to pass downstream rather than be collected by the basin. This requirement was imposed to reduce "clear water" erosion of downstream natural banks.

Thus was formulated the design criteria addressing the unique character of the project's Area Plan condition and its related environmental impacts.

A tentative basin volume for each design storm was determined using traditional hydrograph methods and a preliminary grading design prepared for the chosen site located adjacent to the southern property boundary. To meet the peak flow limits for the multiple design storms, the use of a riser with discharge orifices at various levels was chosen as the approach. This method implied the

need for "flow-thru" analysis of the basin which appeared to preclude the sediment transport required by the agency staff.

Consultation with Hasan Nouri, of Rivertech Inc. (a noted expert in the field of sediment transport), resulted in the decision to utilize a device he had developed ("Diversion Structure For Peak Flow Reduction" by Hasan Nouri, Proceedings of Computational Hydrology, 87"). This diversion structure allows sediment bed load to pass through the basin while "clear water" exits the structure through slots into the basin for storage. After the peak has passed, the basin then drains dry through the same slots.

To accommodate the diversion structure, the riser was redesigned to begin with a below ground restrictive orifice to limit water flow and accommodate the transportation of sediment bed load. This revised the basin calculations to a "flow-thru" analysis with no storage in early stages (when the water level is below the basin floor), a traditional approach with discharge varying with hydraulic head for a 10 year storm (up to second orifice level) and a revised approach considering the action of both orifices under differing hydraulic pressures for greater storm events. The use of hand calculations and computer simulation enabled the solution of this complex problem. After numerous revisions to the basin grading to accommodate the need for specific storage volumes associated with the required discharge rates, the system design was complete.

A comparison of the final results with the design criteria for peak flows is summarized below:

<u>Design Storm (Year)</u>	<u>Existing Peak Flow (c.f.s.)</u>	<u>Target Peak Flow (90% of Existing) (c.f.s.)</u>	<u>Actual Design Peak Flow (c.f.s.)</u>	<u>Percent of Existing (%)</u>
10	171	154	151	88
25	217	195	195	90
100	287	258	264	92

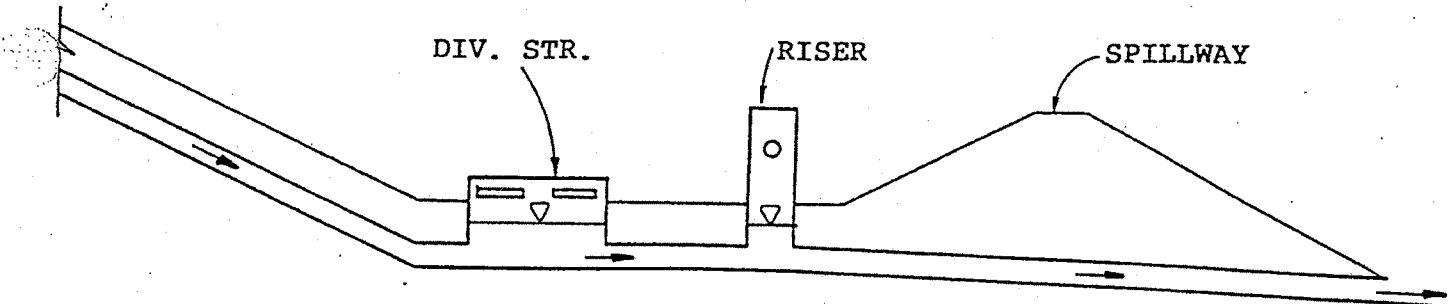
These results are in substantial conformance with the goal of reducing peak flows to approximately 90% of existing flows.

An evaluation of the storage capacity of the basin indicates 21.9 acre-feet at the 100 year flood elevation with approximately 2.4 acre-feet (10%) of available volume before the spillway elevation is reached. This provides the added margin of safety required for major storm events.

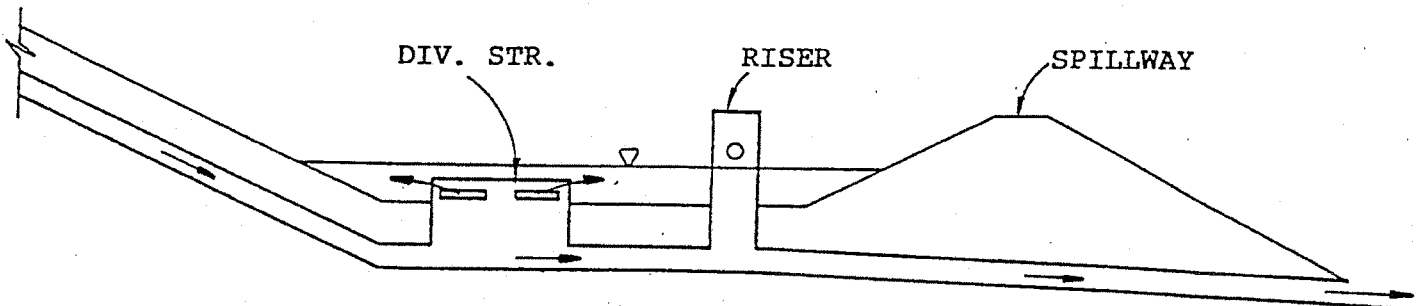
The diversion structure provides a simple, effective method for allowing sediment transport while meeting the other design criteria of reducing peak flows.

In summary, this basin design meets the three major design criteria (peak flow reduction, additional storage, sediment transport) using a combination of components that function effectively in satisfying the variety of conditions and criteria applicable to this basin.

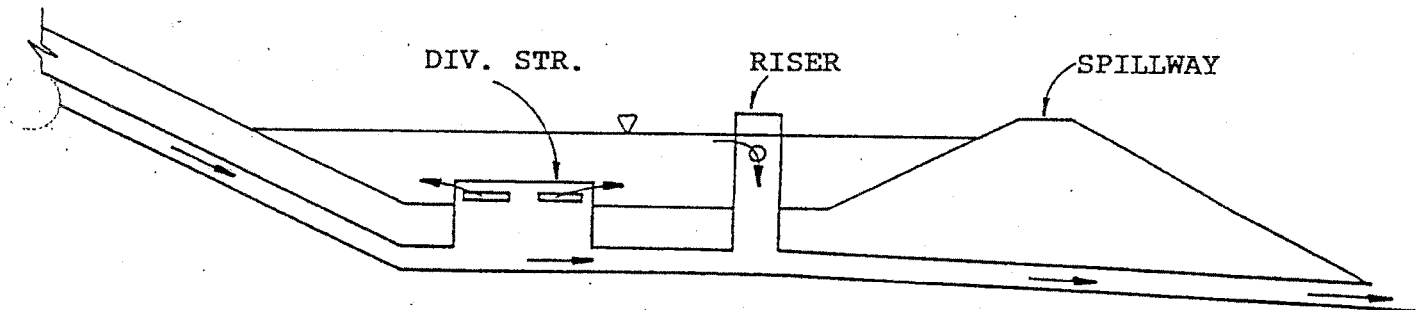
PORTOLA HILLS RETARDING BASIN



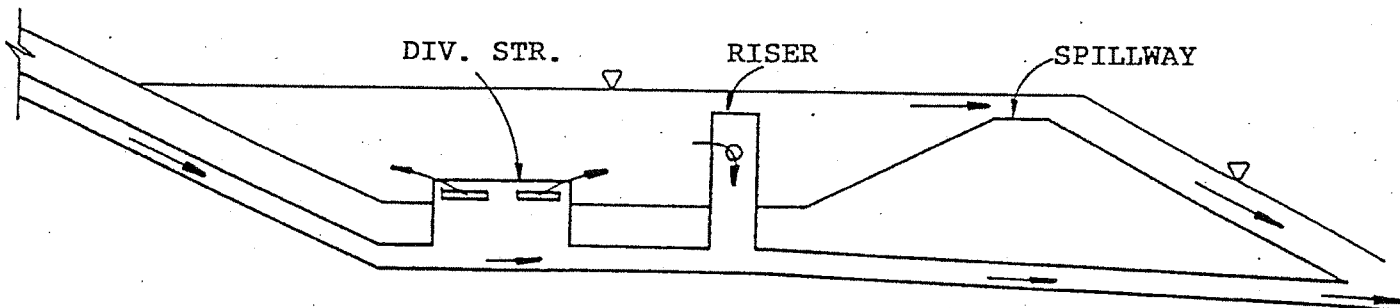
ONE YEAR STORM - LOW FLOW - SINGLE ORIFICE - NO STORAGE



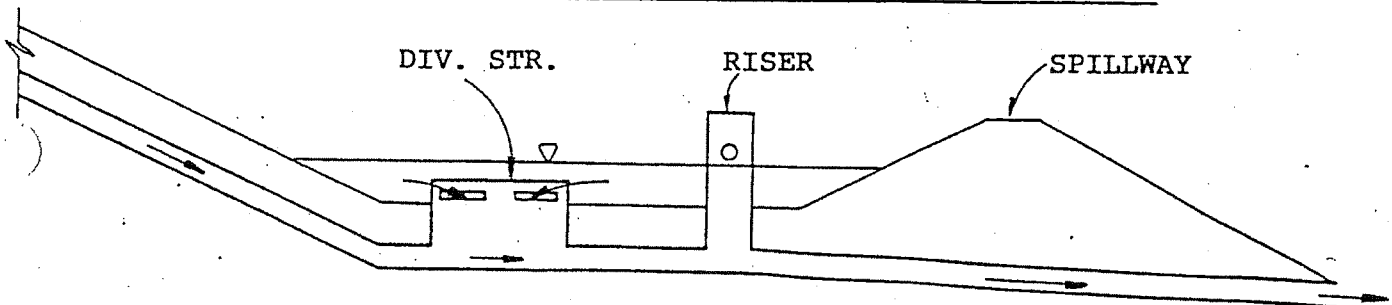
TEN YEAR STORM - LOW FLOW - SINGLE ORIFICE - LIMITED STORAGE



25 & 100 YEAR STORM - MEDIUM FLOW - DOUBLE ORIFICE - HIGH STORAGE



500 YEAR STORM - HIGH FLOW - SPILLWAY FLOW - FULL STORAGE



POST STORM FLOW - DRAIN INTO DIVERSION STRUCTURE - NO STORAGE