# CEQA PRELIMINARY HYDROLOGY/DRAINAGE STUDY

# Hawano Subdivision

## 3100 5566 (TM)
## Environmental Log No. 93-19-006OO

June 2012

***Prepared for:***
Paragon Management Company
4225 Executive Square
Suite 920
La Jolla, CA 92037

***Prepared by:***
Kimley-Horn and Associates, Inc.
401 B Street, Suite 600
San Diego, CA 92101

KHA No. 095765000

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## DECLARATION OF RESPONSIBLE CHARGE

I, hereby declare that I am the Civil Engineer of Work for this project. That I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

Matthew Barlow R.C.E. 62906 — 9/27/12 Date

REGISTERED PROFESSIONAL ENGINEER
MATTHEW BARLOW
No. C62906
Exp 6/14
CIVIL
STATE OF CALIFORNIA

Kimley-Horn and Associates, Inc.

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# 1.0 Introduction

The proposed project involves the development of 79.6 acres in the East Otay Mesa area of San Diego. The project site is located southwest of the future intersection of Alta Road and Airway Road and immediately north of the U.S./Mexico border. The site involves the mass grading of approximately 23 "industrial" pads, half width improvements of Alta Road fronting the project, and extending Siempre Viva Road and Airway Road approximately 1200' to the west.

# 2.0 Existing Drainage Conditions

The existing site has three main drainage inflow points to the north along Airway Road. The total tributary area contributing runoff flows is 170 Ac., approximately 80 Ac. of this area is within the project boundary and conveyed through natural swales across the site, then passes into Mexico via six 7' wide by 4' high box culverts. A portion of this flow outflows near the eastern boundary of the property along Alta Road, but eventually confluences into the same box culvert at the border. Sheet flow from the western property boundary also accounts for a small portion of the total contributing runoff. Please see **Exhibit B** for the delineation of existing drainage basins and existing drainage flow paths.

The site currently consists of open fields with medium vegetation and was previously used for agricultural purposes. Existing runoff is currently conveyed in a series of existing drainage swales in a natural flow condition across the site and eventually into an existing drainage channel described above just south of the site. Per the County of San Diego Hydrology Manual, June 2003 the soil classification for the site is Soil Type D. For modeling purposes an existing runoff coefficient of 0.35 was assumed.

# 3.0 Proposed Drainage Conditions

The proposed project will provide three locations to pick up offsite flows from the north. These locations are denoted as Node 1000, 1010, and 1020 on **Exhibit C-Proposed Condition Drainage Exhibit.** These flows will be conveyed in an underground drainage system in Airway Road, Siempre Viva Road, and Alta Road. This underground drainage system has been provided to bypass offsite flows through the proposed site separating proposed onsite flows from the offsite runoff.

The portion of the bypass drainage system in Alta Road has been upsized to convey an additional flow of 91.5 cfs, which are anticipated 100 yr. offsite flows from the Otay Business Park TM 5505. The 100 year design flow at the bypass system outlet is 186.7 cfs, including the Otay Business Park flows. The proposed 4'x6' box culvert at the outlet has a normal flow capacity of 277.9 cfs and can easily convey the existing offsite flows. An analysis of the bypass system can be found in Appendix C.

Curb inlets and desilt basins will be used to capture onsite flows. A series of underground drainage systems will be provided to route flows to a detention basin located at the southeast corner of the project. The detention basin will be used to detain the developed flows back to existing conditions. The detained flows will be released offsite to the south maintaining the original drainage flow path and avoiding diversion of flows.

Please refer to **Exhibit C** for the proposed drainage system design.

One detention basin has been proposed for this project. It has been sized to detain the 10, 50, and 100-year storm events, and to mitigate the proposed discharge not to exceed the existing condition discharge. The proposed discharge from the site will be significantly less than the existing condition discharge to meet hydromodification criteria. A hydromodification analysis has been prepared in a separate report. Please refer to Table 4.3 for a table comparing the pre-development and post-development discharge. This information is also reflected on the proposed condition drainage exhibit in Exhibit C.

# 4.0 Design Criteria and Methodology

Runoff calculations are based on the requirements in the County of San Diego's Hydrology Manual and Drainage Design Manual (June 2003). The proposed storm drain system will be sized for the 100 year storm.

Runoff calculations for the 10, 50, and 100 year storms were performed using the Rational Method Computer Program Package (AES). The method calculates times of concentration and runoff volumes using criteria specified in the County of San Diego's Hydrology Manual (June 2003). The existing conditions and proposed conditions hydrology were analyzed and the results of the 100 year storm are presented in **Appendix B.** In addition, the existing and proposed 2 and 5 year storm flows tributary to the project limits_are shown in **Table 4.1** and have also been included in **Appendix B** per the request of the County of San Diego Biological Resources. It should be noted, that it is not a requirement to detain the 2 and 5 year storm events. These flow rates are purely provided to support the request of Biological Resources. Drainage maps are presented in the map pockets of this report.

Table 4.1 – Biological Resources 2 and 5 Year Storm Events

| Flow | Detention Basin |
|---|---|
| 2 Year Existing Q (cfs) | 23.7 |
| 2 Year Proposed Q (cfs) | 139.46 |
| 5 Year Existing Q (cfs) | 32.0 |
| 5 Year Proposed Q (cfs) | 196.24 |

### *Detention Basin Analysis and Sizing*

There is one detention basin that will be constructed with this project. The detention basin has been designed to meet the County of San Diego Hydromodification requirements. The hydromodifcation analysis has been provided in a separate document entitled "Hydromodification

Management Plan for Hawano Subdivision". Please see the "Hydromodification Management Plan for Hawano Subdivision" for the hydromodification analysis. The detention basins have also been analyzed to verify that they detain 10, 50, and 100 year rain providing a minimum of 1 foot of freeboard above the 100 year water surface elevation. The Detention Basin is located at the southeast corner of the project and receives onsite flows from the entire project site. The onsite area tributary is approximately 86.3 acres. All offsite flows from the north are being conveyed in a separate underground drainage system from the proposed onsite flows. The offsite flows conveyed in the separate drainage system will be discharged in a location consistent with the existing drainage path. The proposed drainage system has been designed to avoid diversion of flows. For this reason offsite flows will not be routed through the detention basins.

The existing conditions hydrologic analysis calculated a peak existing onsite runoff of 61.9 cfs for the 100 year storm. The total combined existing flow (cumulative flows from Nodes 107 and 105, including offsite flows) is 181.3 cfs for the 100 year storm.

In pre-development conditions, existing topography conveys all offsite and onsite flow to a single discharge location near the southeast corner of the project boundary into the existing box culvert previously discussed. The post-development condition proposes the same single concentrated discharge point for both the onsite and offsite flow.

Hydrographs for the proposed project runoff were generated using the RatHydro computer program that generates a hydrograph based on rational method hydrology data. The 100 year inputs into the RatHydro program are listed in **Table 4.2** below.

Table 4.2 – RatHydro Inputs

| Data | Detention Basin |
|---|---|
| 6 Hour Precipitation (in) | 3.0 |
| Time of Concentration (min.) | 7.5 |
| Peak Flow Rate (cfs) | 408.1 |
| Area (acres) | 86.3 |
| Runoff Coefficient | 0.81 |

The Hydrograph ordinates were input into the Hydraflow Hydrographs program by Intellisolve. This program performs the stage/storage/discharge calculations for various types of outlet structures. The Hydrograph ordinates and output from RatHydro are presented in **Appendix** D.

The detention basin will have an outlet that consists of a low flow, intermediate orifice and weir and an emergency spillway capable of passing the 100 year peak in-flow into the basin. The detention basin will detain the 100 year storm and reduce the peak outflow to the existing conditions flow rate.

**Table 4.3** below shows the results of the detention analysis. Details of the Hydraflow output including the stage/storage/discharge table are located in **Appendix** D.

| Table 4.3 – Detention Analysis Summary Table For / 100-Year Storm | | | | | | |
|---|---|---|---|---|---|---|
| | C | Tc (min.) | I (in/hr) | A (Ac.) | Q (cfs) | V (fps) |
| Prop. Condition inflow Q (cfs) | 0.81 | 7.5 | 5.9 | 86.3 | 408.1 | NA |
| Prop. Condition outflow Q (cfs) | 0.81 | 312* | NA | 86.3 | 46.9 | 6 |
| Ex. Condition Q (cfs) | 0.35 | 40.5 | 2.05 | 86.3 | 61.9 | 3.3 |

Note: Values provided in this table are based on hydrology limited to the project area and do not include offsite flows. Offsite flows bypass the detention basin.
*Time to Peak

**Table 4.4 and 4.5** below present the stage/storage/discharge results for the Detention Basin.

| Table 4.4 – Detention Basin | | | | |
|---|---|---|---|---|
| Storm Event | Max Stage (ft) | Max Storage (acre-feet) | Discharge (cfs) | Ex. Q (CFS) |
| Peak Outflow 100-Year | 9.3 | 15.4 | 46.9 | 61.9 |

The Detention Basin will have a top of embankment 10.1 feet above the bottom of the basin. The total volume of the basin to the top of the embankment is 15.4 acre-feet. The maximum 100 year stage in the basin is 9.1 feet. This will provide a freeboard of 1.0 foot above the 100 year water surface to the top of embankment. The basin will have a footprint of approximately 2.5 acres. The Detention Basin will produce a 100-year peak outflow of 46.9 cfs. An emergency spillway has been provided to safely convey flows in excess of the 100 year storm event.

### *Offsite Ponding*

Offsite ponding at offsite inlets have been reviewed for the 100 year storm. Ponding limits for the 100 year storm were determined using CulvertMaster. Calculations for the headwater elevations at the offsite inlet have been provided in **Appendix E** of this report. An exhibit showing the 100 year inundation limits and APN numbers of the offsite owners has been also been provided as **Exhibit D.**

## ***Erosion***

A Rip Rap dissipater will be provided at the outlet point. The Rip Rap Dissipater will be provided to mitigate the impacts of erosion at the outlet. Rip Rap will be sized and placed in accordance to Section 7 of the San Diego County Drainage Manual dated July 2005 and in accordance to standard detail D-40 of the San Diego Regional Standard Drawings. Preliminary Rip Rap Sizes can be found in Appendix ~~E~~F. All Rip Rap was sized assuming outlet pipes were designed at minimum slope of 0.5%. Rip Rap will need to be re-designed during final design to accommodate velocities from the actual designed slope of pipe.

## 5.0 Conclusion

The proposed Hawano Subdivision storm drain system has been designed in accordance to the County of San Diego Drainage Manual dated July 2005 and the County of San Diego Hydrology Manual dated 2003. The drainage system has been designed to convey the 100 year offsite flows. The drainage system has been designed to maintain the existing drainage patterns and will not substantially alter the course of runoff through the site. Rip Rap will be provided at culvert outlets during final design to minimize the effects of erosion.

As discussed above the detention basin has been designed to detain the peak 10, 50, and 100 year storm events back to existing conditions and to meet the County of San Diego Hydromodification Requirements. The hydromodification analysis is included in a separate document entitled "Interim Hydromodification Management Plan for Hawano Subdivision". Hydromodification controlled the design of the detention basin and based on the parameters set by hydromodification, the detention basin is oversized for the 10, 50, and 100 year storms. The detention basin will detain the peak 10, 50, and 100 year storm events back to existing conditions therefore the proposed improvements will not increase runoff.

Offsite ponding is a result of inlet control for water entering concrete pipe culverts. Limits of inundation for the 100 year storm have been shown in **Exhibit D**. The concrete pipe culverts have been designed to provide a minimum of 1' of freeboard below right of way elevations. Offsite ponding is a temporary condition and would be eliminated/modified as the future lots are developed and storm drain systems are designed to tie into the provided culverts.

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# EXHIBITS

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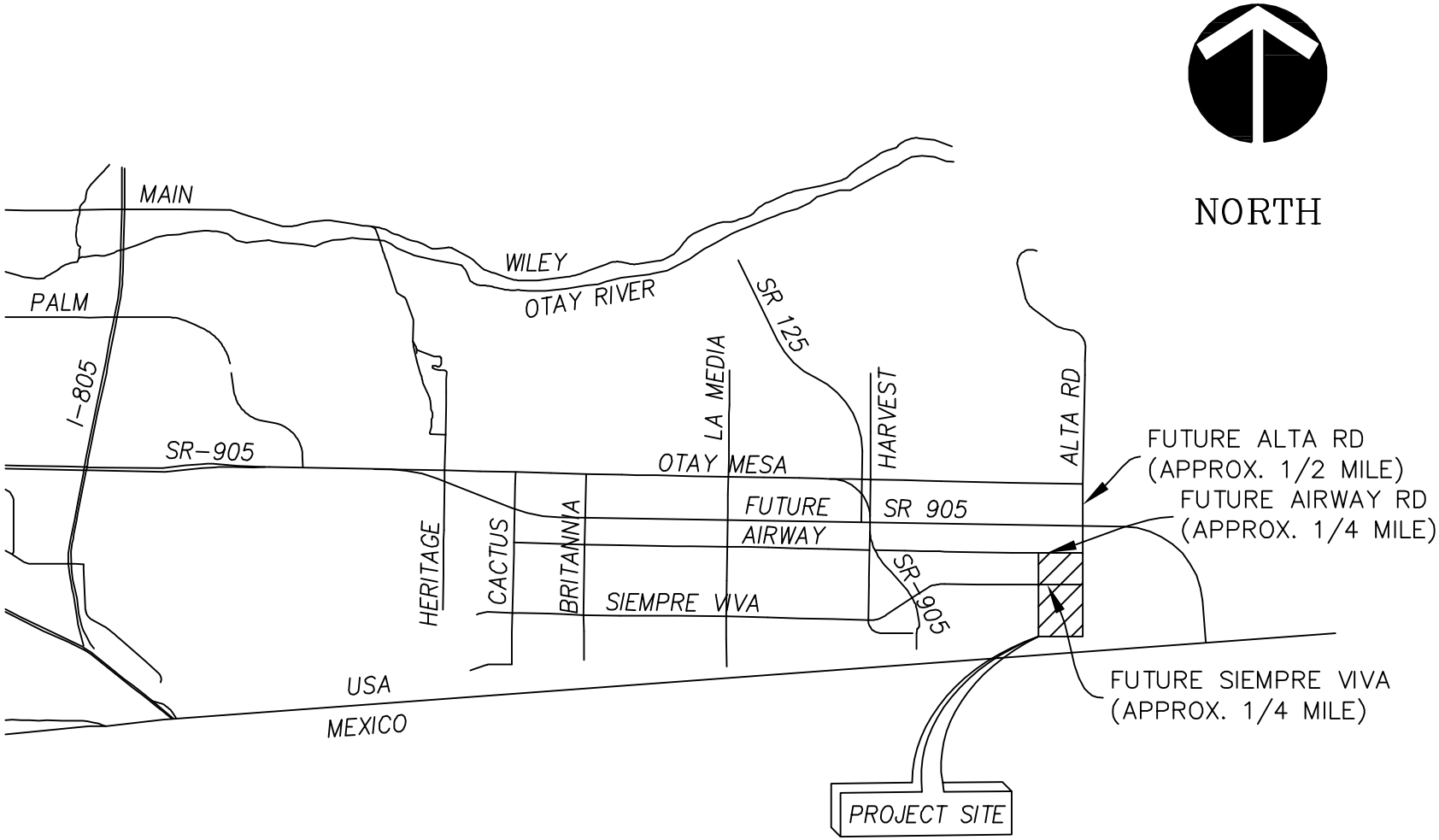
**Exhibit A ~ Vicinity Map**




VICINITY MAP

NOT TO SCALE

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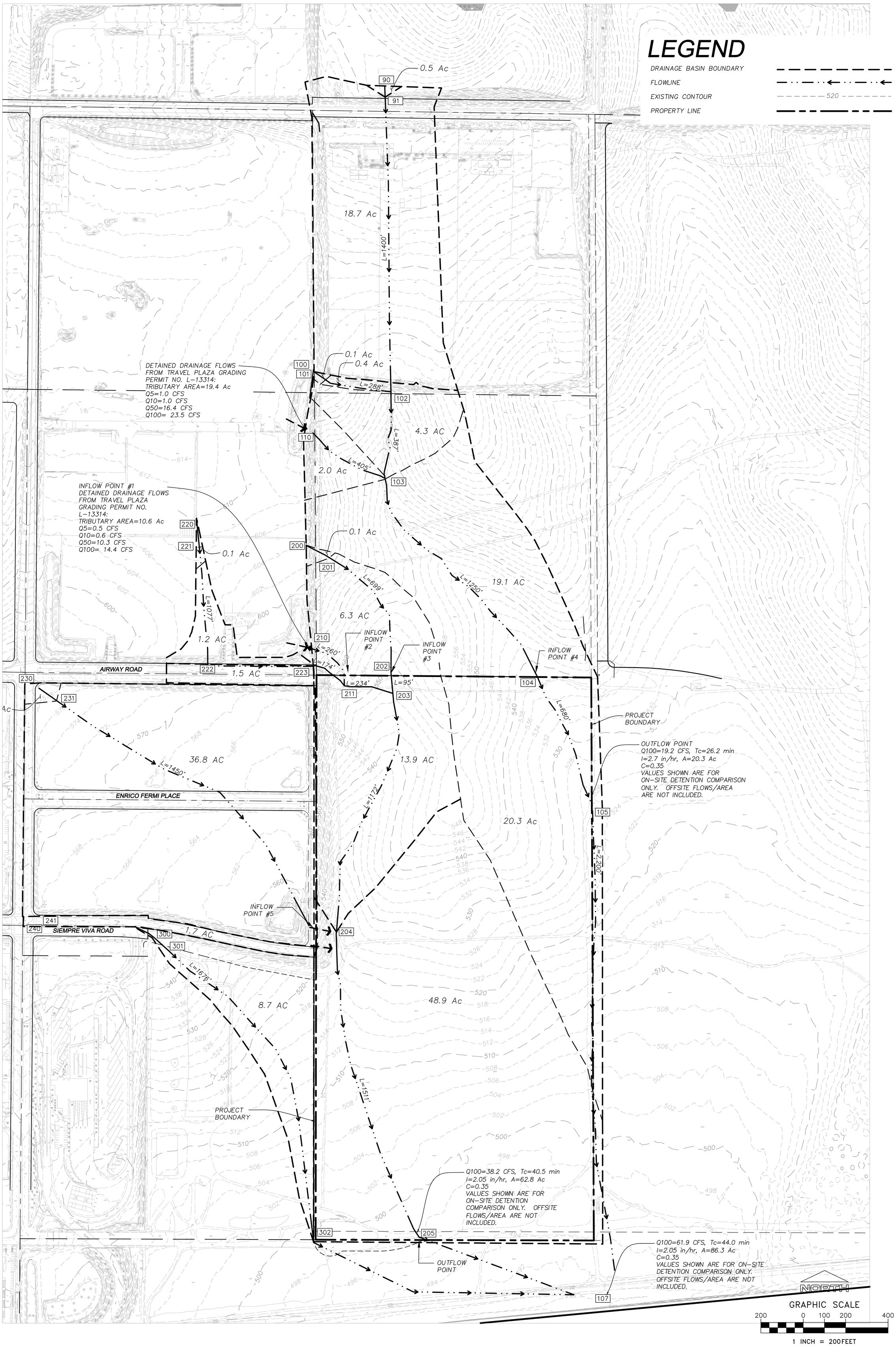
**Exhibit B ~ Existing Condition Drainage Exhibit**




Kimley-Horn and Associates, Inc.

November 30, 2011

HAWANO SUBDIVISION

# EXISTING DRAINAGE EXHIBIT

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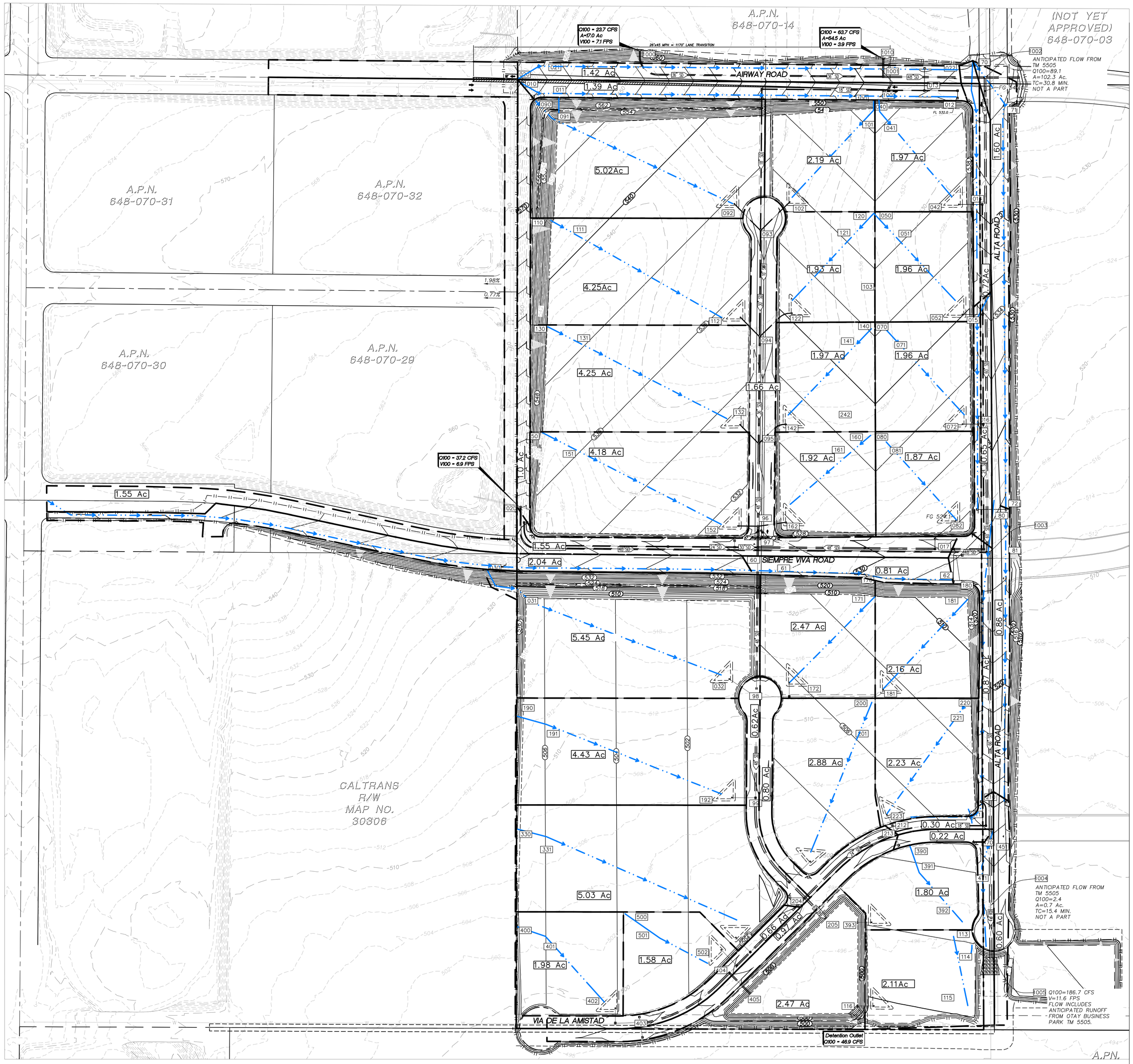
**Exhibit C ~ Proposed Condition Drainage Exhibit**




## LEGEND

- DRAINAGE BASIN BOUNDARY
- FLOWLINE
- EXISTING CONTOUR
- PROPERTY LINE

NORTH

GRAPHIC SCALE

100 0 50 100 200

1 INCH = 100FEET

| 100 YR. DETENTION SUMMARY TABLE FOR ONSITE RUNOFF | | | | | | |
|---|---|---|---|---|---|---|
| | C | Tc (MIN.) | I (IN/HR) | A (Ac.) | Q (CFS) | V (FPS) |
| EX. CONDITIONS | 0.35 | 44 | 2.1 | 86.3 | 61.9 | 3.3 |
| POST DEVELOPMENT | 0.81 | 312* | 5.9 | 86.3 | 46.9# | 6.0 |

NOTE: DATA PROVIDED IN THE TABLE ABOVE IS FOR ON-SITE DETENTION. OFFSITE FLOWS ARE NOT INCLUDED AS THE FLOWS BYPASS THE SITE IN A SEPERATE UNDERGROUND DRAINAGE SYSTEM.
*TIME TO PEAK
#DETAINED 100 YR. FLOWS

Kimley-Horn and Associates, Inc.

JUNE 2012

HAWANO SUBDIVISION

# PROPOSED DRAINAGE EXHIBIT

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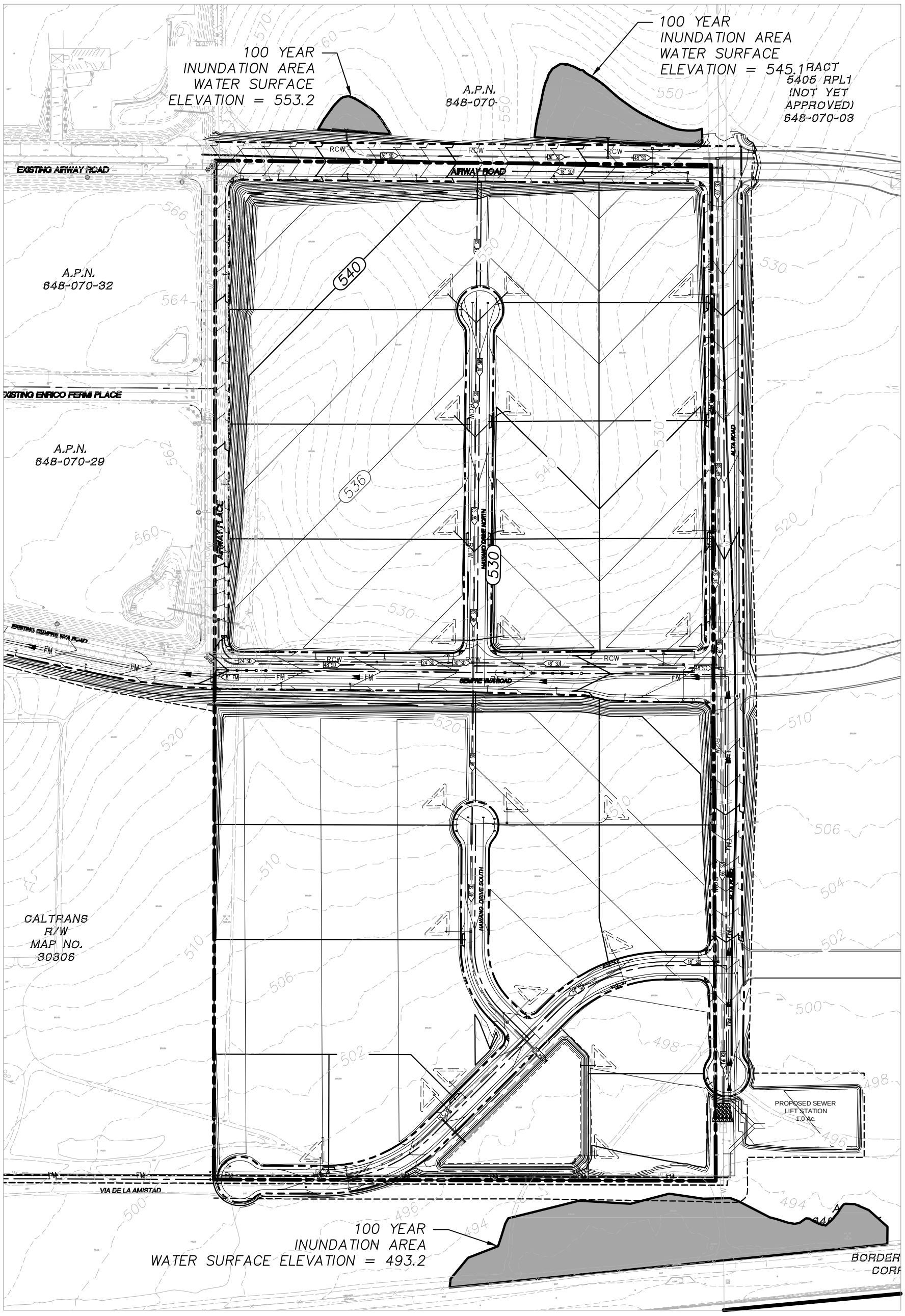
**Exhibit D ~ Inundation Exhibit**




LEGEND

SUBDIVISION BOUNDARY

INUNDATION AREA

NORTH

NTS

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June 2012

INUNDATION EXHIBIT

HAWANO SUBDIVISION

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# APPENDICES

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**Appendix A ~ Hydrology Reference Material**

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length ($L_M$)) of sheet flow to be used in hydrology studies. Initial $T_i$ values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

**Table 3-2**

**MAXIMUM OVERLAND FLOW LENGTH ($L_M$) & INITIAL TIME OF CONCENTRATION ($T_i$)**

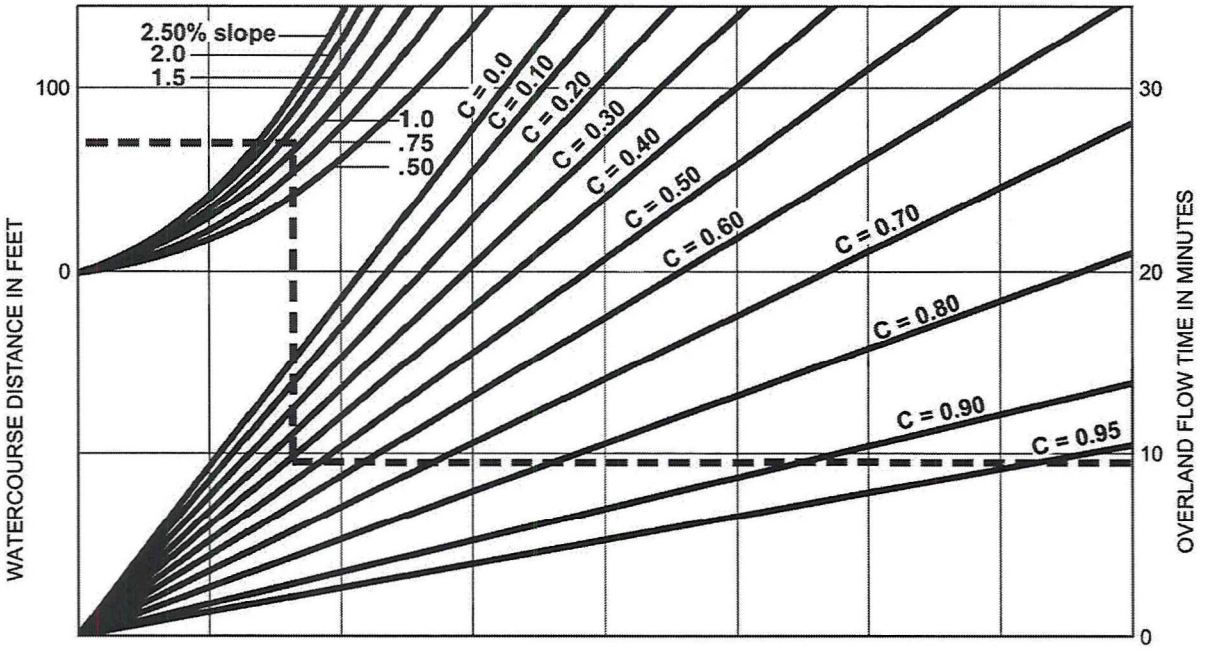
| Element* | DU/ | .5% | | 1% | | 2% | | 3% | | 5% | | 10% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acre | $L_M$ | $T_i$ | $L_M$ | $T_i$ | $L_M$ | $T_i$ | $L_M$ | $T_i$ | $L_M$ | $T_i$ | $L_M$ | $T_i$ |
| Natural | | 50 | 13.2 | 70 | 12.5 | 85 | 10.9 | 100 | 10.3 | 100 | 8.7 | 100 | 6.9 |
| LDR | 1 | 50 | 12.2 | 70 | 11.5 | 85 | 10.0 | 100 | 9.5 | 100 | 8.0 | 100 | 6.4 |
| LDR | 2 | 50 | 11.3 | 70 | 10.5 | 85 | 9.2 | 100 | 8.8 | 100 | 7.4 | 100 | 5.8 |
| LDR | 2.9 | 50 | 10.7 | 70 | 10.0 | 85 | 8.8 | 95 | 8.1 | 100 | 7.0 | 100 | 5.6 |
| MDR | 4.3 | 50 | 10.2 | 70 | 9.6 | 80 | 8.1 | 95 | 7.8 | 100 | 6.7 | 100 | 5.3 |
| MDR | 7.3 | 50 | 9.2 | 65 | 8.4 | 80 | 7.4 | 95 | 7.0 | 100 | 6.0 | 100 | 4.8 |
| MDR | 10.9 | 50 | 8.7 | 65 | 7.9 | 80 | 6.9 | 90 | 6.4 | 100 | 5.7 | 100 | 4.5 |
| MDR | 14.5 | 50 | 8.2 | 65 | 7.4 | 80 | 6.5 | 90 | 6.0 | 100 | 5.4 | 100 | 4.3 |
| HDR | 24 | 50 | 6.7 | 65 | 6.1 | 75 | 5.1 | 90 | 4.9 | 95 | 4.3 | 100 | 3.5 |
| HDR | 43 | 50 | 5.3 | 65 | 4.7 | 75 | 4.0 | 85 | 3.8 | 95 | 3.4 | 100 | 2.7 |
| N. Com | | 50 | 5.3 | 60 | 4.5 | 75 | 4.0 | 85 | 3.8 | 95 | 3.4 | 100 | 2.7 |
| G. Com | | 50 | 4.7 | 60 | 4.1 | 75 | 3.6 | 85 | 3.4 | 90 | 2.9 | 100 | 2.4 |
| O.P./Com | | 50 | 4.2 | 60 | 3.7 | 70 | 3.1 | 80 | 2.9 | 90 | 2.6 | 100 | 2.2 |
| Limited I. | | 50 | 4.2 | 60 | 3.7 | 70 | 3.1 | 80 | 2.9 | 90 | 2.6 | 100 | 2.2 |
| General I. | | 50 | 3.7 | 60 | 3.2 | 70 | 2.7 | 80 | 2.6 | 90 | 2.3 | 100 | 1.9 |

*See Table 3-1 for more detailed description

## Table 3-1
## RUNOFF COEFFICIENTS FOR URBAN AREAS

| Land Use | | Runoff Coefficient "C" | | | | |
|---|---|---|---|---|---|---|
| | | | Soil Type | | | |
| NRCS Elements | County Elements | % IMPER. | A | B | C | D |
| Undisturbed Natural Terrain (Natural) | Permanent Open Space | 0* | 0.20 | 0.25 | 0.30 | 0.35 |
| Low Density Residential (LDR) | Residential, 1.0 DU/A or less | 10 | 0.27 | 0.32 | 0.36 | 0.41 |
| Low Density Residential (LDR) | Residential, 2.0 DU/A or less | 20 | 0.34 | 0.38 | 0.42 | 0.46 |
| Low Density Residential (LDR) | Residential, 2.9 DU/A or less | 25 | 0.38 | 0.41 | 0.45 | 0.49 |
| Medium Density Residential (MDR) | Residential, 4.3 DU/A or less | 30 | 0.41 | 0.45 | 0.48 | 0.52 |
| Medium Density Residential (MDR) | Residential, 7.3 DU/A or less | 40 | 0.48 | 0.51 | 0.54 | 0.57 |
| Medium Density Residential (MDR) | Residential, 10.9 DU/A or less | 45 | 0.52 | 0.54 | 0.57 | 0.60 |
| Medium Density Residential (MDR) | Residential, 14.5 DU/A or less | 50 | 0.55 | 0.58 | 0.60 | 0.63 |
| High Density Residential (HDR) | Residential, 24.0 DU/A or less | 65 | 0.66 | 0.67 | 0.69 | 0.71 |
| High Density Residential (HDR) | Residential, 43.0 DU/A or less | 80 | 0.76 | 0.77 | 0.78 | 0.79 |
| Commercial/Industrial (N. Com) | Neighborhood Commercial | 80 | 0.76 | 0.77 | 0.78 | 0.79 |
| Commercial/Industrial (G. Com) | General Commercial | 85 | 0.80 | 0.80 | 0.81 | 0.82 |
| Commercial/Industrial (O.P. Com) | Office Professional/Commercial | 90 | 0.83 | 0.84 | 0.84 | 0.85 |
| Commercial/Industrial (Limited I.) | Limited Industrial | 90 | 0.83 | 0.84 | 0.84 | 0.85 |
| Commercial/Industrial (General I.) | General Industrial | 95 | 0.87 | 0.87 | 0.87 | 0.87 |

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service




EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

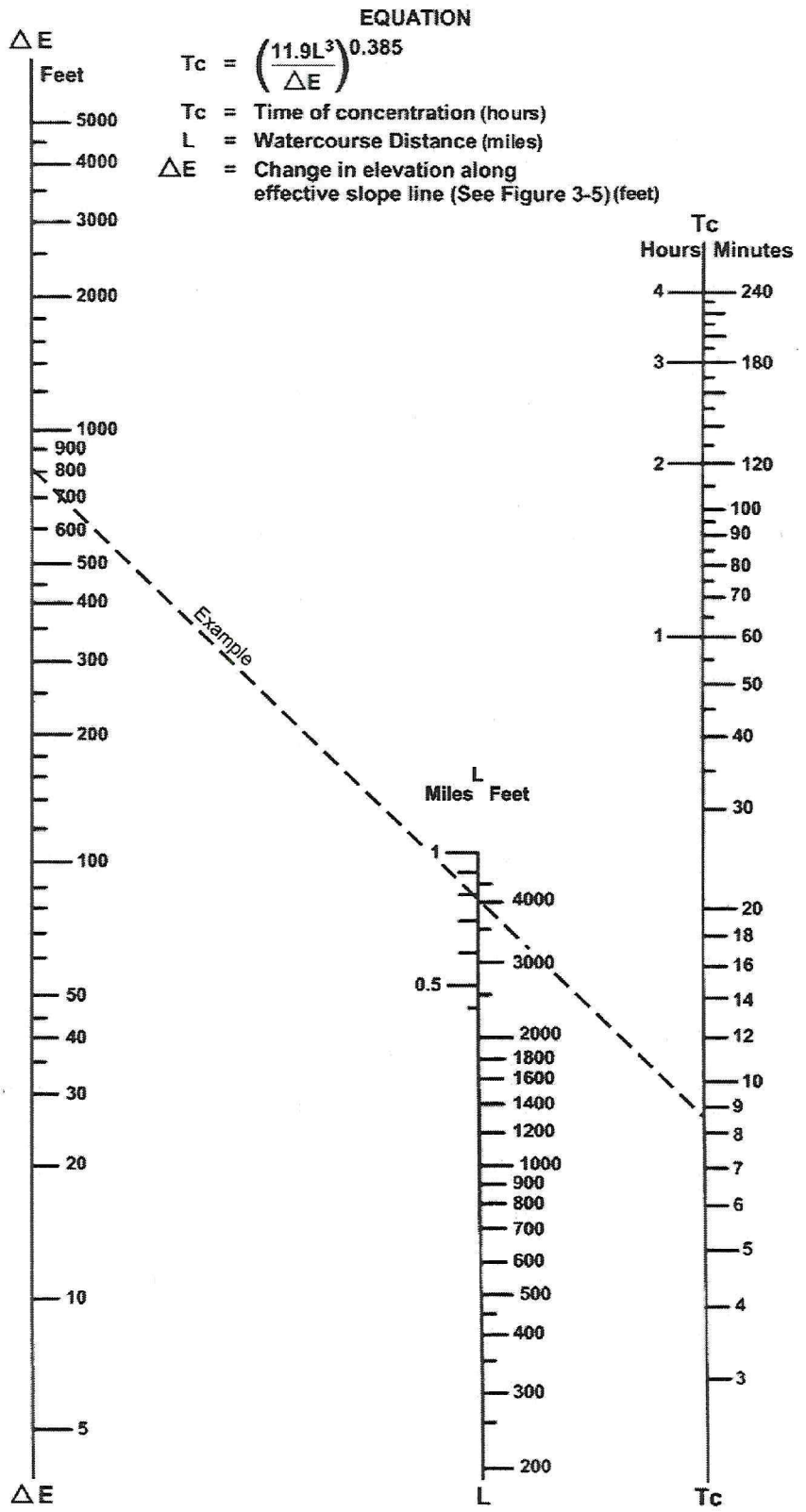
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

OURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

**Rational Formula - Overland Time of Flow Nomograph**

**3-3**

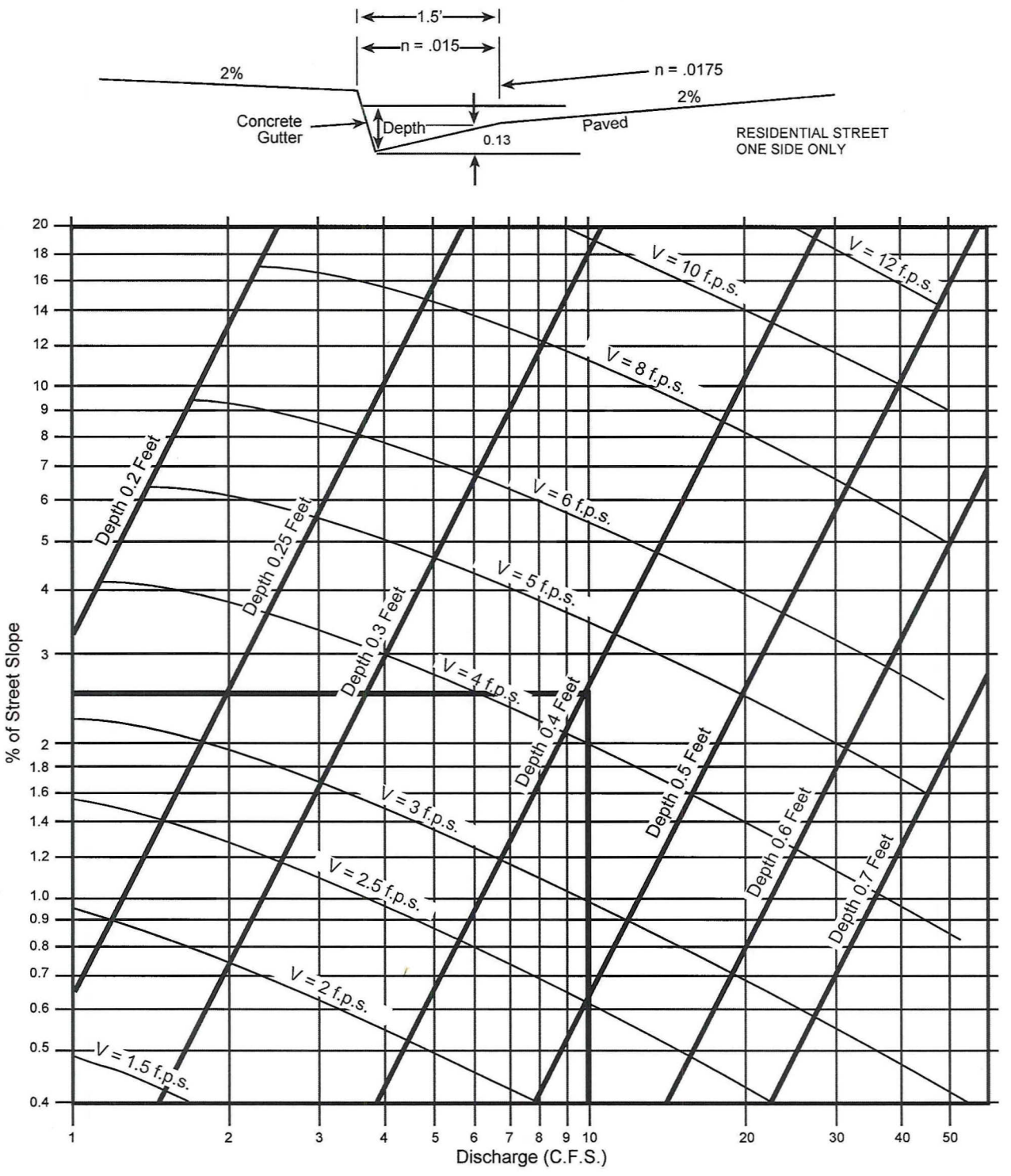



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

**3-4**

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds



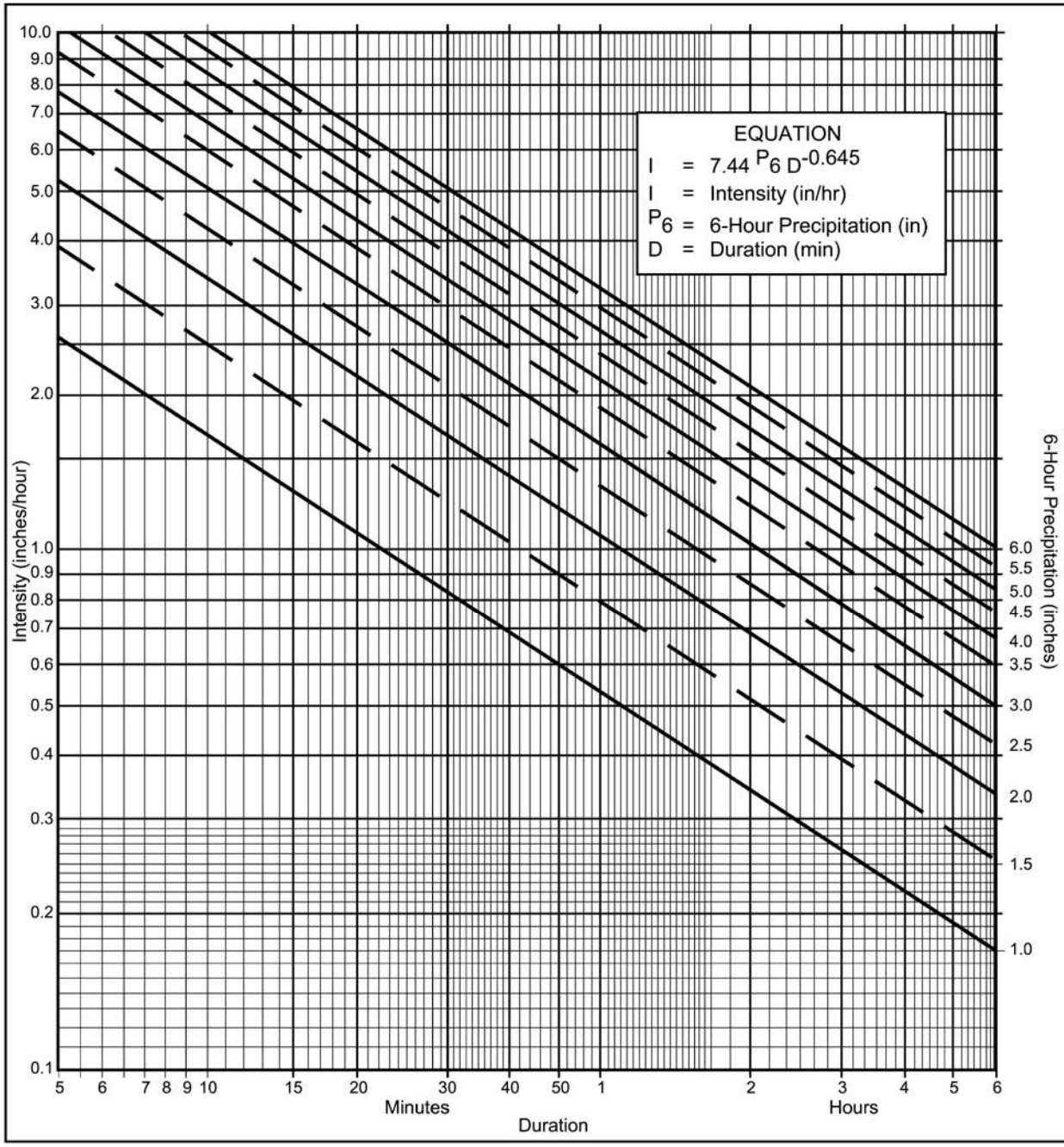

**EXAMPLE:**
**Given: Q = 10 S = 2.5%**
**Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.**

SOURCE: San Diego County Department of Special District Services Design Manual

FIGURE

**Gutter and Roadway Discharge - Velocity Chart**

**3-6**




**Directions for Application:**

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

**Application Form:**

(a) Selected frequency 50 year

(b) $P_6$ = 3 in., $P_{24}$ = 6, $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted $P_6^{(2)}$ = 3 in.

(d) $t_x$ = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

| P6 | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duration | I | I | I | I | I | I | I | I | I | I | I |
| 5 | 2.63 | 3.95 | 5.27 | 6.59 | 7.90 | 9.22 | 10.54 | 11.86 | 13.17 | 14.49 | 15.81 |
| 7 | 2.12 | 3.18 | 4.24 | 5.30 | 6.36 | 7.42 | 8.48 | 9.54 | 10.60 | 11.66 | 12.72 |
| 10 | 1.68 | 2.53 | 3.37 | 4.21 | 5.05 | 5.90 | 6.74 | 7.58 | 8.42 | 9.27 | 10.11 |
| 15 | 1.30 | 1.95 | 2.59 | 3.24 | 3.89 | 4.54 | 5.19 | 5.84 | 6.49 | 7.13 | 7.78 |
| 20 | 1.08 | 1.62 | 2.15 | 2.69 | 3.23 | 3.77 | 4.31 | 4.85 | 5.39 | 5.93 | 6.46 |
| 25 | 0.93 | 1.40 | 1.87 | 2.33 | 2.80 | 3.27 | 3.73 | 4.20 | 4.67 | 5.13 | 5.60 |
| 30 | 0.83 | 1.24 | 1.66 | 2.07 | 2.49 | 2.90 | 3.32 | 3.73 | 4.15 | 4.56 | 4.98 |
| 40 | 0.69 | 1.03 | 1.38 | 1.72 | 2.07 | 2.41 | 2.76 | 3.10 | 3.45 | 3.79 | 4.13 |
| 50 | 0.60 | 0.90 | 1.19 | 1.49 | 1.79 | 2.09 | 2.39 | 2.69 | 2.98 | 3.28 | 3.58 |
| 60 | 0.53 | 0.80 | 1.06 | 1.33 | 1.59 | 1.86 | 2.12 | 2.39 | 2.65 | 2.92 | 3.18 |
| 90 | 0.41 | 0.61 | 0.82 | 1.02 | 1.23 | 1.43 | 1.63 | 1.84 | 2.04 | 2.25 | 2.45 |
| 120 | 0.34 | 0.51 | 0.68 | 0.85 | 1.02 | 1.19 | 1.36 | 1.53 | 1.70 | 1.87 | 2.04 |
| 150 | 0.29 | 0.44 | 0.59 | 0.73 | 0.88 | 1.03 | 1.18 | 1.32 | 1.47 | 1.62 | 1.76 |
| 180 | 0.26 | 0.39 | 0.52 | 0.65 | 0.78 | 0.91 | 1.04 | 1.18 | 1.31 | 1.44 | 1.57 |
| 240 | 0.22 | 0.33 | 0.43 | 0.54 | 0.65 | 0.76 | 0.87 | 0.98 | 1.08 | 1.19 | 1.30 |
| 300 | 0.19 | 0.28 | 0.38 | 0.47 | 0.56 | 0.66 | 0.75 | 0.85 | 0.94 | 1.03 | 1.13 |
| 360 | 0.17 | 0.25 | 0.33 | 0.42 | 0.50 | 0.58 | 0.67 | 0.75 | 0.84 | 0.92 | 1.00 |

**Intensity-Duration Design Chart - Template**

FIGURE

**3-1**

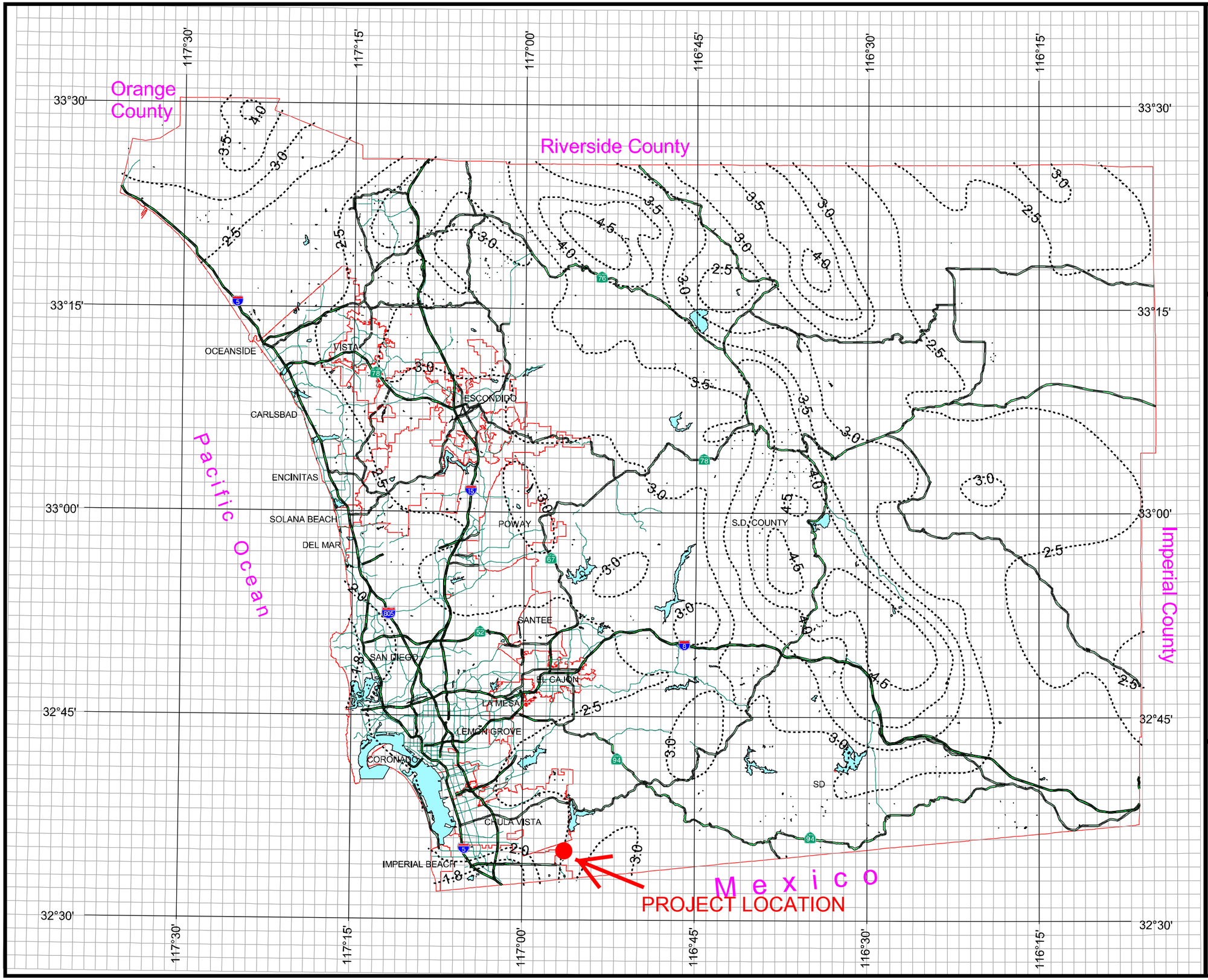
# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**50 Year Rainfall Event - 6 Hours**

Isopluvial (inches)

$P_6$ = 3 INCHES

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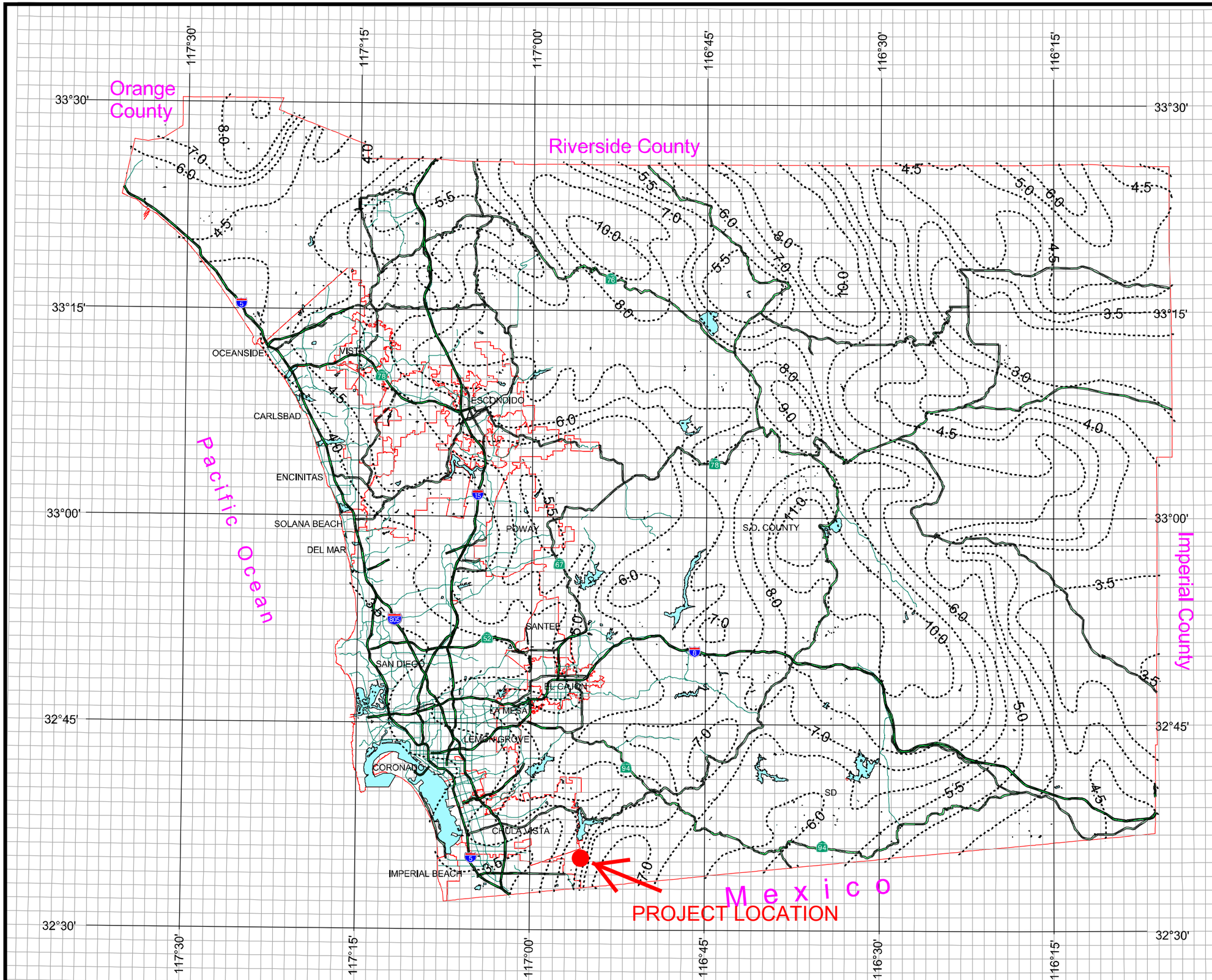
# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**50 Year Rainfall Event - 24 Hours**

Isopluvial (inches)

$P_{24}$ = 6 INCHES

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Kimley-Horn
and Associates, Inc.

**Appendix B ~ Rational Method Runoff Calculation Results**

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2006 Advanced Engineering Software (aes)
             Ver. 2.0 Release Date: 06/01/2005  License ID 1499

                           Analysis prepared by:

                       Kimley-Horn & Associates, Inc
                           401 B Street Suite 600
                            San Diego, CA 92101
                                619-234-9411

 ************************** DESCRIPTION OF STUDY **************************
* Hawano existing 2-year storm                                             *
* P = 1.2"                                                                 *
* 5/3/2010 AG                                                              *
 ***************************************************************************

  FILE NAME: 2EXHAW.DAT
  TIME/DATE OF STUDY: 16:16 05/04/2010
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =   2.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.200
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    608.00
  DOWNSTREAM ELEVATION(FEET) =    602.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.261
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.735
  SUBAREA RUNOFF(CFS) =      0.11
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.11

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    602.00  DOWNSTREAM(FEET) =    578.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   288.00   CHANNEL SLOPE =  0.0833
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.103
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.53
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   3.15
  Tc(MIN.) =   9.41
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    0.43
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       0.52

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   1.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   9.41
  RAINFALL INTENSITY(INCH/HR) =   2.10
  TOTAL STREAM AREA(ACRES) =     0.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  3.16
  TOTAL AREA(ACRES) =    16.90   TOTAL RUNOFF(CFS) =     53.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   3.16
  TOTAL STREAM AREA(ACRES) =    16.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.52     9.41        2.103          0.60
      2       53.30     5.00        3.162         16.90

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       53.58     5.00       3.162
      2       35.98     9.41       2.103

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      53.58   Tc(MIN.) =    5.00
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    578.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   387.00   CHANNEL SLOPE =  0.0310
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   4.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.823
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      54.91
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.71
  AVERAGE FLOW DEPTH(FEET) =   0.76   TRAVEL TIME(MIN.) =   0.96
  Tc(MIN.) =   5.96
  SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =    2.66
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.911
  TOTAL AREA(ACRES) =       19.8         PEAK FLOW RATE(CFS) =      53.58

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.75   FLOW VELOCITY(FEET/SEC.) =   6.64
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.823
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8593
  SUBAREA AREA(ACRES) =    2.30   SUBAREA RUNOFF(CFS) =    2.66
  TOTAL AREA(ACRES) =       22.1   TOTAL RUNOFF(CFS) =      53.61
  TC(MIN.) =   5.96

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.96
  RAINFALL INTENSITY(INCH/HR) =   2.82
  TOTAL STREAM AREA(ACRES) =    22.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.61

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  3.16
  TOTAL AREA(ACRES) =    19.40   TOTAL RUNOFF(CFS) =     23.50

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    586.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   405.00   CHANNEL SLOPE =  0.0494
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.606
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.03
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.87
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.75
  Tc(MIN.) =   6.75
  SUBAREA AREA(ACRES) =     1.00       SUBAREA RUNOFF(CFS) =    1.07
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.384
  TOTAL AREA(ACRES) =       20.4         PEAK FLOW RATE(CFS) =      23.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.81
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    103.00 =     405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.606
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3856
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    1.07
  TOTAL AREA(ACRES) =       21.4   TOTAL RUNOFF(CFS) =      23.50
  TC(MIN.) =   6.75
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.75
  RAINFALL INTENSITY(INCH/HR) =   2.61
  TOTAL STREAM AREA(ACRES) =    21.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.50

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       53.61     5.96        2.823         22.10
      2       23.50     6.75        2.606         21.40

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       74.37     5.96       2.823
      2       72.99     6.75       2.606

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      74.37   Tc(MIN.) =    5.96
  TOTAL AREA(ACRES) =       43.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    566.00  DOWNSTREAM(FEET) =    539.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1250.00   CHANNEL SLOPE =  0.0216
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.905
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      78.14
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.16
  AVERAGE FLOW DEPTH(FEET) =   0.59   TRAVEL TIME(MIN.) =   5.01
  Tc(MIN.) =  10.97
  SUBAREA AREA(ACRES) =     9.60       SUBAREA RUNOFF(CFS) =    7.50
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.587
  TOTAL AREA(ACRES) =       53.1         PEAK FLOW RATE(CFS) =      74.37

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.58   FLOW VELOCITY(FEET/SEC.) =   4.09
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2015.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.905
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5603
  SUBAREA AREA(ACRES) =    9.50   SUBAREA RUNOFF(CFS) =    7.42
  TOTAL AREA(ACRES) =       62.6   TOTAL RUNOFF(CFS) =      74.37
  TC(MIN.) =  10.97
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    539.00  DOWNSTREAM(FEET) =    525.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   680.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.646
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      77.72
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.07
  AVERAGE FLOW DEPTH(FEET) =   0.60   TRAVEL TIME(MIN.) =   2.79
  Tc(MIN.) =  13.75
  SUBAREA AREA(ACRES) =     9.90       SUBAREA RUNOFF(CFS) =    6.68
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.540
  TOTAL AREA(ACRES) =       72.5         PEAK FLOW RATE(CFS) =      74.37

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.58   FLOW VELOCITY(FEET/SEC.) =   4.03
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    2695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.646
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5240
  SUBAREA AREA(ACRES) =   10.00   SUBAREA RUNOFF(CFS) =    6.75
  TOTAL AREA(ACRES) =       82.5   TOTAL RUNOFF(CFS) =      74.37
  TC(MIN.) =  13.75
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    604.00
  DOWNSTREAM ELEVATION(FEET) =    585.00
  ELEVATION DIFFERENCE(FEET) =     19.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.765
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.884
  SUBAREA RUNOFF(CFS) =      0.12
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.12

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    575.00  DOWNSTREAM(FEET) =    549.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   699.00   CHANNEL SLOPE =  0.0372
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.515
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.20
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.18
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   9.87
  Tc(MIN.) =  15.64
  SUBAREA AREA(ACRES) =     3.20       SUBAREA RUNOFF(CFS) =    1.99
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       2.05

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   1.46
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.515
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    3.20   SUBAREA RUNOFF(CFS) =    1.99
  TOTAL AREA(ACRES) =        6.5   TOTAL RUNOFF(CFS) =       4.04
  TC(MIN.) =  15.64

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    549.00  DOWNSTREAM(FEET) =    547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00   CHANNEL SLOPE =  0.0158
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.451
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.45
  AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   1.09
  Tc(MIN.) =  16.73
  SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.06
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        6.6         PEAK FLOW RATE(CFS) =       4.04

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   1.44
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  13
----------------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  3.16
  TOTAL AREA(ACRES) =     7.80   TOTAL RUNOFF(CFS) =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    570.00  DOWNSTREAM(FEET) =    558.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.0462
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.706
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.68
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.18
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   1.36
  Tc(MIN.) =   6.36
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    0.55
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.573
  TOTAL AREA(ACRES) =        8.3         PEAK FLOW RATE(CFS) =      14.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   3.23
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =    1154.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.36
  RAINFALL INTENSITY(INCH/HR) =   2.71
  TOTAL STREAM AREA(ACRES) =     8.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.40

******************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    610.00
  DOWNSTREAM ELEVATION(FEET) =    609.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.782
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.199
  SUBAREA RUNOFF(CFS) =      0.18
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.18

******************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    609.00  DOWNSTREAM(FEET) =    604.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1077.00   CHANNEL SLOPE =  0.0046
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.721
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.39
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.44
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =  40.68
  Tc(MIN.) =  49.46
  SUBAREA AREA(ACRES) =     1.30       SUBAREA RUNOFF(CFS) =    0.38
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       0.44

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   0.43
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =    1127.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    223.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  604.00  DOWNSTREAM ELEVATION(FEET) =  572.00
  STREET LENGTH(FEET) =   549.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.52
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    2.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.04
  STREET FLOW TRAVEL TIME(MIN.) =   1.75   Tc(MIN.) =  51.21
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.705
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .1500
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.280
  SUBAREA AREA(ACRES) =    1.50      SUBAREA RUNOFF(CFS) =    0.16
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =       0.59

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.20   HALFSTREET FLOOD WIDTH(FEET) =   2.00
  FLOW VELOCITY(FEET/SEC.) =  5.24   DEPTH*VELOCITY(FT*FT/SEC.) =   1.04
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    223.00 =    1676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    572.00  DOWNSTREAM(FEET) =    556.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00   CHANNEL SLOPE =  0.0920
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.684
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.63
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.20
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   2.42
  Tc(MIN.) =  53.62
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.08
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.292
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       0.66

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.25
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  53.62
  RAINFALL INTENSITY(INCH/HR) =   0.68
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.66

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  3.16
  TOTAL AREA(ACRES) =     0.70   TOTAL RUNOFF(CFS) =      6.40

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   3.16
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       14.40     6.36        2.706          8.30
      2        0.66    53.62        0.684          3.30
      3        6.40     5.00        3.162          0.70

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.77     5.00       3.162
      2       19.96     6.36       2.706
      3        5.69    53.62       0.684

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      19.96   Tc(MIN.) =    6.36
  TOTAL AREA(ACRES) =       12.3
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    556.00  DOWNSTREAM(FEET) =    548.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   234.00   CHANNEL SLOPE =  0.0342
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.419
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.10
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.23
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.21
  Tc(MIN.) =   7.57
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.30
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.625
  TOTAL AREA(ACRES) =       12.6         PEAK FLOW RATE(CFS) =      19.96

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.21
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       19.96     7.57       2.419       12.60
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
```

```
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1        4.04    16.73       1.451        6.60
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      21.78       7.57        2.419
      2      16.00      16.73        1.451

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      21.78   Tc(MIN.) =    7.57
  TOTAL AREA(ACRES) =       19.2

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    548.00  DOWNSTREAM(FEET) =    520.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1172.00   CHANNEL SLOPE =  0.0239
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.620
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.09
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.99
  AVERAGE FLOW DEPTH(FEET) =   0.31   TRAVEL TIME(MIN.) =   6.53
  Tc(MIN.) =  14.10
  SUBAREA AREA(ACRES) =     6.90       SUBAREA RUNOFF(CFS) =    4.58
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.514
  TOTAL AREA(ACRES) =       26.1         PEAK FLOW RATE(CFS) =      21.78

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   2.95
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    204.00 =    3256.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.620
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4919
  SUBAREA AREA(ACRES) =    6.90   SUBAREA RUNOFF(CFS) =    4.58
  TOTAL AREA(ACRES) =       33.0   TOTAL RUNOFF(CFS) =      26.29
  TC(MIN.) =  14.10

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    520.00  DOWNSTREAM(FEET) =    498.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1511.00   CHANNEL SLOPE =  0.0146
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.177
```

```
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      32.11
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.79
  AVERAGE FLOW DEPTH(FEET) =   0.41   TRAVEL TIME(MIN.) =   9.04
  Tc(MIN.) =  23.15
  SUBAREA AREA(ACRES) =    23.90       SUBAREA RUNOFF(CFS) =   11.53
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.458
  TOTAL AREA(ACRES) =       56.9         PEAK FLOW RATE(CFS) =      30.63

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.40   FLOW VELOCITY(FEET/SEC.) =   2.74
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.177
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4434
  SUBAREA AREA(ACRES) =   24.00   SUBAREA RUNOFF(CFS) =   11.58
  TOTAL AREA(ACRES) =       80.9   TOTAL RUNOFF(CFS) =      42.21
  TC(MIN.) =  23.15

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  23.15
  RAINFALL INTENSITY(INCH/HR) =   1.18
  TOTAL STREAM AREA(ACRES) =    80.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     42.21

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  3.16
  TOTAL AREA(ACRES) =    36.50   TOTAL RUNOFF(CFS) =     37.20

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   3.16
  TOTAL STREAM AREA(ACRES) =    36.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       42.21    23.15        1.177         80.90
      2       37.20     5.00        3.162         36.50

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

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       46.32     5.00       3.162
      2       56.06    23.15       1.177

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      56.06   Tc(MIN.) =   23.15
  TOTAL AREA(ACRES) =      117.4
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    549.00
  DOWNSTREAM ELEVATION(FEET) =    546.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.612
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.226
  SUBAREA RUNOFF(CFS) =      0.18
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.18

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    546.00  DOWNSTREAM(FEET) =    499.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1676.00   CHANNEL SLOPE =  0.0280
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.912
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.11
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.08
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =  25.76
  Tc(MIN.) =  34.37
  SUBAREA AREA(ACRES) =     4.40       SUBAREA RUNOFF(CFS) =    1.64
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        4.6         PEAK FLOW RATE(CFS) =       1.72

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   1.26
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1776.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.912
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    4.30   SUBAREA RUNOFF(CFS) =    1.61
  TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =       3.33
  TC(MIN.) =  34.37
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.9  TC(MIN.) =     34.37
```

```
  PEAK FLOW RATE(CFS)   =       3.33
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2006 Advanced Engineering Software (aes)
             Ver. 2.0 Release Date: 06/01/2005  License ID 1499

                           Analysis prepared by:

                       Kimley-Horn & Associates, Inc
                           401 B Street Suite 600
                            San Diego, CA 92101
                                619-234-9411

 ************************** DESCRIPTION OF STUDY **************************
* Hawano existing 5-year storm                                             *
* P = 1.6"                                                                 *
* 5/4/2010 AG                                                              *
 ***************************************************************************

  FILE NAME: 5EXHAW.DAT
  TIME/DATE OF STUDY: 16:24 05/04/2010
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =   5.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.600
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    608.00
  DOWNSTREAM ELEVATION(FEET) =    602.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.261
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.646
  SUBAREA RUNOFF(CFS) =      0.15
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.15

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    602.00  DOWNSTREAM(FEET) =    578.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   288.00   CHANNEL SLOPE =  0.0833
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.866
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.45
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.69
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   2.84
  Tc(MIN.) =   9.10
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    0.59
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       0.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   2.03
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   9.10
  RAINFALL INTENSITY(INCH/HR) =   2.87
  TOTAL STREAM AREA(ACRES) =     0.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.70

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  4.22
  TOTAL AREA(ACRES) =    16.90   TOTAL RUNOFF(CFS) =     53.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =    16.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.70     9.10        2.866          0.60
      2       53.30     5.00        4.216         16.90

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       53.69     5.00       4.216
      2       36.94     9.10       2.866

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      53.69   Tc(MIN.) =    5.00
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    578.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   387.00   CHANNEL SLOPE =  0.0310
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   4.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.765
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      55.46
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.73
  AVERAGE FLOW DEPTH(FEET) =   0.77   TRAVEL TIME(MIN.) =   0.96
  Tc(MIN.) =   5.96
  SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =    3.55
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.699
  TOTAL AREA(ACRES) =       19.8         PEAK FLOW RATE(CFS) =      53.69

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.75   FLOW VELOCITY(FEET/SEC.) =   6.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.765
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6686
  SUBAREA AREA(ACRES) =    2.30   SUBAREA RUNOFF(CFS) =    3.55
  TOTAL AREA(ACRES) =       22.1   TOTAL RUNOFF(CFS) =      55.62
  TC(MIN.) =   5.96

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.96
  RAINFALL INTENSITY(INCH/HR) =   3.76
  TOTAL STREAM AREA(ACRES) =    22.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     55.62

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  4.22
  TOTAL AREA(ACRES) =    19.40   TOTAL RUNOFF(CFS) =     23.50

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    586.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   405.00   CHANNEL SLOPE =  0.0494
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.479
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.21
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.89
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.73
  Tc(MIN.) =   6.73
  SUBAREA AREA(ACRES) =     1.00       SUBAREA RUNOFF(CFS) =    1.43
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.293
  TOTAL AREA(ACRES) =       20.4         PEAK FLOW RATE(CFS) =      23.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.81
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    103.00 =     405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.479
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2988
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    1.43
  TOTAL AREA(ACRES) =       21.4   TOTAL RUNOFF(CFS) =      23.50
  TC(MIN.) =   6.73
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.73
  RAINFALL INTENSITY(INCH/HR) =   3.48
  TOTAL STREAM AREA(ACRES) =    21.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.50

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       55.62     5.96        3.765         22.10
      2       23.50     6.73        3.479         21.40

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       76.42     5.96       3.765
      2       74.91     6.73       3.479

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      76.42   Tc(MIN.) =    5.96
  TOTAL AREA(ACRES) =       43.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    566.00  DOWNSTREAM(FEET) =    539.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1250.00   CHANNEL SLOPE =  0.0216
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.545
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      81.46
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.19
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   4.97
  Tc(MIN.) =  10.93
  SUBAREA AREA(ACRES) =     9.60       SUBAREA RUNOFF(CFS) =   10.02
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.473
  TOTAL AREA(ACRES) =       53.1         PEAK FLOW RATE(CFS) =      76.42

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.58   FLOW VELOCITY(FEET/SEC.) =   4.12
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2015.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.545
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4633
  SUBAREA AREA(ACRES) =    9.50   SUBAREA RUNOFF(CFS) =    9.91
  TOTAL AREA(ACRES) =       62.6   TOTAL RUNOFF(CFS) =      76.42
  TC(MIN.) =  10.93
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    539.00  DOWNSTREAM(FEET) =    525.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   680.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.204
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      80.89
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.14
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   2.74
  Tc(MIN.) =  13.67
  SUBAREA AREA(ACRES) =     9.90       SUBAREA RUNOFF(CFS) =    8.94
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.456
  TOTAL AREA(ACRES) =       72.5         PEAK FLOW RATE(CFS) =      76.42

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.59   FLOW VELOCITY(FEET/SEC.) =   4.05
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    2695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.204
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4504
  SUBAREA AREA(ACRES) =   10.00   SUBAREA RUNOFF(CFS) =    9.04
  TOTAL AREA(ACRES) =       82.5   TOTAL RUNOFF(CFS) =      81.89
  TC(MIN.) =  13.67

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    604.00
  DOWNSTREAM ELEVATION(FEET) =    585.00
  ELEVATION DIFFERENCE(FEET) =     19.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.765
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.846
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    575.00  DOWNSTREAM(FEET) =    549.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   699.00   CHANNEL SLOPE =  0.0372
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.140
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.68
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.36
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   8.54
  Tc(MIN.) =  14.30
  SUBAREA AREA(ACRES) =     3.20       SUBAREA RUNOFF(CFS) =    2.81
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       2.90

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   1.69
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.140
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    3.20   SUBAREA RUNOFF(CFS) =    2.81
  TOTAL AREA(ACRES) =        6.5   TOTAL RUNOFF(CFS) =       5.70
  TC(MIN.) =  14.30

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    549.00  DOWNSTREAM(FEET) =    547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00   CHANNEL SLOPE =  0.0158
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.053
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.75
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.67
  AVERAGE FLOW DEPTH(FEET) =   0.15   TRAVEL TIME(MIN.) =   0.95
  Tc(MIN.) =  15.25
  SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.08
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        6.6         PEAK FLOW RATE(CFS) =       5.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.15   FLOW VELOCITY(FEET/SEC.) =   1.66
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  13
----------------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  4.22
  TOTAL AREA(ACRES) =     7.80   TOTAL RUNOFF(CFS) =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    570.00  DOWNSTREAM(FEET) =    558.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.0462
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.611
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.77
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.20
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   1.36
  Tc(MIN.) =   6.36
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    0.74
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.436
  TOTAL AREA(ACRES) =        8.3         PEAK FLOW RATE(CFS) =      14.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   3.23
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =    1154.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.36
  RAINFALL INTENSITY(INCH/HR) =   3.61
  TOTAL STREAM AREA(ACRES) =     8.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.40

******************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    610.00
  DOWNSTREAM ELEVATION(FEET) =    609.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.782
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.931
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.24

******************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    609.00  DOWNSTREAM(FEET) =    604.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1077.00   CHANNEL SLOPE =  0.0046
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.976
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.54
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.45
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =  39.51
  Tc(MIN.) =  48.29
  SUBAREA AREA(ACRES) =     1.30       SUBAREA RUNOFF(CFS) =    0.52
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       0.60

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   0.49
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =    1127.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    223.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  604.00  DOWNSTREAM ELEVATION(FEET) =  572.00
  STREET LENGTH(FEET) =   549.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.71
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    2.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.04
  STREET FLOW TRAVEL TIME(MIN.) =   1.75   Tc(MIN.) =  50.04
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.954
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .1500
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.280
  SUBAREA AREA(ACRES) =    1.50      SUBAREA RUNOFF(CFS) =    0.21
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =       0.80

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.20   HALFSTREET FLOOD WIDTH(FEET) =   2.00
  FLOW VELOCITY(FEET/SEC.) =  5.24   DEPTH*VELOCITY(FT*FT/SEC.) =   1.04
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    223.00 =    1676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    572.00  DOWNSTREAM(FEET) =    556.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00   CHANNEL SLOPE =  0.0920
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.931
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.86
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.51
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   1.92
  Tc(MIN.) =  51.96
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.11
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.292
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       0.90

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.58
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  51.96
  RAINFALL INTENSITY(INCH/HR) =   0.93
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.90

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  4.22
  TOTAL AREA(ACRES) =     0.70   TOTAL RUNOFF(CFS) =      6.40

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       14.40     6.36        3.611          8.30
      2        0.90    51.96        0.931          3.30
      3        6.40     5.00        4.216          0.70

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.81     5.00       4.216
      2       19.99     6.36       3.611
      3        6.02    51.96       0.931

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      19.99   Tc(MIN.) =    6.36
  TOTAL AREA(ACRES) =       12.3
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    556.00  DOWNSTREAM(FEET) =    548.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   234.00   CHANNEL SLOPE =  0.0342
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.230
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.19
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.25
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.20
  Tc(MIN.) =   7.56
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.40
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.494
  TOTAL AREA(ACRES) =       12.6         PEAK FLOW RATE(CFS) =      20.11

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.23
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.11     7.56       3.230       12.60
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
```

```
     1        5.70    15.25       2.053        6.60
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      22.93       7.56        3.230
     2      18.48      15.25        2.053

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      22.93   Tc(MIN.) =    7.56
  TOTAL AREA(ACRES) =       19.2

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    548.00  DOWNSTREAM(FEET) =    520.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1172.00   CHANNEL SLOPE =  0.0239
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.186
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      26.03
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.11
  AVERAGE FLOW DEPTH(FEET) =   0.32   TRAVEL TIME(MIN.) =   6.28
  Tc(MIN.) =  13.84
  SUBAREA AREA(ACRES) =     6.90       SUBAREA RUNOFF(CFS) =    6.19
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.451
  TOTAL AREA(ACRES) =       26.1         PEAK FLOW RATE(CFS) =      25.71

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.32   FLOW VELOCITY(FEET/SEC.) =   3.07
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    204.00 =    3256.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.186
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4421
  SUBAREA AREA(ACRES) =    6.90   SUBAREA RUNOFF(CFS) =    6.19
  TOTAL AREA(ACRES) =       33.0   TOTAL RUNOFF(CFS) =      31.90
  TC(MIN.) =  13.84

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    520.00  DOWNSTREAM(FEET) =    498.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1511.00   CHANNEL SLOPE =  0.0146
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.605
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      39.81
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.96
  AVERAGE FLOW DEPTH(FEET) =   0.46   TRAVEL TIME(MIN.) =   8.51
  Tc(MIN.) =  22.35
  SUBAREA AREA(ACRES) =    23.90       SUBAREA RUNOFF(CFS) =   15.73
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.429
  TOTAL AREA(ACRES) =       56.9         PEAK FLOW RATE(CFS) =      39.14

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   2.96
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.605
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4231
  SUBAREA AREA(ACRES) =   24.00   SUBAREA RUNOFF(CFS) =   15.79
  TOTAL AREA(ACRES) =       80.9   TOTAL RUNOFF(CFS) =      54.93
  TC(MIN.) =  22.35

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  22.35
  RAINFALL INTENSITY(INCH/HR) =   1.60
  TOTAL STREAM AREA(ACRES) =    80.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     54.93

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  4.22
  TOTAL AREA(ACRES) =    36.50   TOTAL RUNOFF(CFS) =     37.20

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =    36.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       54.93    22.35        1.605         80.90
      2       37.20     5.00        4.216         36.50

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

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       49.49     5.00       4.216
      2       69.09    22.35       1.605

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      69.09   Tc(MIN.) =   22.35
  TOTAL AREA(ACRES) =      117.4
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    549.00
  DOWNSTREAM ELEVATION(FEET) =    546.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.612
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.969
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    546.00  DOWNSTREAM(FEET) =    499.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1676.00   CHANNEL SLOPE =  0.0280
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.299
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.54
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.25
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =  22.40
  Tc(MIN.) =  31.01
  SUBAREA AREA(ACRES) =     4.40       SUBAREA RUNOFF(CFS) =    2.34
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        4.6         PEAK FLOW RATE(CFS) =       2.45

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   1.43
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1776.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.299
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    4.30   SUBAREA RUNOFF(CFS) =    2.29
  TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =       4.74
  TC(MIN.) =  31.01
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.9  TC(MIN.) =     31.01
  PEAK FLOW RATE(CFS)   =       4.74
```

==========
==========
END OF RATIONAL METHOD ANALYSIS

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2006 Advanced Engineering Software (aes)
             Ver. 2.0 Release Date: 06/01/2005  License ID 1499

                           Analysis prepared by:

                       Kimley-Horn & Associates, Inc
                           401 B Street Suite 600
                            San Diego, CA 92101
                                619-234-9411

 ************************** DESCRIPTION OF STUDY **************************
* Hawano existing 10-year storm                                            *
* P = 1.9"                                                                 *
* 5/4/2010 AG                                                              *
 ***************************************************************************

  FILE NAME: 10EXHAW.DAT
  TIME/DATE OF STUDY: 16:25 05/04/2010
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.900
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    608.00
  DOWNSTREAM ELEVATION(FEET) =    602.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.261
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.330
  SUBAREA RUNOFF(CFS) =      0.18
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.18

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    602.00  DOWNSTREAM(FEET) =    578.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   288.00   CHANNEL SLOPE =  0.0833
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.444
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.54
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.80
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   2.67
  Tc(MIN.) =   8.93
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    0.71
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       0.85

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   2.14
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.93
  RAINFALL INTENSITY(INCH/HR) =   3.44
  TOTAL STREAM AREA(ACRES) =     0.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.85

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  5.01
  TOTAL AREA(ACRES) =    16.90   TOTAL RUNOFF(CFS) =     53.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   5.01
  TOTAL STREAM AREA(ACRES) =    16.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.85     8.93        3.444          0.60
      2       53.30     5.00        5.006         16.90

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       53.77     5.00       5.006
      2       37.51     8.93       3.444

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      53.77   Tc(MIN.) =    5.00
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    578.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   387.00   CHANNEL SLOPE =  0.0310
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   4.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.473
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      55.88
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.76
  AVERAGE FLOW DEPTH(FEET) =   0.77   TRAVEL TIME(MIN.) =   0.95
  Tc(MIN.) =   5.95
  SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =    4.22
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.598
  TOTAL AREA(ACRES) =       19.8         PEAK FLOW RATE(CFS) =      53.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.75   FLOW VELOCITY(FEET/SEC.) =   6.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.473
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5782
  SUBAREA AREA(ACRES) =    2.30   SUBAREA RUNOFF(CFS) =    4.22
  TOTAL AREA(ACRES) =       22.1   TOTAL RUNOFF(CFS) =      57.16
  TC(MIN.) =   5.95

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.95
  RAINFALL INTENSITY(INCH/HR) =   4.47
  TOTAL STREAM AREA(ACRES) =    22.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     57.16

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  5.01
  TOTAL AREA(ACRES) =    19.40   TOTAL RUNOFF(CFS) =     23.50

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    586.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   405.00   CHANNEL SLOPE =  0.0494
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.135
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.35
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.92
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.72
  Tc(MIN.) =   6.72
  SUBAREA AREA(ACRES) =     1.00       SUBAREA RUNOFF(CFS) =    1.70
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.250
  TOTAL AREA(ACRES) =       20.4         PEAK FLOW RATE(CFS) =      23.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.81
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    103.00 =     405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.135
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2577
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    1.70
  TOTAL AREA(ACRES) =       21.4   TOTAL RUNOFF(CFS) =      23.50
  TC(MIN.) =   6.72
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.72
  RAINFALL INTENSITY(INCH/HR) =   4.14
  TOTAL STREAM AREA(ACRES) =    21.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.50

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       57.16     5.95        4.473         22.10
      2       23.50     6.72        4.135         21.40

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       77.97     5.95       4.473
      2       76.35     6.72       4.135

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      77.97   Tc(MIN.) =    5.95
  TOTAL AREA(ACRES) =       43.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    566.00  DOWNSTREAM(FEET) =    539.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1250.00   CHANNEL SLOPE =  0.0216
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.035
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      83.96
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.24
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   4.91
  Tc(MIN.) =  10.86
  SUBAREA AREA(ACRES) =     9.60       SUBAREA RUNOFF(CFS) =   11.94
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.419
  TOTAL AREA(ACRES) =       53.1         PEAK FLOW RATE(CFS) =      77.97

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.59   FLOW VELOCITY(FEET/SEC.) =   4.15
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2015.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.035
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4173
  SUBAREA AREA(ACRES) =    9.50   SUBAREA RUNOFF(CFS) =   11.82
  TOTAL AREA(ACRES) =       62.6   TOTAL RUNOFF(CFS) =      79.28
  TC(MIN.) =  10.86

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    539.00  DOWNSTREAM(FEET) =    525.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   680.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.629
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      84.62
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.19
  AVERAGE FLOW DEPTH(FEET) =   0.62   TRAVEL TIME(MIN.) =   2.71
  Tc(MIN.) =  13.57
  SUBAREA AREA(ACRES) =     9.90       SUBAREA RUNOFF(CFS) =   10.67
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.416
  TOTAL AREA(ACRES) =       72.5         PEAK FLOW RATE(CFS) =      79.35

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =   4.08
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    2695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.629
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4156
  SUBAREA AREA(ACRES) =   10.00   SUBAREA RUNOFF(CFS) =   10.78
  TOTAL AREA(ACRES) =       82.5   TOTAL RUNOFF(CFS) =      90.13
  TC(MIN.) =  13.57

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    604.00
  DOWNSTREAM ELEVATION(FEET) =    585.00
  ELEVATION DIFFERENCE(FEET) =     19.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.765
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.567
  SUBAREA RUNOFF(CFS) =      0.19
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.19

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    575.00  DOWNSTREAM(FEET) =    549.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   699.00   CHANNEL SLOPE =  0.0372
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.610
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.99
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.46
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   7.96
  Tc(MIN.) =  13.72
  SUBAREA AREA(ACRES) =     3.20       SUBAREA RUNOFF(CFS) =    3.42
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       3.53

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   1.83
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.610
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    3.20   SUBAREA RUNOFF(CFS) =    3.42
  TOTAL AREA(ACRES) =        6.5   TOTAL RUNOFF(CFS) =       6.96
  TC(MIN.) =  13.72

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    549.00  DOWNSTREAM(FEET) =    547.50
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00   CHANNEL SLOPE =  0.0158
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.505
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.01
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.75
  AVERAGE FLOW DEPTH(FEET) =   0.17   TRAVEL TIME(MIN.) =   0.90
  Tc(MIN.) =  14.63
  SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.10
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        6.6         PEAK FLOW RATE(CFS) =       6.96

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   1.74
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  13
----------------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  5.01
  TOTAL AREA(ACRES) =     7.80   TOTAL RUNOFF(CFS) =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    570.00  DOWNSTREAM(FEET) =    558.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.0462
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.291
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.84
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.21
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   1.35
  Tc(MIN.) =   6.35
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    0.88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.371
  TOTAL AREA(ACRES) =        8.3         PEAK FLOW RATE(CFS) =      14.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   3.23
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =    1154.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.35
  RAINFALL INTENSITY(INCH/HR) =   4.29
  TOTAL STREAM AREA(ACRES) =     8.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    610.00
  DOWNSTREAM ELEVATION(FEET) =    609.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.782
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.481
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    609.00  DOWNSTREAM(FEET) =    604.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1077.00   CHANNEL SLOPE =  0.0046
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.254
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.65
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.53
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =  34.00
  Tc(MIN.) =  42.78
  SUBAREA AREA(ACRES) =     1.30       SUBAREA RUNOFF(CFS) =    0.67
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       0.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   0.55
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =    1127.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    223.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  604.00  DOWNSTREAM ELEVATION(FEET) =  572.00
  STREET LENGTH(FEET) =   549.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.91
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    2.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.04
  STREET FLOW TRAVEL TIME(MIN.) =   1.75   Tc(MIN.) =  44.52
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.222
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .1500
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.280
  SUBAREA AREA(ACRES) =    1.50      SUBAREA RUNOFF(CFS) =    0.27
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =       1.03

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.20   HALFSTREET FLOOD WIDTH(FEET) =   2.00
  FLOW VELOCITY(FEET/SEC.) =  5.24   DEPTH*VELOCITY(FT*FT/SEC.) =   1.04
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    223.00 =    1676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    572.00  DOWNSTREAM(FEET) =    556.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00   CHANNEL SLOPE =  0.0920
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.191
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.10
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.59
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   1.82
  Tc(MIN.) =  46.34
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.15
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.292
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       1.15

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   1.57
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  46.34
  RAINFALL INTENSITY(INCH/HR) =   1.19
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.15

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  5.01
  TOTAL AREA(ACRES) =     0.70   TOTAL RUNOFF(CFS) =      6.40

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   5.01
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       14.40     6.35        4.291          8.30
      2        1.15    46.34        1.191          3.30
      3        6.40     5.00        5.006          0.70

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.86     5.00       5.006
      2       20.04     6.35       4.291
      3        6.66    46.34       1.191

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.04   Tc(MIN.) =    6.35
  TOTAL AREA(ACRES) =       12.3
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    556.00  DOWNSTREAM(FEET) =    548.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   234.00   CHANNEL SLOPE =  0.0342
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.839
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.28
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.26
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.20
  Tc(MIN.) =   7.55
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.47
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.432
  TOTAL AREA(ACRES) =       12.6         PEAK FLOW RATE(CFS) =      20.91

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.27
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.91     7.55       3.839       12.60
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1        6.96    14.63       2.505        6.60
```

```
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      24.50       7.55        3.839
      2      20.60      14.63        2.505

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      24.50   Tc(MIN.) =    7.55
  TOTAL AREA(ACRES) =       19.2

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    548.00  DOWNSTREAM(FEET) =    520.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1172.00   CHANNEL SLOPE =  0.0239
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.614
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      28.20
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.18
  AVERAGE FLOW DEPTH(FEET) =   0.33   TRAVEL TIME(MIN.) =   6.15
  Tc(MIN.) =  13.69
  SUBAREA AREA(ACRES) =     6.90       SUBAREA RUNOFF(CFS) =    7.40
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.421
  TOTAL AREA(ACRES) =       26.1         PEAK FLOW RATE(CFS) =      28.71

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.34   FLOW VELOCITY(FEET/SEC.) =   3.17
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    204.00 =    3256.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.614
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4185
  SUBAREA AREA(ACRES) =    6.90   SUBAREA RUNOFF(CFS) =    7.40
  TOTAL AREA(ACRES) =       33.0   TOTAL RUNOFF(CFS) =      36.10
  TC(MIN.) =  13.69

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    520.00  DOWNSTREAM(FEET) =    498.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1511.00   CHANNEL SLOPE =  0.0146
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.936
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      45.63
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.10
  AVERAGE FLOW DEPTH(FEET) =   0.49   TRAVEL TIME(MIN.) =   8.13
  Tc(MIN.) =  21.82
  SUBAREA AREA(ACRES) =    23.90       SUBAREA RUNOFF(CFS) =   18.97
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.415
  TOTAL AREA(ACRES) =       56.9         PEAK FLOW RATE(CFS) =      45.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.49   FLOW VELOCITY(FEET/SEC.) =   3.10
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.936
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4135
  SUBAREA AREA(ACRES) =   24.00   SUBAREA RUNOFF(CFS) =   19.05
  TOTAL AREA(ACRES) =       80.9   TOTAL RUNOFF(CFS) =      64.74
  TC(MIN.) =  21.82

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  21.82
  RAINFALL INTENSITY(INCH/HR) =   1.94
  TOTAL STREAM AREA(ACRES) =    80.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     64.74

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  5.01
  TOTAL AREA(ACRES) =    36.50   TOTAL RUNOFF(CFS) =     37.20

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   5.01
  TOTAL STREAM AREA(ACRES) =    36.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       64.74    21.82        1.936         80.90
      2       37.20     5.00        5.006         36.50

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

  ** PEAK FLOW RATE TABLE **
```

```
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       52.04     5.00       5.006
      2       79.12    21.82       1.936

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      79.12   Tc(MIN.) =   21.82
  TOTAL AREA(ACRES) =      117.4
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    549.00
  DOWNSTREAM ELEVATION(FEET) =    546.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.612
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.525
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    546.00  DOWNSTREAM(FEET) =    499.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1676.00   CHANNEL SLOPE =  0.0280
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.588
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.86
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.33
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =  21.03
  Tc(MIN.) =  29.64
  SUBAREA AREA(ACRES) =     4.40       SUBAREA RUNOFF(CFS) =    2.87
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        4.6         PEAK FLOW RATE(CFS) =       3.00

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   1.55
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1776.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.588
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    4.30   SUBAREA RUNOFF(CFS) =    2.80
  TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =       5.80
  TC(MIN.) =  29.64
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.9  TC(MIN.) =     29.64
  PEAK FLOW RATE(CFS)   =       5.80
============================================================================
```

==========

END OF RATIONAL METHOD ANALYSIS

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2006 Advanced Engineering Software (aes)
             Ver. 2.0 Release Date: 06/01/2005  License ID 1499

                           Analysis prepared by:

                       Kimley-Horn & Associates, Inc
                           401 B Street Suite 600
                            San Diego, CA 92101
                                619-234-9411

 ************************** DESCRIPTION OF STUDY **************************
* Hawano existing 50-year storm                                            *
* P = 2.8"                                                                 *
* 5/4/2010 AG                                                              *
 ***************************************************************************

  FILE NAME: 50EXHAW.DAT
  TIME/DATE OF STUDY: 16:27 05/04/2010
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  50.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.800
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    608.00
  DOWNSTREAM ELEVATION(FEET) =    602.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.261
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.381
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    602.00  DOWNSTREAM(FEET) =    578.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   288.00   CHANNEL SLOPE =  0.0833
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.276
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.80
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.24
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   2.15
  Tc(MIN.) =   8.41
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    1.08
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       1.30

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   2.56
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.41
  RAINFALL INTENSITY(INCH/HR) =   5.28
  TOTAL STREAM AREA(ACRES) =     0.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.38
  TOTAL AREA(ACRES) =    16.90   TOTAL RUNOFF(CFS) =     53.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   7.38
  TOTAL STREAM AREA(ACRES) =    16.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        1.30     8.41        5.276          0.60
      2       53.30     5.00        7.377         16.90

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       54.07     5.00       7.377
      2       39.41     8.41       5.276

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      54.07   Tc(MIN.) =    5.00
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    578.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   387.00   CHANNEL SLOPE =  0.0310
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   4.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.594
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      57.18
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.79
  AVERAGE FLOW DEPTH(FEET) =   0.78   TRAVEL TIME(MIN.) =   0.95
  Tc(MIN.) =   5.95
  SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =    6.22
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.425
  TOTAL AREA(ACRES) =       19.8         PEAK FLOW RATE(CFS) =      55.48

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.77   FLOW VELOCITY(FEET/SEC.) =   6.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.594
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4234
  SUBAREA AREA(ACRES) =    2.30   SUBAREA RUNOFF(CFS) =    6.22
  TOTAL AREA(ACRES) =       22.1   TOTAL RUNOFF(CFS) =      61.70
  TC(MIN.) =   5.95

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.95
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =    22.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     61.70

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.38
  TOTAL AREA(ACRES) =    19.40   TOTAL RUNOFF(CFS) =     23.50

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    586.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   405.00   CHANNEL SLOPE =  0.0494
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.083
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.75
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.87
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.74
  Tc(MIN.) =   6.74
  SUBAREA AREA(ACRES) =     1.00       SUBAREA RUNOFF(CFS) =    2.49
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.176
  TOTAL AREA(ACRES) =       20.4         PEAK FLOW RATE(CFS) =      23.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.81
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    103.00 =     405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.083
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.1872
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.49
  TOTAL AREA(ACRES) =       21.4   TOTAL RUNOFF(CFS) =      24.37
  TC(MIN.) =   6.74

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.74
  RAINFALL INTENSITY(INCH/HR) =   6.08
  TOTAL STREAM AREA(ACRES) =    21.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     24.37

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       61.70     5.95        6.594         22.10
      2       24.37     6.74        6.083         21.40

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       83.20     5.95       6.594
      2       81.29     6.74       6.083

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      83.20   Tc(MIN.) =    5.95
  TOTAL AREA(ACRES) =       43.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
```

```
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    566.00  DOWNSTREAM(FEET) =    539.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1250.00   CHANNEL SLOPE =  0.0216
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.506
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      92.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.35
  AVERAGE FLOW DEPTH(FEET) =   0.64   TRAVEL TIME(MIN.) =   4.79
  Tc(MIN.) =  10.74
  SUBAREA AREA(ACRES) =     9.60       SUBAREA RUNOFF(CFS) =   17.73
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.326
  TOTAL AREA(ACRES) =       53.1         PEAK FLOW RATE(CFS) =      83.20

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =   4.21
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2015.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.506
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3386
  SUBAREA AREA(ACRES) =    9.50   SUBAREA RUNOFF(CFS) =   17.55
  TOTAL AREA(ACRES) =       62.6   TOTAL RUNOFF(CFS) =      95.49
  TC(MIN.) =  10.74

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    539.00  DOWNSTREAM(FEET) =    525.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   680.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.925
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     103.46
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.42
  AVERAGE FLOW DEPTH(FEET) =   0.69   TRAVEL TIME(MIN.) =   2.56
  Tc(MIN.) =  13.30
  SUBAREA AREA(ACRES) =     9.90       SUBAREA RUNOFF(CFS) =   15.93
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.348
  TOTAL AREA(ACRES) =       72.5         PEAK FLOW RATE(CFS) =      99.11

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.68   FLOW VELOCITY(FEET/SEC.) =   4.37
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    2695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.925
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3558
  SUBAREA AREA(ACRES) =   10.00   SUBAREA RUNOFF(CFS) =   16.09
  TOTAL AREA(ACRES) =       82.5   TOTAL RUNOFF(CFS) =     115.21
  TC(MIN.) =  13.30

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    604.00
  DOWNSTREAM ELEVATION(FEET) =    585.00
  ELEVATION DIFFERENCE(FEET) =     19.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.765
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.730
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.28

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    575.00  DOWNSTREAM(FEET) =    549.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   699.00   CHANNEL SLOPE =  0.0372
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.121
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.11
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.77
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   6.57
  Tc(MIN.) =  12.33
  SUBAREA AREA(ACRES) =     3.20       SUBAREA RUNOFF(CFS) =    5.41
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       5.58

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   2.13
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.121
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    3.20   SUBAREA RUNOFF(CFS) =    5.41
  TOTAL AREA(ACRES) =        6.5   TOTAL RUNOFF(CFS) =      10.98
  TC(MIN.) =  12.33

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    549.00  DOWNSTREAM(FEET) =    547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00   CHANNEL SLOPE =  0.0158
```

```
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.960
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.06
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.02
  AVERAGE FLOW DEPTH(FEET) =   0.22   TRAVEL TIME(MIN.) =   0.79
  Tc(MIN.) =  13.12
  SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.16
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        6.6         PEAK FLOW RATE(CFS) =      10.98

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.22   FLOW VELOCITY(FEET/SEC.) =   2.06
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  13
----------------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.38
  TOTAL AREA(ACRES) =     7.80   TOTAL RUNOFF(CFS) =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    570.00  DOWNSTREAM(FEET) =    558.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.0462
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.326
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.05
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.22
  AVERAGE FLOW DEPTH(FEET) =   0.20   TRAVEL TIME(MIN.) =   1.35
  Tc(MIN.) =   6.35
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    1.30
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.260
  TOTAL AREA(ACRES) =        8.3         PEAK FLOW RATE(CFS) =      14.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   3.23
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =    1154.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.35
  RAINFALL INTENSITY(INCH/HR) =   6.33
  TOTAL STREAM AREA(ACRES) =     8.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    610.00
  DOWNSTREAM ELEVATION(FEET) =    609.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.782
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.130
  SUBAREA RUNOFF(CFS) =      0.42
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.42

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    609.00  DOWNSTREAM(FEET) =    604.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1077.00   CHANNEL SLOPE =  0.0046
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.947
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.00
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.59
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =  30.66
  Tc(MIN.) =  39.44
  SUBAREA AREA(ACRES) =     1.30       SUBAREA RUNOFF(CFS) =    1.04
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       1.20

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   0.63
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =    1127.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    223.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  604.00  DOWNSTREAM ELEVATION(FEET) =  572.00
  STREET LENGTH(FEET) =   549.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.41
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
```

```
    HALFSTREET FLOOD WIDTH(FEET) =    3.72
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.44
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.02
  STREET FLOW TRAVEL TIME(MIN.) =   2.06   Tc(MIN.) =  41.50
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.884
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .1500
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.280
  SUBAREA AREA(ACRES) =    1.50      SUBAREA RUNOFF(CFS) =    0.42
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =       1.58

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   4.34
  FLOW VELOCITY(FEET/SEC.) =  4.37   DEPTH*VELOCITY(FT*FT/SEC.) =   1.05
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    223.00 =    1676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    572.00  DOWNSTREAM(FEET) =    556.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00   CHANNEL SLOPE =  0.0920
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.840
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.70
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.89
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   1.53
  Tc(MIN.) =  43.03
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.23
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.292
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       1.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   1.98
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  43.03
  RAINFALL INTENSITY(INCH/HR) =   1.84
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.77

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.38
  TOTAL AREA(ACRES) =     0.70   TOTAL RUNOFF(CFS) =      6.40

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   7.38
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       14.40     6.35        6.326         8.30
      2        1.77    43.03        1.840         3.30
      3        6.40     5.00        7.377         0.70

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.95     5.00       7.377
      2       20.15     6.35       6.326
      3        7.56    43.03       1.840

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.15   Tc(MIN.) =    6.35
  TOTAL AREA(ACRES) =       12.3
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    556.00  DOWNSTREAM(FEET) =    548.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   234.00   CHANNEL SLOPE =  0.0342
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.650
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.50
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.21
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.22
  Tc(MIN.) =   7.56
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.69
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.326
  TOTAL AREA(ACRES) =       12.6         PEAK FLOW RATE(CFS) =      23.22

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.27   FLOW VELOCITY(FEET/SEC.) =   3.36
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       23.22     7.56       5.650       12.60
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       10.98    13.12       3.960        6.60
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      29.55       7.56        5.650
      2      27.26      13.12        3.960

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.55   Tc(MIN.) =    7.56
  TOTAL AREA(ACRES) =       19.2

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    548.00  DOWNSTREAM(FEET) =    520.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1172.00   CHANNEL SLOPE =  0.0239
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.918
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      35.09
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.38
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   5.77
  Tc(MIN.) =  13.34
  SUBAREA AREA(ACRES) =     6.90       SUBAREA RUNOFF(CFS) =   11.08
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.370
  TOTAL AREA(ACRES) =       26.1         PEAK FLOW RATE(CFS) =      37.79

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.39   FLOW VELOCITY(FEET/SEC.) =   3.46
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    204.00 =    3256.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.918
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3780
  SUBAREA AREA(ACRES) =    6.90   SUBAREA RUNOFF(CFS) =   11.08
  TOTAL AREA(ACRES) =       33.0   TOTAL RUNOFF(CFS) =      48.88
  TC(MIN.) =  13.34

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    520.00  DOWNSTREAM(FEET) =    498.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1511.00   CHANNEL SLOPE =  0.0146
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.950
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
```

```
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      63.34
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.42
  AVERAGE FLOW DEPTH(FEET) =   0.58   TRAVEL TIME(MIN.) =   7.37
  Tc(MIN.) =  20.70
  SUBAREA AREA(ACRES) =    23.90       SUBAREA RUNOFF(CFS) =   28.91
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.391
  TOTAL AREA(ACRES) =       56.9         PEAK FLOW RATE(CFS) =      65.72

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.60   FLOW VELOCITY(FEET/SEC.) =   3.44
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.950
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3970
  SUBAREA AREA(ACRES) =   24.00   SUBAREA RUNOFF(CFS) =   29.03
  TOTAL AREA(ACRES) =       80.9   TOTAL RUNOFF(CFS) =      94.75
  TC(MIN.) =  20.70

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  20.70
  RAINFALL INTENSITY(INCH/HR) =   2.95
  TOTAL STREAM AREA(ACRES) =    80.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     94.75

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.38
  TOTAL AREA(ACRES) =    36.50   TOTAL RUNOFF(CFS) =     37.20

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   7.38
  TOTAL STREAM AREA(ACRES) =    36.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       94.75    20.70        2.950         80.90
      2       37.20     5.00        7.377         36.50

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       60.08     5.00       7.377
      2      109.63    20.70       2.950

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     109.63   Tc(MIN.) =   20.70
  TOTAL AREA(ACRES) =      117.4
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    549.00
  DOWNSTREAM ELEVATION(FEET) =    546.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.612
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.195
  SUBAREA RUNOFF(CFS) =      0.43
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.43

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    546.00  DOWNSTREAM(FEET) =    499.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1676.00   CHANNEL SLOPE =  0.0280
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.499
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.90
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.54
  AVERAGE FLOW DEPTH(FEET) =   0.09   TRAVEL TIME(MIN.) =  18.17
  Tc(MIN.) =  26.79
  SUBAREA AREA(ACRES) =     4.40       SUBAREA RUNOFF(CFS) =    4.51
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        4.6         PEAK FLOW RATE(CFS) =       4.71

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   1.80
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1776.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.499
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    4.30   SUBAREA RUNOFF(CFS) =    4.41
  TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =       9.12
  TC(MIN.) =  26.79
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.9  TC(MIN.) =     26.79
  PEAK FLOW RATE(CFS)   =       9.12
============================================================================
============================================================================
```

END OF RATIONAL METHOD ANALYSIS

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2006 Advanced Engineering Software (aes)
             Ver. 2.0 Release Date: 06/01/2005  License ID 1499

                           Analysis prepared by:

                       Kimley-Horn & Associates, Inc
                           401 B Street Suite 600
                            San Diego, CA 92101
                                619-234-9411

 ************************** DESCRIPTION OF STUDY **************************
* Hawano existing 100-year storm                                           *
* P = 3.0"                                                                 *
* 5/4/2010 AG                                                              *
 ***************************************************************************

  FILE NAME: 100EXHAW.DAT
  TIME/DATE OF STUDY: 16:29 05/04/2010
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    608.00
  DOWNSTREAM ELEVATION(FEET) =    602.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.261
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.837
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.28

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    602.00  DOWNSTREAM(FEET) =    578.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   288.00   CHANNEL SLOPE =  0.0833
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.634
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.87
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.19
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   2.19
  Tc(MIN.) =   8.45
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    1.15
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       1.39

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   2.74
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.45
  RAINFALL INTENSITY(INCH/HR) =   5.63
  TOTAL STREAM AREA(ACRES) =     0.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.39

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.90
  TOTAL AREA(ACRES) =    16.90   TOTAL RUNOFF(CFS) =     53.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   7.90
  TOTAL STREAM AREA(ACRES) =    16.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        1.39     8.45        5.634          0.60
      2       53.30     5.00        7.904         16.90

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       54.12     5.00       7.904
      2       39.38     8.45       5.634

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      54.12   Tc(MIN.) =    5.00
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    578.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   387.00   CHANNEL SLOPE =  0.0310
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.067
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      57.45
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.81
  AVERAGE FLOW DEPTH(FEET) =   0.78   TRAVEL TIME(MIN.) =   0.95
  Tc(MIN.) =   5.95
  SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =    6.66
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.401
  TOTAL AREA(ACRES) =       19.8         PEAK FLOW RATE(CFS) =      56.06

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.77   FLOW VELOCITY(FEET/SEC.) =   6.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.067
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4016
  SUBAREA AREA(ACRES) =    2.30   SUBAREA RUNOFF(CFS) =    6.66
  TOTAL AREA(ACRES) =       22.1   TOTAL RUNOFF(CFS) =      62.72
  TC(MIN.) =   5.95

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.95
  RAINFALL INTENSITY(INCH/HR) =   7.07
  TOTAL STREAM AREA(ACRES) =    22.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     62.72

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.90
  TOTAL AREA(ACRES) =    19.40   TOTAL RUNOFF(CFS) =     23.50

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    586.00  DOWNSTREAM(FEET) =    566.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   405.00   CHANNEL SLOPE =  0.0494
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.522
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.84
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.89
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.74
  Tc(MIN.) =   6.74
  SUBAREA AREA(ACRES) =     1.00       SUBAREA RUNOFF(CFS) =    2.67
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.166
  TOTAL AREA(ACRES) =       20.4         PEAK FLOW RATE(CFS) =      23.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   3.81
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    103.00 =     405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.522
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.1772
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.67
  TOTAL AREA(ACRES) =       21.4   TOTAL RUNOFF(CFS) =      24.74
  TC(MIN.) =   6.74

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.74
  RAINFALL INTENSITY(INCH/HR) =   6.52
  TOTAL STREAM AREA(ACRES) =    21.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     24.74

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       62.72     5.95        7.067         22.10
      2       24.74     6.74        6.522         21.40

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       84.56     5.95       7.067
      2       82.62     6.74       6.522

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      84.56   Tc(MIN.) =    5.95
  TOTAL AREA(ACRES) =       43.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
```

```
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    566.00  DOWNSTREAM(FEET) =    539.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1250.00   CHANNEL SLOPE =  0.0216
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.835
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      94.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.37
  AVERAGE FLOW DEPTH(FEET) =   0.65   TRAVEL TIME(MIN.) =   4.76
  Tc(MIN.) =  10.71
  SUBAREA AREA(ACRES) =     9.60       SUBAREA RUNOFF(CFS) =   19.03
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.313
  TOTAL AREA(ACRES) =       53.1         PEAK FLOW RATE(CFS) =      84.56

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.62   FLOW VELOCITY(FEET/SEC.) =   4.26
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2015.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.835
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3275
  SUBAREA AREA(ACRES) =    9.50   SUBAREA RUNOFF(CFS) =   18.83
  TOTAL AREA(ACRES) =       62.6   TOTAL RUNOFF(CFS) =      99.12
  TC(MIN.) =  10.71

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    539.00  DOWNSTREAM(FEET) =    525.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   680.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.215
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     107.67
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.46
  AVERAGE FLOW DEPTH(FEET) =   0.71   TRAVEL TIME(MIN.) =   2.54
  Tc(MIN.) =  13.25
  SUBAREA AREA(ACRES) =     9.90       SUBAREA RUNOFF(CFS) =   17.11
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.339
  TOTAL AREA(ACRES) =       72.5         PEAK FLOW RATE(CFS) =     103.52

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.69   FLOW VELOCITY(FEET/SEC.) =   4.43
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    2695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.215
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3474
  SUBAREA AREA(ACRES) =   10.00   SUBAREA RUNOFF(CFS) =   17.28
  TOTAL AREA(ACRES) =       82.5   TOTAL RUNOFF(CFS) =     120.81
  TC(MIN.) =  13.25

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    604.00
  DOWNSTREAM ELEVATION(FEET) =    585.00
  ELEVATION DIFFERENCE(FEET) =     19.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.765
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.210
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.30

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    575.00  DOWNSTREAM(FEET) =    549.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   699.00   CHANNEL SLOPE =  0.0372
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.413
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.34
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.77
  AVERAGE FLOW DEPTH(FEET) =   0.09   TRAVEL TIME(MIN.) =   6.58
  Tc(MIN.) =  12.34
  SUBAREA AREA(ACRES) =     3.20       SUBAREA RUNOFF(CFS) =    5.79
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       5.97

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   2.24
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.413
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    3.20   SUBAREA RUNOFF(CFS) =    5.79
  TOTAL AREA(ACRES) =        6.5   TOTAL RUNOFF(CFS) =      11.76
  TC(MIN.) =  12.34

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    549.00  DOWNSTREAM(FEET) =    547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00   CHANNEL SLOPE =  0.0158
```

```
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.246
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.08
  AVERAGE FLOW DEPTH(FEET) =   0.23   TRAVEL TIME(MIN.) =   0.76
  Tc(MIN.) =  13.10
  SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.17
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        6.6         PEAK FLOW RATE(CFS) =      11.76

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.23   FLOW VELOCITY(FEET/SEC.) =   2.06
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  13
----------------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.90
  TOTAL AREA(ACRES) =     7.80   TOTAL RUNOFF(CFS) =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    570.00  DOWNSTREAM(FEET) =    558.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.0462
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.780
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.09
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.23
  AVERAGE FLOW DEPTH(FEET) =   0.20   TRAVEL TIME(MIN.) =   1.34
  Tc(MIN.) =   6.34
  SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =    1.39
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.244
  TOTAL AREA(ACRES) =        8.3         PEAK FLOW RATE(CFS) =      14.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   3.23
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =    1154.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.34
  RAINFALL INTENSITY(INCH/HR) =   6.78
  TOTAL STREAM AREA(ACRES) =     8.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.40

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    610.00
  DOWNSTREAM ELEVATION(FEET) =    609.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.782
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.496
  SUBAREA RUNOFF(CFS) =      0.45
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    609.00  DOWNSTREAM(FEET) =    604.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1077.00   CHANNEL SLOPE =  0.0046
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.130
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.61
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =  29.40
  Tc(MIN.) =  38.18
  SUBAREA AREA(ACRES) =     1.30       SUBAREA RUNOFF(CFS) =    1.14
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       1.31

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   0.63
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =    1127.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    223.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  604.00  DOWNSTREAM ELEVATION(FEET) =  572.00
  STREET LENGTH(FEET) =   549.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.54
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
```

```
    HALFSTREET FLOOD WIDTH(FEET) =    4.22
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.37
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.04
  STREET FLOW TRAVEL TIME(MIN.) =   2.09   Tc(MIN.) =  40.27
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.058
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .1500
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.280
  SUBAREA AREA(ACRES) =    1.50      SUBAREA RUNOFF(CFS) =    0.46
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =       1.73

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   4.72
  FLOW VELOCITY(FEET/SEC.) =  4.40   DEPTH*VELOCITY(FT*FT/SEC.) =   1.09
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    223.00 =    1676.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    572.00  DOWNSTREAM(FEET) =    556.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00   CHANNEL SLOPE =  0.0920
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.007
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.82
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   1.60
  Tc(MIN.) =  41.87
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.25
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.292
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =       1.93

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   1.89
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  41.87
  RAINFALL INTENSITY(INCH/HR) =   2.01
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.93

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.90
  TOTAL AREA(ACRES) =     0.70   TOTAL RUNOFF(CFS) =      6.40

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   7.90
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       14.40     6.34        6.780         8.30
      2        1.93    41.87        2.007         3.30
      3        6.40     5.00        7.904         0.70

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.98     5.00       7.904
      2       20.18     6.34       6.780
      3        7.82    41.87       2.007

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.18   Tc(MIN.) =    6.34
  TOTAL AREA(ACRES) =       12.3
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    211.00 =    1850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    556.00  DOWNSTREAM(FEET) =    548.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   234.00   CHANNEL SLOPE =  0.0342
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.057
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.56
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.22
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   1.21
  Tc(MIN.) =   7.55
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.75
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.311
  TOTAL AREA(ACRES) =       12.6         PEAK FLOW RATE(CFS) =      23.76

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.27   FLOW VELOCITY(FEET/SEC.) =   3.44
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       23.76     7.55       6.057       12.60
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    203.00 =    2084.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF     Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       11.76    13.10       4.246        6.60
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     894.00 FEET.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      30.54       7.55        6.057
      2      28.42      13.10        4.246

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      30.54   Tc(MIN.) =    7.55
  TOTAL AREA(ACRES) =       19.2

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    548.00  DOWNSTREAM(FEET) =    520.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1172.00   CHANNEL SLOPE =  0.0239
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.216
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      36.51
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.43
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   5.69
  Tc(MIN.) =  13.25
  SUBAREA AREA(ACRES) =     6.90       SUBAREA RUNOFF(CFS) =   11.93
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.362
  TOTAL AREA(ACRES) =       26.1         PEAK FLOW RATE(CFS) =      39.88

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.40   FLOW VELOCITY(FEET/SEC.) =   3.54
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    204.00 =    3256.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.216
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3723
  SUBAREA AREA(ACRES) =    6.90   SUBAREA RUNOFF(CFS) =   11.93
  TOTAL AREA(ACRES) =       33.0   TOTAL RUNOFF(CFS) =      51.80
  TC(MIN.) =  13.25

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    520.00  DOWNSTREAM(FEET) =    498.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1511.00   CHANNEL SLOPE =  0.0146
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.177
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
```

```
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      67.43
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.45
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   7.29
  Tc(MIN.) =  20.54
  SUBAREA AREA(ACRES) =    23.90       SUBAREA RUNOFF(CFS) =   31.13
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.388
  TOTAL AREA(ACRES) =       56.9         PEAK FLOW RATE(CFS) =      70.17

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.62   FLOW VELOCITY(FEET/SEC.) =   3.49
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.177
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3946
  SUBAREA AREA(ACRES) =   24.00   SUBAREA RUNOFF(CFS) =   31.26
  TOTAL AREA(ACRES) =       80.9   TOTAL RUNOFF(CFS) =     101.43
  TC(MIN.) =  20.54

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  20.54
  RAINFALL INTENSITY(INCH/HR) =   3.18
  TOTAL STREAM AREA(ACRES) =    80.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    101.43

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.00   RAIN INTENSITY(INCH/HOUR) =  7.90
  TOTAL AREA(ACRES) =    36.50   TOTAL RUNOFF(CFS) =     37.20

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.00
  RAINFALL INTENSITY(INCH/HR) =   7.90
  TOTAL STREAM AREA(ACRES) =    36.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1      101.43    20.54        3.177         80.90
      2       37.20     5.00        7.904         36.50

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       61.89     5.00       7.904
      2      116.39    20.54       3.177

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     116.39   Tc(MIN.) =   20.54
  TOTAL AREA(ACRES) =      117.4
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    205.00 =    4767.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    549.00
  DOWNSTREAM ELEVATION(FEET) =    546.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.612
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.566
  SUBAREA RUNOFF(CFS) =      0.46
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.46

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    546.00  DOWNSTREAM(FEET) =    499.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1676.00   CHANNEL SLOPE =  0.0280
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.738
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.12
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.62
  AVERAGE FLOW DEPTH(FEET) =   0.09   TRAVEL TIME(MIN.) =  17.26
  Tc(MIN.) =  25.88
  SUBAREA AREA(ACRES) =     4.40       SUBAREA RUNOFF(CFS) =    4.94
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.410
  TOTAL AREA(ACRES) =        4.6         PEAK FLOW RATE(CFS) =       5.16

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   1.93
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1776.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.738
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
  SUBAREA AREA(ACRES) =    4.30   SUBAREA RUNOFF(CFS) =    4.83
  TOTAL AREA(ACRES) =        8.9   TOTAL RUNOFF(CFS) =       9.99
  TC(MIN.) =  25.88
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.9  TC(MIN.) =     25.88
  PEAK FLOW RATE(CFS)   =       9.99
============================================================================
============================================================================
```

END OF RATIONAL METHOD ANALYSIS

Kimley-Horn
and Associates, Inc.

**Appendix C ~ 100 Yr. Storm Drain Analysis for Offsite Bypass System**

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2006 Advanced Engineering Software (aes)
             Ver. 2.0 Release Date: 06/01/2005  License ID 1499

                          Analysis prepared by:

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1111111111111111111111111111111111111111111111111111111111111111111111111111

 ************************** DESCRIPTION OF STUDY **************************
* Hawano Subdivision                                                       *
* 100 Yr. Offsite Bypass System                                            *
* 11/28/2011 KDC                                                           *
 ***************************************************************************

  FILE NAME: C:\HAWANO\HAWOFF.DAT
  TIME/DATE OF STUDY: 08:50 11/29/2011
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE   1000.00 TO NODE   1000.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  13.60   RAIN INTENSITY(INCH/HOUR) =  4.15
  TOTAL AREA(ACRES) =    17.00   TOTAL RUNOFF(CFS) =     23.70

****************************************************************************
  FLOW PROCESS FROM NODE   1000.00 TO NODE   1001.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   552.00  DOWNSTREAM(FEET) =   539.80
  FLOW LENGTH(FEET) =   725.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.18
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.70
  PIPE TRAVEL TIME(MIN.) =   1.19    Tc(MIN.) =  14.79
```

```
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1001.00 =     725.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1001.00 TO NODE   1001.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  14.79
  RAINFALL INTENSITY(INCH/HR) =   3.93
  TOTAL STREAM AREA(ACRES) =    17.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.70

****************************************************************************
  FLOW PROCESS FROM NODE   1010.00 TO NODE   1010.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  23.30   RAIN INTENSITY(INCH/HOUR) =  2.93
  TOTAL AREA(ACRES) =    64.50   TOTAL RUNOFF(CFS) =     63.70

****************************************************************************
  FLOW PROCESS FROM NODE   1010.00 TO NODE   1001.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   540.00  DOWNSTREAM(FEET) =   539.80
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  33.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.74
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      63.70
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =  23.40
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1001.00 =      45.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1001.00 TO NODE   1001.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  23.40
  RAINFALL INTENSITY(INCH/HR) =   2.92
  TOTAL STREAM AREA(ACRES) =    64.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     63.70

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1        23.70    14.79        3.928        17.00
     2        63.70    23.40        2.921        64.50

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        63.96    14.79       3.928
     2        81.33    23.40       2.921

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      81.33   Tc(MIN.) =   23.40
  TOTAL AREA(ACRES) =       81.5
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1001.00 =     725.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE   1001.00 TO NODE   1002.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   539.80  DOWNSTREAM(FEET) =   538.40
  FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  36.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.45
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       81.33
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =  23.97
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1002.00 =    1015.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1002.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  23.97
  RAINFALL INTENSITY(INCH/HR) =   2.88
  TOTAL STREAM AREA(ACRES) =    81.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     81.33

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1002.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  30.80   RAIN INTENSITY(INCH/HOUR) =  2.45
  TOTAL AREA(ACRES) =   102.30   TOTAL RUNOFF(CFS) =     89.10

+--------------------------------------------------------------------------+
| Anticipated Runoff from Adjacent Site                                    |
| Reference Otay Business Park TM 5505                                     |
| Environmental Log 93-19-006W                                             |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1002.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  30.80
  RAINFALL INTENSITY(INCH/HR) =   2.45
  TOTAL STREAM AREA(ACRES) =   102.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     89.10

  ** CONFLUENCE DATA **
  STREAM      RUNOFF      Tc      INTENSITY      AREA
  NUMBER       (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1        81.33    23.97        2.876        81.50
     2        89.10    30.80        2.447       102.30

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

  ** PEAK FLOW RATE TABLE **
  STREAM      RUNOFF      Tc      INTENSITY
  NUMBER       (CFS)    (MIN.)   (INCH/HOUR)
     1       150.67    23.97       2.876
     2       158.28    30.80       2.447

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =     158.28   Tc(MIN.) =   30.80
  TOTAL AREA(ACRES) =      183.8
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1002.00 =    1015.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1003.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   538.40  DOWNSTREAM(FEET) =   531.70
  FLOW LENGTH(FEET) =  1330.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  43.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.35
  ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     158.28
  PIPE TRAVEL TIME(MIN.) =   2.14    Tc(MIN.) =  32.94
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1003.00 =    2345.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1003.00 TO NODE   1003.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  32.94
  RAINFALL INTENSITY(INCH/HR) =   2.34
  TOTAL STREAM AREA(ACRES) =   183.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    158.28

****************************************************************************
  FLOW PROCESS FROM NODE   1020.00 TO NODE   1020.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  33.40   RAIN INTENSITY(INCH/HOUR) =  2.32
  TOTAL AREA(ACRES) =    37.20   TOTAL RUNOFF(CFS) =     30.20

****************************************************************************
  FLOW PROCESS FROM NODE   1020.00 TO NODE   1003.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   538.70  DOWNSTREAM(FEET) =   531.70
  FLOW LENGTH(FEET) =  1400.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.86
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.20
  PIPE TRAVEL TIME(MIN.) =   3.40    Tc(MIN.) =  36.80
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1003.00 =    1445.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1003.00 TO NODE   1003.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  36.80
  RAINFALL INTENSITY(INCH/HR) =   2.18
  TOTAL STREAM AREA(ACRES) =    37.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     30.20

  ** CONFLUENCE DATA **
  STREAM      RUNOFF       Tc       INTENSITY       AREA
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
```

```
     1       158.28    32.94        2.343        183.80
     2        30.20    36.80        2.181         37.20

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

  ** PEAK FLOW RATE TABLE **
  STREAM      RUNOFF      Tc      INTENSITY
  NUMBER       (CFS)    (MIN.)   (INCH/HOUR)
     1       185.32    32.94       2.343
     2       177.57    36.80       2.181

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     185.32   Tc(MIN.) =   32.94
  TOTAL AREA(ACRES) =      221.0
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1003.00 =    2345.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1003.00 TO NODE   1004.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   531.70  DOWNSTREAM(FEET) =   526.80
  FLOW LENGTH(FEET) =   990.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  63.0 INCH PIPE IS  47.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.65
  ESTIMATED PIPE DIAMETER(INCH) =  63.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     185.32
  PIPE TRAVEL TIME(MIN.) =   1.55    Tc(MIN.) =  34.49
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1004.00 =    3335.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1004.00 TO NODE   1004.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  34.49
  RAINFALL INTENSITY(INCH/HR) =   2.27
  TOTAL STREAM AREA(ACRES) =   221.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    185.32

****************************************************************************
  FLOW PROCESS FROM NODE   1004.00 TO NODE   1004.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  15.40   RAIN INTENSITY(INCH/HOUR) =  3.83
  TOTAL AREA(ACRES) =     0.70   TOTAL RUNOFF(CFS) =      2.40

+--------------------------------------------------------------------------+
| Anticipated Flows from Adjacent Site                                     |
| See Otay Business Park TM 5505                                           |
| Environmental Log 93-19-006W                                             |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE   1004.00 TO NODE   1004.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  15.40
  RAINFALL INTENSITY(INCH/HR) =   3.83
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.40
```

```
** CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER       (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       185.32     34.49       2.274        221.00
    2         2.40     15.40       3.826          0.70

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

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF      Tc       INTENSITY
NUMBER       (CFS)     (MIN.)   (INCH/HOUR)
    1       112.56     15.40       3.826
    2       186.74     34.49       2.274

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     186.74   Tc(MIN.) =   34.49
TOTAL AREA(ACRES) =      221.7
LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1004.00 =    3335.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE   1004.00 TO NODE   1005.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   526.80  DOWNSTREAM(FEET) =   525.50
FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  57.0 INCH PIPE IS  42.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.17
ESTIMATED PIPE DIAMETER(INCH) =  57.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     186.74
PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =  34.68
LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1005.00 =    3485.00 FEET.

+--------------------------------------------------------------------------+
| END ANALYSIS OF DRAINAGE SYSTEM                                          |
| FOR OFFSITE BYPASS FLOWS                                                 |
|                                                                          |
+--------------------------------------------------------------------------+
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)     =      221.7  TC(MIN.) =     34.68
PEAK FLOW RATE(CFS)   =     186.74
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

# 4'x6' Box- Node 1004 to 1005

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Discharge |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.013 | |
| Channel Slope | 0.00500 | ft/ft |
| Normal Depth | 4.00 | ft |
| Bottom Width | 6.00 | ft |

## Results

| | | |
|---|---|---|
| Discharge | 277.85 | ft³/s |
| Flow Area | 24.00 | ft² |
| Wetted Perimeter | 14.00 | ft |
| Hydraulic Radius | 1.71 | ft |
| Top Width | 6.00 | ft |
| Critical Depth | 4.05 | ft |
| Critical Slope | 0.00483 | ft/ft |
| Velocity | 11.58 | ft/s |
| Velocity Head | 2.08 | ft |
| Specific Energy | 6.08 | ft |
| Froude Number | 1.02 | |
| Flow Type | Supercritical | |

$Q_{DESIGN} = 186.7$ CFS

$Q_{CAPACITY} = 277.9$ CFS

$Q_{DESIGN} < Q_{CAPACITY}$

$\therefore$ BOX CULVERT OKAY

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Downstream Velocity | Infinity | ft/s |
| Upstream Velocity | Infinity | ft/s |
| Normal Depth | 4.00 | ft |
| Critical Depth | 4.05 | ft |
| Channel Slope | 0.00500 | ft/ft |
| Critical Slope | 0.00483 | ft/ft |

# 60" SD-Node 1002 To 1003

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Full Flow Capacity |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.013 | |
| Channel Slope | 0.00500 | ft/ft |
| Normal Depth | 5.00 | ft |
| Diameter | 5.00 | ft |
| Discharge | 184.15 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Discharge | 184.15 | $ft^3/s$ |
| Normal Depth | 5.00 | ft |
| Flow Area | 19.63 | $ft^2$ |
| Wetted Perimeter | 15.71 | ft |
| Hydraulic Radius | 1.25 | ft |
| Top Width | 0.00 | ft |
| Critical Depth | 3.89 | ft |
| Percent Full | 100.0 | % |
| Critical Slope | 0.00556 | ft/ft |
| Velocity | 9.38 | ft/s |
| Velocity Head | 1.37 | ft |
| Specific Energy | 6.37 | ft |
| Froude Number | 0.00 | |
| Maximum Discharge | 198.09 | $ft^3/s$ |
| Discharge Full | 184.15 | $ft^3/s$ |
| Slope Full | 0.00500 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |

# 60" SD-Node 1002 To 1003

## GVF Output Data

| | | |
|---|---|---|
| Normal Depth Over Rise | 100.00 | % |
| Downstream Velocity | Infinity | ft/s |
| Upstream Velocity | Infinity | ft/s |
| Normal Depth | 5.00 | ft |
| Critical Depth | 3.89 | ft |
| Channel Slope | 0.00500 | ft/ft |
| Critical Slope | 0.00556 | ft/ft |

$Q_{100}$ DESIGN = 158.3 CFS

$Q_{CAPACITY}$ @ MIN. SLOPE OF 0.5% = 184.2 CFS

$Q_{100}$ DESIGN < $Q_{CAPACITY}$

∴ 60" STORM DRAIN IS OK

# 66" SD- NODE 1003 TO 1004

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Full Flow Capacity |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.013 | |
| Channel Slope | 0.00500 | ft/ft |
| Normal Depth | 5.50 | ft |
| Diameter | 5.50 | ft |
| Discharge | 237.44 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Discharge | 237.44 | $ft^3/s$ |
| Normal Depth | 5.50 | ft |
| Flow Area | 23.76 | $ft^2$ |
| Wetted Perimeter | 17.28 | ft |
| Hydraulic Radius | 1.38 | ft |
| Top Width | 0.00 | ft |
| Critical Depth | 4.31 | ft |
| Percent Full | 100.0 | % |
| Critical Slope | 0.00547 | ft/ft |
| Velocity | 9.99 | ft/s |
| Velocity Head | 1.55 | ft |
| Specific Energy | 7.05 | ft |
| Froude Number | 0.00 | |
| Maximum Discharge | 255.42 | $ft^3/s$ |
| Discharge Full | 237.44 | $ft^3/s$ |
| Slope Full | 0.00500 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |

# 66" SD- NODE 1003 TO 1004

## GVF Output Data

| | | |
|---|---|---|
| Normal Depth Over Rise | 100.00 | % |
| Downstream Velocity | Infinity | ft/s |
| Upstream Velocity | Infinity | ft/s |
| Normal Depth | 5.50 | ft |
| Critical Depth | 4.31 | ft |
| Channel Slope | 0.00500 | ft/ft |
| Critical Slope | 0.00547 | ft/ft |

$Q_{100}$ DESIGN= 185.3 CFS

$Q_{CAPACITY}$ @ MIN SLOPE OF 0.5% = 237.4 CFS

$Q_{100}$ DESIGN < $Q_{CAPACITY}$

∴ 66" STORM DRAIN OKAY

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**Appendix D ~ Detention Analysis Results**

RATIONAL METHOD HYDROGRAPH PROGRAM
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RUN DATE 4/13/2011
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 8 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 86.3 ACRES
RUNOFF COEFFICIENT 0.81
PEAK DISCHARGE 408.1 CFS

| | |
|---|---|
| TIME (MIN) = 0 | DISCHARGE (CFS) = 0 |
| TIME (MIN) = 8 | DISCHARGE (CFS) = 12.5 |
| TIME (MIN) = 16 | DISCHARGE (CFS) = 12.7 |
| TIME (MIN) = 24 | DISCHARGE (CFS) = 13.1 |
| TIME (MIN) = 32 | DISCHARGE (CFS) = 13.3 |
| TIME (MIN) = 40 | DISCHARGE (CFS) = 13.8 |
| TIME (MIN) = 48 | DISCHARGE (CFS) = 14 |
| TIME (MIN) = 56 | DISCHARGE (CFS) = 14.5 |
| TIME (MIN) = 64 | DISCHARGE (CFS) = 14.8 |
| TIME (MIN) = 72 | DISCHARGE (CFS) = 15.3 |
| TIME (MIN) = 80 | DISCHARGE (CFS) = 15.7 |
| TIME (MIN) = 88 | DISCHARGE (CFS) = 16.3 |
| TIME (MIN) = 96 | DISCHARGE (CFS) = 16.7 |
| TIME (MIN) = 104 | DISCHARGE (CFS) = 17.5 |
| TIME (MIN) = 112 | DISCHARGE (CFS) = 17.9 |
| TIME (MIN) = 120 | DISCHARGE (CFS) = 18.9 |
| TIME (MIN) = 128 | DISCHARGE (CFS) = 19.4 |
| TIME (MIN) = 136 | DISCHARGE (CFS) = 20.6 |
| TIME (MIN) = 144 | DISCHARGE (CFS) = 21.3 |
| TIME (MIN) = 152 | DISCHARGE (CFS) = 22.9 |
| TIME (MIN) = 160 | DISCHARGE (CFS) = 23.8 |
| TIME (MIN) = 168 | DISCHARGE (CFS) = 25.8 |
| TIME (MIN) = 176 | DISCHARGE (CFS) = 27 |
| TIME (MIN) = 184 | DISCHARGE (CFS) = 30 |
| TIME (MIN) = 192 | DISCHARGE (CFS) = 31.8 |
| TIME (MIN) = 200 | DISCHARGE (CFS) = 36.5 |
| TIME (MIN) = 208 | DISCHARGE (CFS) = 39.5 |
| TIME (MIN) = 216 | DISCHARGE (CFS) = 48.3 |
| TIME (MIN) = 224 | DISCHARGE (CFS) = 55 |
| TIME (MIN) = 232 | DISCHARGE (CFS) = 80.8 |
| TIME (MIN) = 240 | DISCHARGE (CFS) = 113.8 |
| TIME (MIN) = 248 | DISCHARGE (CFS) = 408.1 |
| TIME (MIN) = 256 | DISCHARGE (CFS) = 64.8 |
| TIME (MIN) = 264 | DISCHARGE (CFS) = 43.4 |
| TIME (MIN) = 272 | DISCHARGE (CFS) = 33.9 |
| TIME (MIN) = 280 | DISCHARGE (CFS) = 28.4 |
| TIME (MIN) = 288 | DISCHARGE (CFS) = 24.7 |
| TIME (MIN) = 296 | DISCHARGE (CFS) = 22.1 |
| TIME (MIN) = 304 | DISCHARGE (CFS) = 20 |
| TIME (MIN) = 312 | DISCHARGE (CFS) = 18.4 |
| TIME (MIN) = 320 | DISCHARGE (CFS) = 17.1 |
| TIME (MIN) = 328 | DISCHARGE (CFS) = 16 |
| TIME (MIN) = 336 | DISCHARGE (CFS) = 15 |
| TIME (MIN) = 344 | DISCHARGE (CFS) = 14.2 |
| TIME (MIN) = 352 | DISCHARGE (CFS) = 13.5 |
| TIME (MIN) = 360 | DISCHARGE (CFS) = 12.9 |
| TIME (MIN) = 368 | DISCHARGE (CFS) = 0 |

# Hydrograph Report

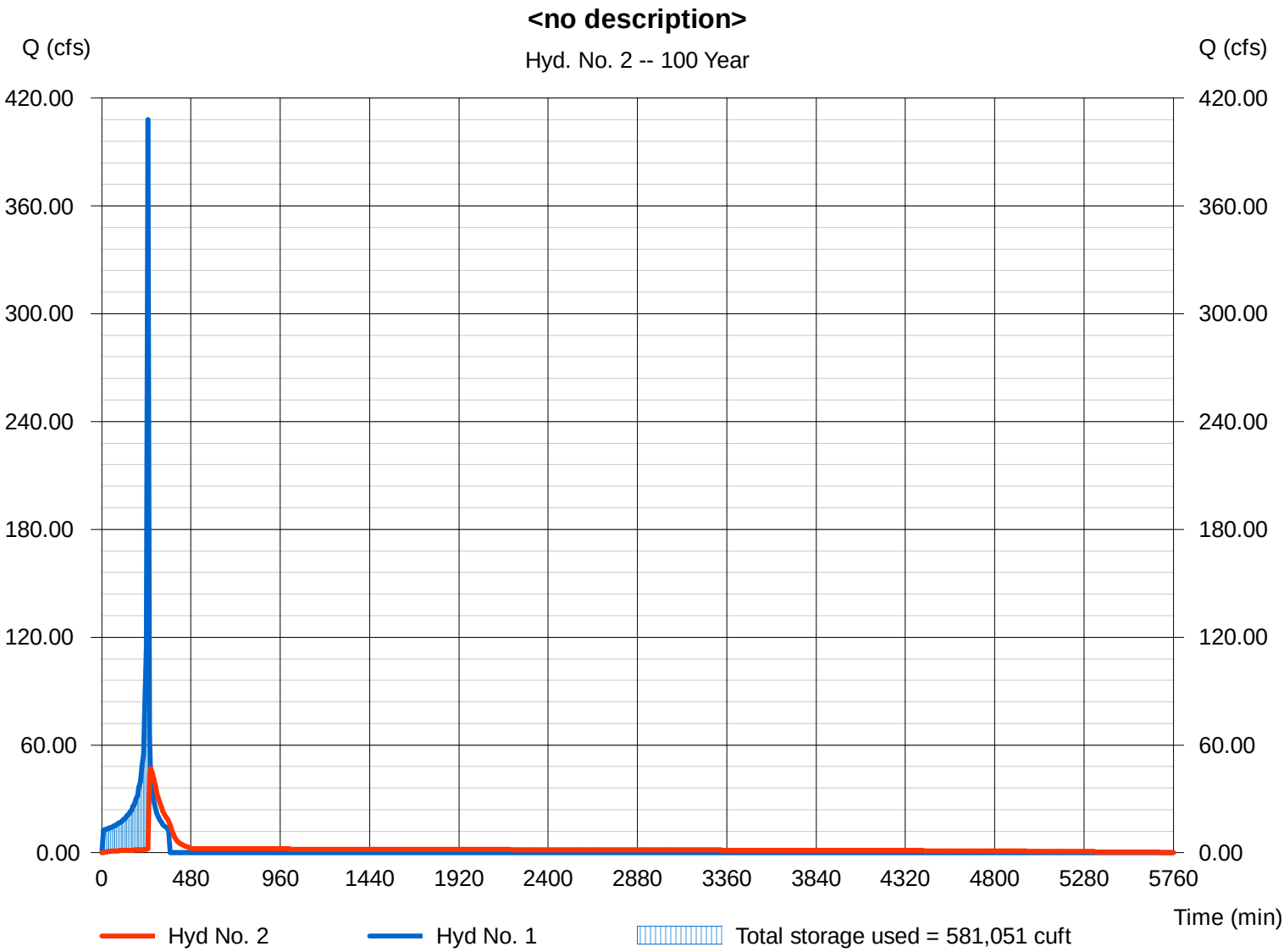
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Jun 7, 2012

## Hyd. No. 2

<no description>

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 46.93 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 264 min |
| Time interval | = | 8 min | Hyd. volume | = | 756,434 cuft |
| Inflow hyd. No. | = | 1 - 100 yr - 6 hour inflow | Max. Elevation | = | 503.06 ft |
| Reservoir name | = | Detention Basin | Max. Storage | = | 581,051 cuft |

Storage Indication method used.



# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Jun 7, 2012

## Pond No. 1 - Detention Basin

## Pond Data

**Contours -** User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 494.00 ft

## Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 494.00 | 60 | 0 | 0 |
| 2.00 | 496.00 | 65,690 | 45,152 | 45,152 |
| 4.00 | 498.00 | 70,450 | 136,099 | 181,251 |
| 6.00 | 500.00 | 75,371 | 145,779 | 327,030 |
| 8.00 | 502.00 | 80,030 | 155,362 | 482,392 |
| 10.00 | 504.00 | 108,900 | 188,172 | 670,563 |

## Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 24.00 | 5.60 | 0.00 | 0.00 |
| **Span (in)** | = 24.00 | 5.60 | 0.00 | 0.00 |
| **No. Barrels** | = 2 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 494.00 | 494.01 | 0.00 | 0.00 |
| **Length (ft)** | = 100.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.50 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | Yes | No | No |

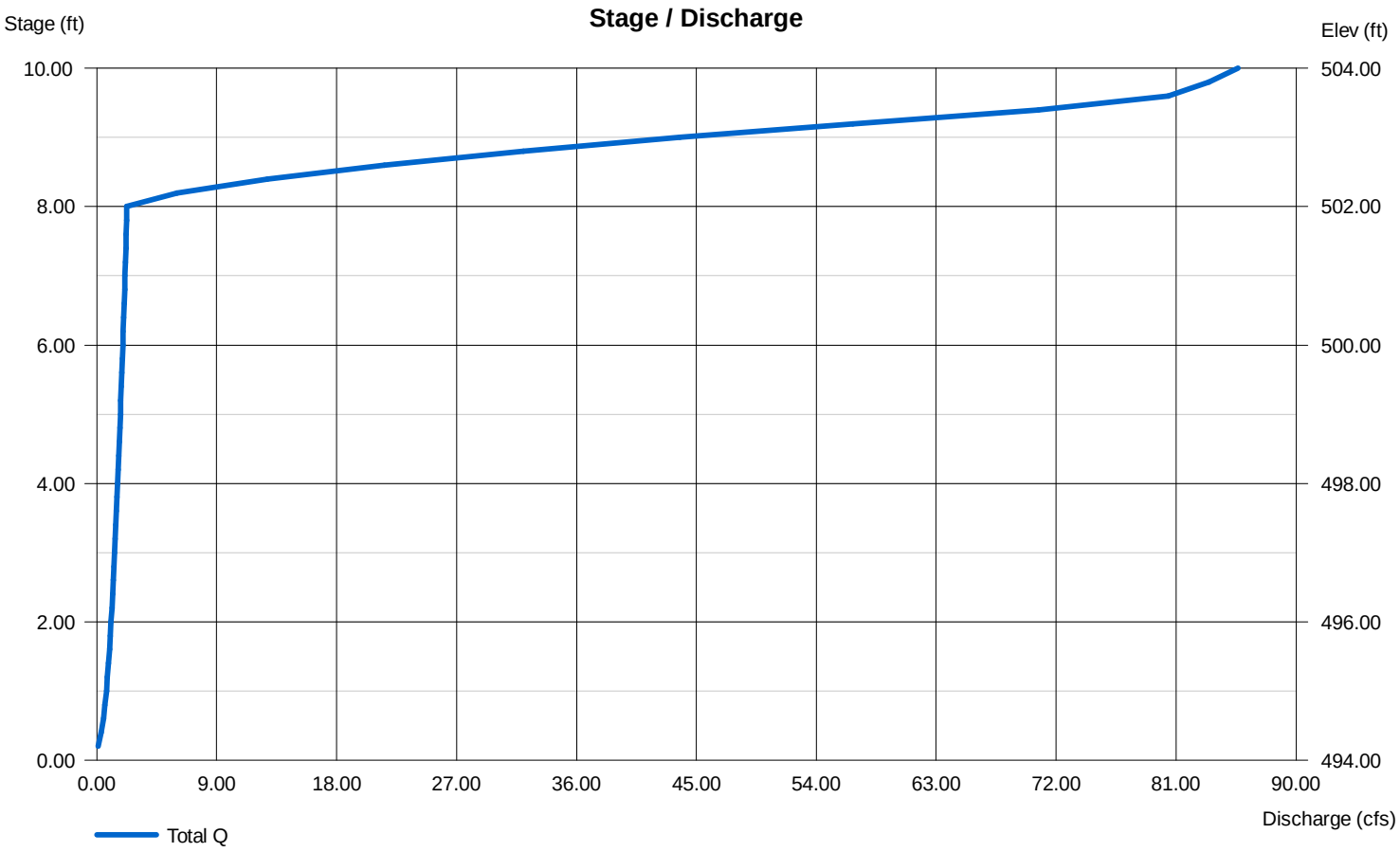
## Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 12.57 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 502.00 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = Riser | --- | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



**Appendix E ~ 100-Year Headwater Calculations**

# Culvert Calculator Report
## Worksheet-1

Solve For: Headwater Elevation

| Culvert Summary | | | | | |
|---|---|---|---|---|---|
| Allowable HW Elevation | 496.43 | ft | Headwater Depth/Height | 0.57 | |
| Computed Headwater Elev | 493.19 | ft | Discharge | 400.00 | cfs |
| Inlet Control HW Elev. | 493.15 | ft | Tailwater Elevation | 491.73 | ft |
| Outlet Control HW Elev. | 493.19 | ft | Control Type | Entrance Control | |

| Grades | | | | | |
|---|---|---|---|---|---|
| Upstream Invert | 490.93 | ft | Downstream Invert | 490.43 | ft |
| Length | 100.00 | ft | Constructed Slope | 0.005000 | ft/ft |

| Hydraulic Profile | | | | | |
|---|---|---|---|---|---|
| Profile | S2 | | Depth, Downstream | 1.25 | ft |
| Slope Type | Steep | | Normal Depth | 1.25 | ft |
| Flow Regime | Supercritical | | Critical Depth | 1.41 | ft |
| Velocity Downstream | 7.64 | ft/s | Critical Slope | 0.003449 | ft/ft |

| Section | | | | | |
|---|---|---|---|---|---|
| Section Shape | Box | | Mannings Coefficient | 0.013 | |
| Section Material | Concrete | | Span | 7.00 | ft |
| Section Size | 7 x 4 ft | | Rise | 4.00 | ft |
| Number Sections | 6 | | | | |

| Outlet Control Properties | | | | | |
|---|---|---|---|---|---|
| Outlet Control HW Elev. | 493.19 | ft | Upstream Velocity Head | 0.71 | ft |
| Ke | 0.20 | | Entrance Loss | 0.14 | ft |

| Inlet Control Properties | | | | | |
|---|---|---|---|---|---|
| Inlet Control HW Elev. | 493.15 | ft | Flow Control | N/A | |
| Inlet Type | 90° headwall w 45° bevels | | Area Full | 168.0 | ft² |
| K | 0.49500 | | HDS 5 Chart | 10 | |
| M | 0.66700 | | HDS 5 Scale | 2 | |
| C | 0.03140 | | Equation Form | 2 | |
| Y | 0.82000 | | | | |

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**Appendix F ~ Preliminary Rip Rap Size**

**Preliminary Rip Rap Sizing**

| Outlet Structure | $Q_{100}$ (cfs) | $V_{100}$ (fps) | T (ft) | Rock Class | Dimensions |
|---|---|---|---|---|---|
| **Offsite 4'H x 6'W Box Culvert** | 186.7 | 11.6 | 3.5 | (1/2) ton | 18'W x 24'L |
| **(2) 24" RCP from Detention Basin** | 17.1 | 6 | 1.1 | No. 2 backing | 15'W x 20'L |