

# **Appendix H**

## **Amanda Estates Drainage Study**

Hunsaker & Associates 2015

AMANDA ESTATES  
Drainage Study

City of Escondido, CA

Prepared for

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W.O. 2321-0018

Preparation/Revision Date:  
February 12, 2015



Handwritten signature of Raymond L. Martin in black ink.

Raymond L. Martin, RCE # 48670  
Hunsaker & Associates  
San Diego, Inc.

2/12/15

Date

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## 1 Scope

The purpose of this study is to provide flood control calculations in support of a proposed subdivision of land for creation of 21 single family residential lots in the City of Escondido, CA. This report will provide preliminary calculations for existing and proposed runoff for the 50-year frequency storm event.



## 2 Existing Conditions

The Amanda Estates project site is 11.22 acres, located in the City of Escondido, California. The property is located west of the proposed extension of Amanda Lane, north of Gamble Lane, east of Greenwood Place, and south of Blackhawk Glen. See Vicinity Map below.

The pre-project topography varies from 842 to 743 MSL. A hill is currently centrally located with a residential home at its peak. An access road to the home connects it to Amanda Lane. Drainage is radial down the slope. However, runoff from the eastern half of the site is eventually directed towards the southeast within both man-made and naturally occurring drainage channels. This runoff sheet flows in a southeasterly

direction and confluences with runoff generated by areas south and east of the project boundary. A riser located at the northwest corner of Gamble Lane and Eucalyptus Avenue collects this flow and directs it south within the existing 48" storm drain on Eucalyptus Avenue. The eastern portion of the site is within the Hamilton Lane storm drain basin as designated in the City of Escondido Drainage Master Plan.

The western portion of the site slopes towards the west. Runoff from this area is collected by storm drain facilities located at the rear of two existing residential lots along Greenwood Place. Cumulative, both lots receive runoff from approximately 5.4 acres of the Amanda Estates project area. This area is part of the Del Dios Avenue Drainage Basin as designated in the City's Drainage Master Plan.

The 'Existing Condition' hydrologic model included within this report includes analysis of areas south of Gamble Lane. These areas were included to analyze the existing storm drain since developed flows from Amanda Estates are proposed to be added to the Gamble Lane storm drain system. Existing and proposed condition hydraulic analysis on the existing system is included in Appendix 4.

### **Hydrologic and Geotechnical Characteristics;**

The project is situated at the divide of two drainage basin; Hamilton Lane and Del Dios Avenue. The Hamilton Lane Drainage Basin is tributary to Felicita Creek and Lake Hodges, as part of the San Dieguito Hydrologic Unit, Hodges Hydrologic Area, and the Felicita Creek Hydrologic Subarea (basin number 905.24).

The Del Dios Drainage Basin is tributary to the Escondido Creek within the Escondido Creek Hydrologic Area (basin number 904.6) within the Carlsbad Watershed.

The site is mapped within a Zone X, described to be an area 'determined to be outside the 0.2% annual chance floodplain'.

According to the NRCS Web Spoil Survey website, the onsite soils consist of Fallbrook sandy loam which are within the hydrologic soil type C classification. The hydrologic calculations included herein assumed a more conservative type D soil which will result in higher runoffs.

### **3 Project Description**

The proposed development will create 21 single residential lots. Amanda Lane, which provides access to the site from Gamble Lane, will also be improved between the site and Gamble Lane. Project improvements will include sidewalks and streets as well as include storm drain facilities and utilities such as water and sewer. The site layout of Amanda Estates will have an interior looped street which connects to Amanda Lane.

Additional offsite improvements associated with the site will include street improvements in the vicinity of the Gamble Lane- Amanda Lane intersection which includes storm drain, curb and street pavement.

#### **Drainage Routing and Improvements:**

The proposed onsite site design will cut and flatten the existing hill. Street grades will vary between 4-12% and slope towards the southwest corner of the site. A small portion of area which previously drained west is diverted east in the proposed design. Approximately 2.68 acres will be diverted from the west (Del Dios Drainage Basin) to the east (Hamilton Lane Drainage Basin). The reduction in area towards the west will reduce the amount of runoff currently flowing onto two residential lots along Greenwood Place. No impervious areas will be added to the westward-draining areas. On the other hand, the increase in acreage towards the east will increase the unmitigated peak flow amounts. Therefore, an onsite detention basin is proposed to attenuate the peak developed flows draining to the southeast corner of the site and will reduce them below existing condition. This basin will also serve water quality and hydromodification uses as described in the *Major Stormwater Management Plans (SWMP) for Amanda Estates* (February 2015).

Currently, drainage from the areas west of Amanda Lane generally sheet flows across Amanda Lane towards the east then southeast till it reaches a riser located at the northwest corner of Gamble Lane and Eucalyptus Avenue. The improvements of Amanda Lane will slightly alter this existing drainage scenario. For example, offsite flows from the northern portion of existing Amanda Lane will be collected with catch basin inlets and be conveyed together with developed 'Amanda Estate' flows south towards the existing storm drain on Gamble Lane. These offsite flows are from approximately 4 acres of land east of Amanda Lane. The drainage patterns associated with the southern portion of Amanda Lane will remain unaffected by the Amanda Estate project and continue to flow overland towards the northwest corner of Gamble Lane and Eucalyptus Avenue and continue downstream in the existing 48" storm drain.

A small portion of Amanda Lane at the entrance to the developed site will include a bioretention swale along the east side of the road to collect and treat the 85<sup>th</sup> percentile rainfall event as described in the *SWMP for Amanda Estates*.

The proposed onsite detention basin was sized to attenuate peak flows to below existing condition in order to insure that the existing downstream storm drain infrastructure along Gamble Lane and Eucalyptus Avenue was not compromised. Appendix 4 includes the preliminary hydraulic analysis for the Gamble Lane storm drain system. The analysis routes the proposed flows to verify adequacy of the existing system.

## 4 Methodology

### 4.1 *Hydrology*

The Rational Method as described in the June 2003 San Diego County Hydrology Manual (SDCHM), Section 3, was used for the hydrologic calculations for this project. The Rational Method formula is expressed as follows:

$$Q = C I A$$

$$I = 7.44P_6T_c^{-0.645}$$

$$T_c = T_t + T_i$$

$$T_t = (11.9 * L^3 / \Delta E)^{0.385}$$

Where:

Q = Peak discharge, in cubic feet per second (cfs).

C = Runoff coefficient, proportion of the rainfall that runs off the surface. The C coefficient was obtained from Table 3-1 of the SDCHM. It has no units and is based on the soil group and the development type for the drainage sub-area.

A = Drainage area contributing to the design location (ac).

I = Average rainfall intensity (in/hr). The formula can be found on Figure 3-2 of the SDCHM.

P<sub>6</sub> = 6-hour precipitation (in). This value was taken from the 6-hour isopluvial maps found in Appendix B of the SDCHM.

T<sub>i</sub> = Initial time of concentration, from Table 3-2 of the SDCHM.

T<sub>t</sub> = Travel time (min), from Figure 3-4 of the SDCHM.

L = Longest flow path distance (mi).

ΔE = Change in elevation along flowpath (ft).

### 4.2 *Hydraulics*

In order to provide adequate flood control, increases in peak flow rates at the outfall location for this site were mitigated using the design of the proposed basin. Mitigation within the basin was modeled using RickRatHydro as an input to Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2011.

RickRatHydro was used to produce a hydrograph for the project drainage areas, based on the area, time of concentration, P<sub>6</sub> value, runoff coefficient, and peak flow rate.

The hydrograph was then imported into Hydraflow Hydrographs and was routed through the proposed basin by using an iteration of outlet structures, until the resulting outlet structure provided a flow rate to the outfall that was equal to or less than that during the existing condition, and the water surface elevation was below the top of the basin.

Storm drain analysis along Gamble Lane was prepared using a separate extension of AutoCAD Civil 3D 2011 named Storm Sewer. Pre and Post condition hydraulic analysis was prepared to verify storm drain adequacy. See Appendix 4 for results.

## 5 Results and Conclusions

**Table 1 Rational Method Results**

Existing Condition		
Location/Node #*	Area (ac)	50-Year Peak Flow (cfs)
102	2.89	3.54
112	2.51	3.10
263	28.85	34.63
504	15.49	21.44
Totals:	49.74	62.71
Proposed Condition		
Location/Node #*	Area (ac)	50-Year Peak Flow (cfs)
102	1.43	1.70
112	1.32	1.42
263	18.83	22.30
513	28.10	27.39
Totals:	49.68	52.81

\*Nodes locations are shown the hydrology exhibits in Appendix 2.

As illustrated above, development of the Amanda Estates project site will decrease the cumulative amount of peak flow by approximately 10 cfs. This reduction can be attributed to the site design and its inclusion of a detention to reduce peak flow amounts below existing condition. Therefore, the proposed drainage design and peak flow routing by the Amanda Estates project will not adversely affect the existing downstream infrastructures.

Due to the addition of storm drain and flows from Amanda Estates and Amanda Lane, a portion of the existing upper reach of the Gamble storm drain system will be replace/relocated. Hydraulic analysis confirms that the downstream reaches of the existing Gamble Lane are adequate for the proposed flows.

## 6 References

*Plans for the Improvement of Escondido Tract No. 692*, Manitou Engineering Company, September 3, 1998.

*Major Storm Water Management Plan for Amanda Estates*, Hunsaker & Associates San Diego, Inc., February 2015.

San Diego County Hydrology Manual, June 2003.

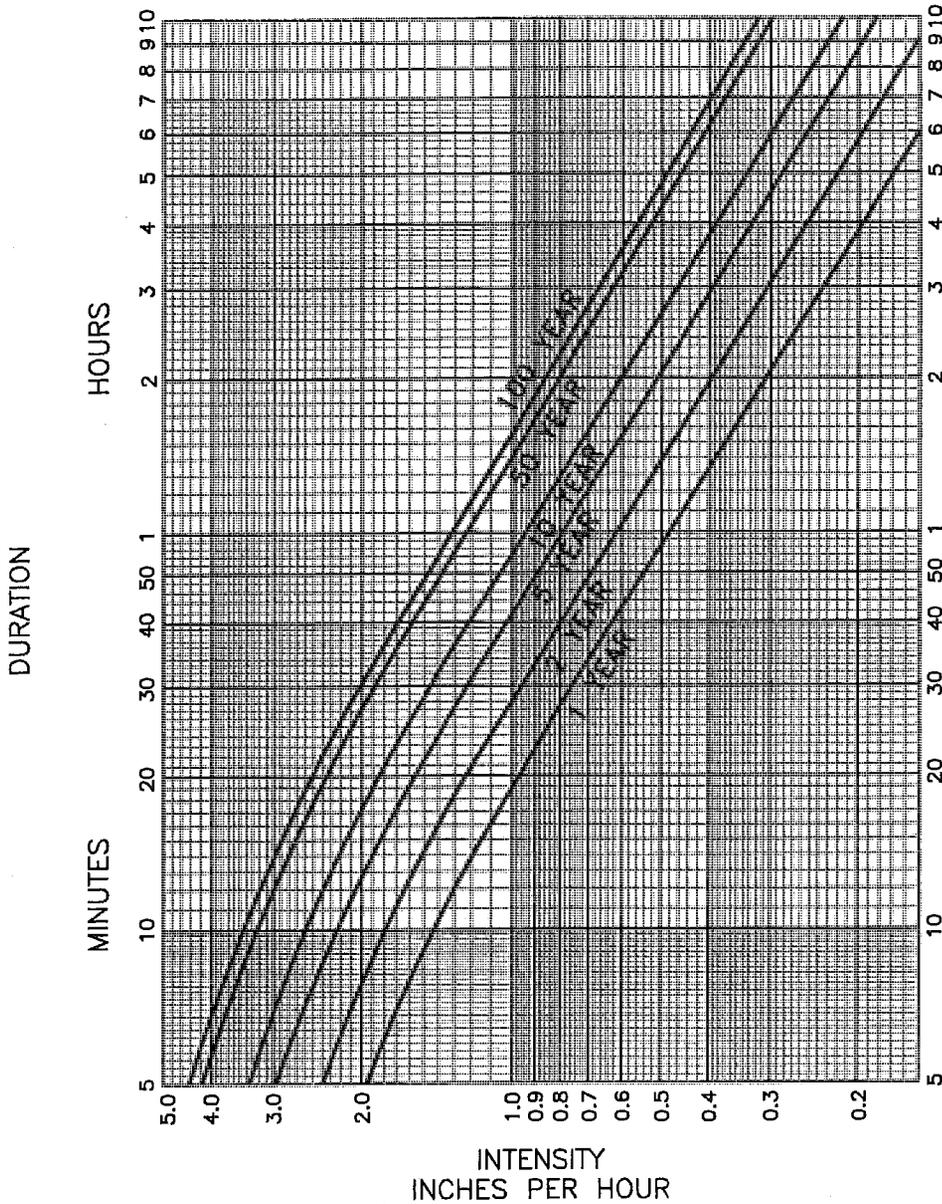
City of San Diego Drainage Design Manual, April 1984

City of Escondido- Design Standards and Standard Drawings, April 2, 2014.

FEMA Flood Insurance Rate Map (Firmette).

## **7 Watershed Information**

- City of Escondido- Runoff intensity duration curves and runoff coefficients.
- FEMA Flood Insurance Rate Map (Firmette).



50 yr  
 5 - 4.2  
 10 - 3.2  
 15 - 2.7  
 20 - 2.35  
 25 - 2.1  
 30 - 1.85  
 40 - 1.60  
 50 - 1.39  
 60 - 1.22

ESCONDIDO RUNOFF COEFFICIENTS

PARKS, GOLF COURSES, CEMETERIES.....	0.25
UNDEVELOPED LAND, OPEN SPACE.....	0.35
RURAL - OVER 1/2 ACRE LOTS.....	0.45
SINGLE FAMILY.....	0.55
MOBILE HOME.....	0.65
MULTIPLE UNITS.....	0.70
COMMERCIAL.....	0.85
INDUSTRIAL.....	0.95

APPROVED:	DATE: 5/6/09
<i>Edward J. Denny</i>	
DIRECTOR OF ENGINEERING SERVICES	
REVISED	APPROVED

**CITY OF ESCONDIDO**  
 DEPARTMENT OF ENGINEERING SERVICES

SCALE:  
 NOT TO SCALE

**RUNNOFF INTENSITY  
 DURATION CURVE**

FIGURE NO.  
 1



00 FT

117°05'37

**CITY OF ESCONDIDO  
060290**

ance Program at 1-800-638-6620.



**MAP SCALE 1" = 500'**

0 250 500 750 1,000 FEET

**NFIP**

PANEL 1076G

**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM**

**FLOOD INSURANCE RATE MAP  
SAN DIEGO COUNTY,  
CALIFORNIA  
AND INCORPORATED AREAS**

**PANEL 1076 OF 2375**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ESCONDIDO, CITY OF	060290	1076	G
SAN DIEGO COUNTY	060284	1076	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



**MAP NUMBER  
06073C1076G**

**MAP REVISED  
MAY 16, 2012**

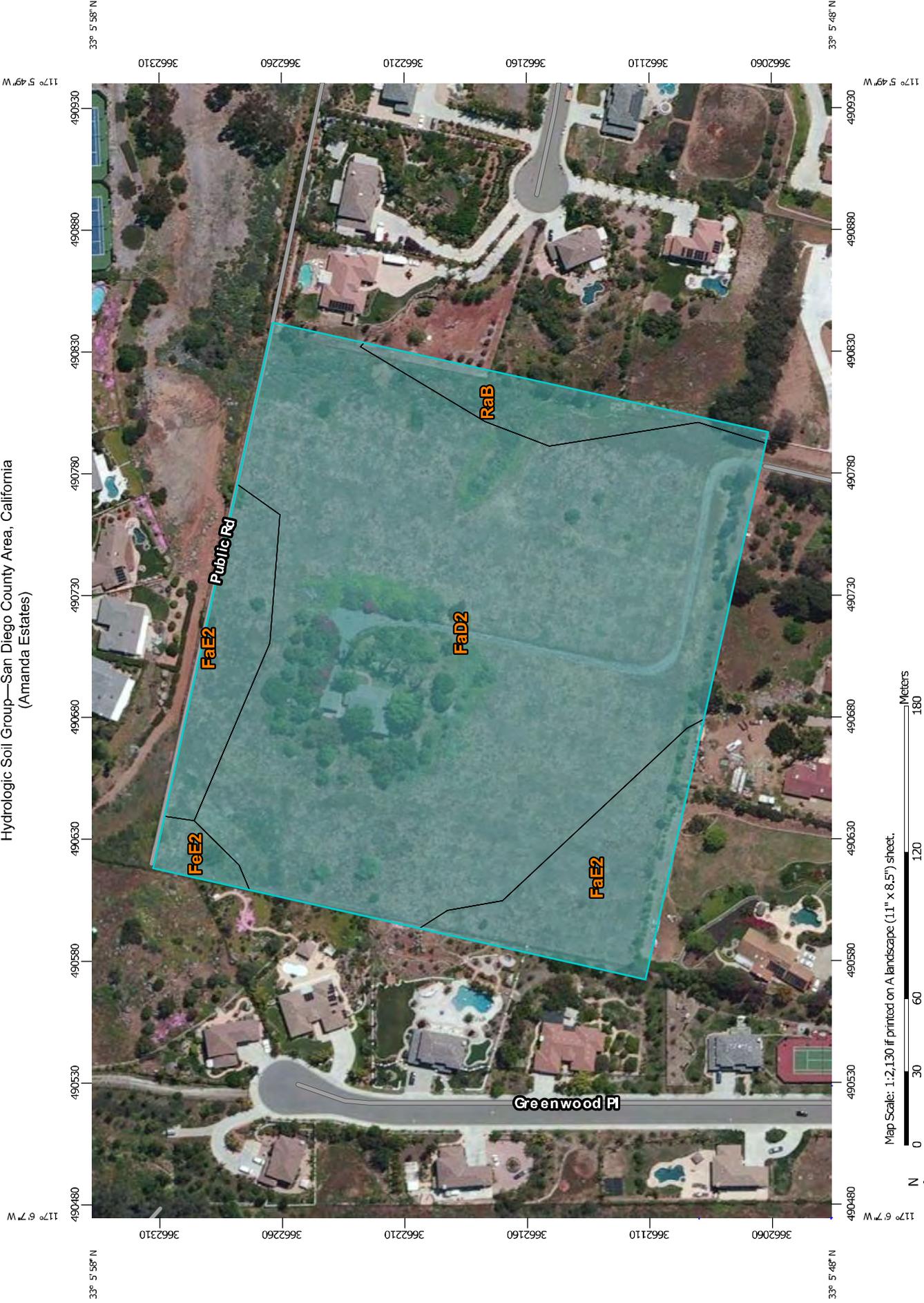
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

## 8 Appendices

## **Appendix 1 - Soils Information**

Hydrologic Soil Group—San Diego County Area, California  
(Amanda Estates)



Map Scale: 1:2,130 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

## MAP LEGEND

**Area of Interest (AOI)**  
 Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

**Soil Rating Lines**

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

**Soil Rating Points**

-  A
-  A/D
-  B
-  B/D

The soil surveys that comprise your AOI were mapped at 1:24,000.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California  
 Survey Area Data: Version 7, Nov 15, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 3, 2010—Jun 19, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## MAP INFORMATION

-  C
  -  C/D
  -  D
  -  Not rated or not available
- Water Features**
-  Streams and Canals
- Transportation**
-  Rails
  -  Interstate Highways
  -  US Routes
  -  Major Roads
  -  Local Roads
- Background**
-  Aerial Photography

## Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded	C	9.3	78.6%
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded	C	1.8	15.5%
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded	C	0.2	1.4%
RaB	Ramona sandy loam, 2 to 5 percent slopes	C	0.5	4.6%
<b>Totals for Area of Interest</b>			<b>11.8</b>	<b>100.0%</b>

## **Appendix 2 - Hydrology Calculations and Exhibits**

# EXISTING CONDITION

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003,1985,1981 HYDROLOGY MANUAL  
(c) Copyright 1982-2010 Advanced Engineering Software (aes)  
Ver. 17.0 Release Date: 07/01/2010 License ID 1239

Analysis prepared by:

Hunsaker & Associates San Diego, Inc.  
9707 Waples Street  
San Diego, CA 92121

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*

\* Amanda Lane \*  
\* EXISTING CONDITION, 50 year return interval \*  
\* W.O. 2321-0018, DLN 1166 \*  
\*\*\*\*\*

FILE NAME: R:\1166\HYD\CALCS\AES\50EX.DAT  
TIME/DATE OF STUDY: 10:49 02/11/2015

-----  
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
-----

USER SPECIFIED STORM EVENT(YEAR) = 50.00  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90  
RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000

\*USER SPECIFIED:

NUMBER OF [TIME,INTENSITY] DATA PAIRS = 9

- 1) 5.000; 4.200
- 2) 10.000; 3.200
- 3) 15.000; 2.700
- 4) 20.000; 2.350
- 5) 25.000; 2.100
- 6) 30.000; 1.850
- 7) 40.000; 1.600
- 8) 50.000; 1.390
- 9) 60.000; 1.220

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF- CROWN TO		STREET-CROSSFALL:		CURB	GUTTER-GEOMETRIES:			MANNING
	WIDTH	CROSSFALL	IN-	OUT-/PARK-		HEIGHT	WIDTH	LIP	
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<<<<<  
-----

\*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00  
UPSTREAM ELEVATION(FEET) = 846.00  
DOWNSTREAM ELEVATION(FEET) = 836.00  
ELEVATION DIFFERENCE(FEET) = 10.00  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.267  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.947  
SUBAREA RUNOFF(CFS) = 0.25  
TOTAL AREA(ACRES) = 0.18 TOTAL RUNOFF(CFS) = 0.25

\*\*\*\*\*

FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 53

-----  
>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<  
-----

>>>>TRAVELTIME THRU SUBAREA<<<<<

```

=====
ELEVATION DATA: UPSTREAM(FEET) = 836.00 DOWNSTREAM(FEET) = 772.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 329.00 CHANNEL SLOPE = 0.1945
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) = 0.25
FLOW VELOCITY(FEET/SEC) = 2.47 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 2.22 Tc(MIN.) = 8.49
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 102.00 = 429.00 FEET.

*****
FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.503
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
SUBAREA AREA(ACRES) = 2.71 SUBAREA RUNOFF(CFS) = 3.32
TOTAL AREA(ACRES) = 2.9 TOTAL RUNOFF(CFS) = 3.54
TC(MIN.) = 8.49

*****
FLOW PROCESS FROM NODE 110.00 TO NODE 111.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 824.00
DOWNSTREAM ELEVATION(FEET) = 814.00
ELEVATION DIFFERENCE(FEET) = 10.00
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.267
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10%, IS USED IN Tc CALCULATION!
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.947
SUBAREA RUNOFF(CFS) = 0.18
TOTAL AREA(ACRES) = 0.13 TOTAL RUNOFF(CFS) = 0.18

*****
FLOW PROCESS FROM NODE 111.00 TO NODE 112.00 IS CODE = 53
-----
>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 814.00 DOWNSTREAM(FEET) = 777.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 263.00 CHANNEL SLOPE = 0.1407
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) = 0.18
FLOW VELOCITY(FEET/SEC) = 2.10 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 2.09 Tc(MIN.) = 8.35
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 112.00 = 363.00 FEET.

*****
FLOW PROCESS FROM NODE 111.00 TO NODE 112.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.529
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
SUBAREA AREA(ACRES) = 2.38 SUBAREA RUNOFF(CFS) = 2.94
TOTAL AREA(ACRES) = 2.5 TOTAL RUNOFF(CFS) = 3.10
TC(MIN.) = 8.35

*****
FLOW PROCESS FROM NODE 221.00 TO NODE 222.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4000
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 831.00
DOWNSTREAM ELEVATION(FEET) = 821.00
ELEVATION DIFFERENCE(FEET) = 10.00

```

URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.849  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.030  
SUBAREA RUNOFF(CFS) = 0.35  
TOTAL AREA(ACRES) = 0.22 TOTAL RUNOFF(CFS) = 0.35

\*\*\*\*\*  
FLOW PROCESS FROM NODE 222.00 TO NODE 223.00 IS CODE = 51  
-----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<  
=====

ELEVATION DATA: UPSTREAM(FEET) = 821.00 DOWNSTREAM(FEET) = 744.00  
CHANNEL LENGTH THRU SUBAREA(FEET) = 807.00 CHANNEL SLOPE = 0.0954  
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 2.000  
MANNING'S FACTOR = 0.020 MAXIMUM DEPTH(FEET) = 2.00  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.193  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.63  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 3.19  
AVERAGE FLOW DEPTH(FEET) = 0.05 TRAVEL TIME(MIN.) = 4.22  
Tc(MIN.) = 10.07  
SUBAREA AREA(ACRES) = 2.21 SUBAREA RUNOFF(CFS) = 2.47  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.355  
TOTAL AREA(ACRES) = 2.4 PEAK FLOW RATE(CFS) = 2.75

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
DEPTH(FEET) = 0.07 FLOW VELOCITY(FEET/SEC.) = 3.79  
LONGEST FLOWPATH FROM NODE 221.00 TO NODE 223.00 = 907.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 223.00 TO NODE 223.00 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.) = 10.07  
RAINFALL INTENSITY(INCH/HR) = 3.19  
TOTAL STREAM AREA(ACRES) = 2.43  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.75

\*\*\*\*\*  
FLOW PROCESS FROM NODE 250.00 TO NODE 251.00 IS CODE = 21  
-----

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

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00  
UPSTREAM ELEVATION(FEET) = 816.30  
DOWNSTREAM ELEVATION(FEET) = 810.00  
ELEVATION DIFFERENCE(FEET) = 6.30  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.310  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.738  
SUBAREA RUNOFF(CFS) = 0.14  
TOTAL AREA(ACRES) = 0.11 TOTAL RUNOFF(CFS) = 0.14

\*\*\*\*\*  
FLOW PROCESS FROM NODE 251.00 TO NODE 252.00 IS CODE = 53  
-----

>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA<<<<<  
=====

ELEVATION DATA: UPSTREAM(FEET) = 810.00 DOWNSTREAM(FEET) = 743.50  
CHANNEL LENGTH THRU SUBAREA(FEET) = 755.00 CHANNEL SLOPE = 0.0881  
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION  
CHANNEL FLOW THRU SUBAREA(CFS) = 0.14  
FLOW VELOCITY(FEET/SEC) = 1.66 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)  
TRAVEL TIME(MIN.) = 7.57 Tc(MIN.) = 14.88  
LONGEST FLOWPATH FROM NODE 250.00 TO NODE 252.00 = 855.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 251.00 TO NODE 252.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<  
=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.712

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4468  
SUBAREA AREA(ACRES) = 3.35 SUBAREA RUNOFF(CFS) = 4.09  
TOTAL AREA(ACRES) = 3.5 TOTAL RUNOFF(CFS) = 4.19  
TC(MIN.) = 14.88

\*\*\*\*\*  
FLOW PROCESS FROM NODE 252.00 TO NODE 223.00 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.) = 14.88  
RAINFALL INTENSITY(INCH/HR) = 2.71  
TOTAL STREAM AREA(ACRES) = 3.46  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.19

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.75	10.07	3.193	2.43
2	4.19	14.88	2.712	3.46

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	5.59	10.07	3.193
2	6.53	14.88	2.712

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 6.53 Tc(MIN.) = 14.88  
TOTAL AREA(ACRES) = 5.9  
LONGEST FLOWPATH FROM NODE 221.00 TO NODE 223.00 = 907.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 223.00 TO NODE 262.00 IS CODE = 31  
-----

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 743.50 DOWNSTREAM(FEET) = 734.50  
FLOW LENGTH(FEET) = 192.00 MANNING'S N = 0.013  
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.8 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 10.70  
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 6.53  
PIPE TRAVEL TIME(MIN.) = 0.30 Tc(MIN.) = 15.18  
LONGEST FLOWPATH FROM NODE 221.00 TO NODE 262.00 = 1099.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 262.00 TO NODE 262.00 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.) = 15.18  
RAINFALL INTENSITY(INCH/HR) = 2.69  
TOTAL STREAM AREA(ACRES) = 5.89  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 6.53

\*\*\*\*\*  
FLOW PROCESS FROM NODE 260.00 TO NODE 261.00 IS CODE = 21  
-----

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

=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00  
UPSTREAM ELEVATION(FEET) = 840.00  
DOWNSTREAM ELEVATION(FEET) = 830.00  
ELEVATION DIFFERENCE(FEET) = 10.00

URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.267  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.947  
SUBAREA RUNOFF(CFS) = 0.36  
TOTAL AREA(ACRES) = 0.26 TOTAL RUNOFF(CFS) = 0.36

\*\*\*\*\*  
FLOW PROCESS FROM NODE 261.00 TO NODE 262.00 IS CODE = 52  
-----

>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 830.00 DOWNSTREAM(FEET) = 734.50  
CHANNEL LENGTH THRU SUBAREA(FEET) = 1028.00 CHANNEL SLOPE = 0.0929  
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION  
CHANNEL FLOW THRU SUBAREA(CFS) = 0.36  
FLOW VELOCITY(FEET/SEC) = 4.57 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)  
TRAVEL TIME(MIN.) = 3.75 Tc(MIN.) = 10.01  
LONGEST FLOWPATH FROM NODE 260.00 TO NODE 262.00 = 1128.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 261.00 TO NODE 262.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.199  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4000  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3987  
SUBAREA AREA(ACRES) = 9.97 SUBAREA RUNOFF(CFS) = 12.76  
TOTAL AREA(ACRES) = 10.2 TOTAL RUNOFF(CFS) = 13.05  
TC(MIN.) = 10.01

\*\*\*\*\*  
FLOW PROCESS FROM NODE 262.00 TO NODE 262.00 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.) = 10.01  
RAINFALL INTENSITY(INCH/HR) = 3.20  
TOTAL STREAM AREA(ACRES) = 10.23  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 13.05

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	6.53	15.18	2.687	5.89
2	13.05	10.01	3.199	10.23

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	18.53	10.01	3.199
2	17.49	15.18	2.687

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 18.53 Tc(MIN.) = 10.01  
TOTAL AREA(ACRES) = 16.1  
LONGEST FLOWPATH FROM NODE 260.00 TO NODE 262.00 = 1128.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 262.00 TO NODE 263.00 IS CODE = 52  
-----

>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 734.50 DOWNSTREAM(FEET) = 704.70  
CHANNEL LENGTH THRU SUBAREA(FEET) = 670.00 CHANNEL SLOPE = 0.0445  
CHANNEL FLOW THRU SUBAREA(CFS) = 18.53  
FLOW VELOCITY(FEET/SEC) = 6.19 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)  
TRAVEL TIME(MIN.) = 1.80 Tc(MIN.) = 11.82  
LONGEST FLOWPATH FROM NODE 260.00 TO NODE 263.00 = 1798.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 262.00 TO NODE 263.00 IS CODE = 81  
-----  
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<  
-----  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.018  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4000  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4019  
SUBAREA AREA(ACRES) = 4.29 SUBAREA RUNOFF(CFS) = 5.18  
TOTAL AREA(ACRES) = 20.4 TOTAL RUNOFF(CFS) = 24.76  
TC(MIN.) = 11.82

\*\*\*\*\*  
FLOW PROCESS FROM NODE 263.00 TO NODE 263.00 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.) = 11.82  
RAINFALL INTENSITY(INCH/HR) = 3.02  
TOTAL STREAM AREA(ACRES) = 20.41  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 24.76

\*\*\*\*\*  
FLOW PROCESS FROM NODE 310.00 TO NODE 311.00 IS CODE = 21  
-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
-----  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4000  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00  
UPSTREAM ELEVATION(FEET) = 824.00  
DOWNSTREAM ELEVATION(FEET) = 814.00  
ELEVATION DIFFERENCE(FEET) = 10.00  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.849  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.030  
SUBAREA RUNOFF(CFS) = 0.34  
TOTAL AREA(ACRES) = 0.21 TOTAL RUNOFF(CFS) = 0.34

\*\*\*\*\*  
FLOW PROCESS FROM NODE 311.00 TO NODE 312.00 IS CODE = 53  
-----  
>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA<<<<<  
-----  
ELEVATION DATA: UPSTREAM(FEET) = 814.00 DOWNSTREAM(FEET) = 751.00  
CHANNEL LENGTH THRU SUBAREA(FEET) = 467.00 CHANNEL SLOPE = 0.1349  
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION  
CHANNEL FLOW THRU SUBAREA(CFS) = 0.34  
FLOW VELOCITY(FEET/SEC) = 2.06 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)  
TRAVEL TIME(MIN.) = 3.78 Tc(MIN.) = 9.63  
LONGEST FLOWPATH FROM NODE 310.00 TO NODE 312.00 = 567.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 311.00 TO NODE 312.00 IS CODE = 81  
-----  
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<  
-----  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.273  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3527  
SUBAREA AREA(ACRES) = 3.72 SUBAREA RUNOFF(CFS) = 4.26  
TOTAL AREA(ACRES) = 3.9 TOTAL RUNOFF(CFS) = 4.54  
TC(MIN.) = 9.63

\*\*\*\*\*  
FLOW PROCESS FROM NODE 312.00 TO NODE 263.00 IS CODE = 52  
-----  
>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA<<<<<  
-----  
ELEVATION DATA: UPSTREAM(FEET) = 751.00 DOWNSTREAM(FEET) = 704.70  
CHANNEL LENGTH THRU SUBAREA(FEET) = 775.00 CHANNEL SLOPE = 0.0597  
CHANNEL FLOW THRU SUBAREA(CFS) = 4.54  
FLOW VELOCITY(FEET/SEC) = 5.04 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)

TRAVEL TIME(MIN.) = 2.56 Tc(MIN.) = 12.20  
LONGEST FLOWPATH FROM NODE 310.00 TO NODE 263.00 = 1342.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 312.00 TO NODE 263.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.980  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4047  
SUBAREA AREA(ACRES) = 4.51 SUBAREA RUNOFF(CFS) = 6.05  
TOTAL AREA(ACRES) = 8.4 TOTAL RUNOFF(CFS) = 10.18  
TC(MIN.) = 12.20

\*\*\*\*\*  
FLOW PROCESS FROM NODE 263.00 TO NODE 263.00 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.) = 12.20  
RAINFALL INTENSITY(INCH/HR) = 2.98  
TOTAL STREAM AREA(ACRES) = 8.44  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 10.18

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	24.76	11.82	3.018	20.41
2	10.18	12.20	2.980	8.44

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	34.62	11.82	3.018
2	34.63	12.20	2.980

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 34.63 Tc(MIN.) = 12.20  
TOTAL AREA(ACRES) = 28.9  
LONGEST FLOWPATH FROM NODE 260.00 TO NODE 263.00 = 1798.00 FEET.

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|  
|  
+-----+

\*\*\*\*\*  
FLOW PROCESS FROM NODE 500.00 TO NODE 501.00 IS CODE = 21

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

=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4900  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 85.00  
UPSTREAM ELEVATION(FEET) = 782.00  
DOWNSTREAM ELEVATION(FEET) = 780.30  
ELEVATION DIFFERENCE(FEET) = 1.70  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.547  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 75.00  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.691  
SUBAREA RUNOFF(CFS) = 0.65  
TOTAL AREA(ACRES) = 0.36 TOTAL RUNOFF(CFS) = 0.65

\*\*\*\*\*  
FLOW PROCESS FROM NODE 501.00 TO NODE 502.00 IS CODE = 61

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<

```

>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 766.00 DOWNSTREAM ELEVATION(FEET) = 751.60
STREET LENGTH(FEET) = 695.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 10.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 6.28
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.31
HALFSTREET FLOOD WIDTH(FEET) = 9.41
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.13
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.98
STREET FLOW TRAVEL TIME(MIN.) = 3.71 Tc(MIN.) = 11.25
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.075
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.461
SUBAREA AREA(ACRES) = 7.90 SUBAREA RUNOFF(CFS) = 11.17
TOTAL AREA(ACRES) = 8.3 PEAK FLOW RATE(CFS) = 11.72

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36 HALFSTREET FLOOD WIDTH(FEET) = 10.00
FLOW VELOCITY(FEET/SEC.) = 3.93 DEPTH*VELOCITY(FT*FT/SEC.) = 1.43
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 502.00 = 780.00 FEET.

*****
FLOW PROCESS FROM NODE 503.00 TO NODE 502.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.075
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4462
SUBAREA AREA(ACRES) = 2.71 SUBAREA RUNOFF(CFS) = 3.33
TOTAL AREA(ACRES) = 11.0 TOTAL RUNOFF(CFS) = 15.05
TC(MIN.) = 11.25

*****
FLOW PROCESS FROM NODE 502.00 TO NODE 504.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 751.00 DOWNSTREAM(FEET) = 730.00
FLOW LENGTH(FEET) = 312.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 9.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 15.18
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 15.05
PIPE TRAVEL TIME(MIN.) = 0.34 Tc(MIN.) = 11.60
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 504.00 = 1092.00 FEET.

*****
FLOW PROCESS FROM NODE 504.00 TO NODE 504.00 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.) = 11.60
RAINFALL INTENSITY(INCH/HR) = 3.04
TOTAL STREAM AREA(ACRES) = 10.97
PEAK FLOW RATE(CFS) AT CONFLUENCE = 15.05

*****
FLOW PROCESS FROM NODE 510.00 TO NODE 511.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

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=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 85.00
UPSTREAM ELEVATION(FEET) = 747.70
DOWNSTREAM ELEVATION(FEET) = 746.00
ELEVATION DIFFERENCE(FEET) = 1.70
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.919
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH = 75.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.616
SUBAREA RUNOFF(CFS) = 0.77
TOTAL AREA(ACRES) = 0.46 TOTAL RUNOFF(CFS) = 0.77

*****
FLOW PROCESS FROM NODE 511.00 TO NODE 512.00 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STANDARD CURB SECTION USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 740.00 DOWNSTREAM ELEVATION(FEET) = 730.00
STREET LENGTH(FEET) = 448.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 15.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.71
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.27
HALFSTREET FLOOD WIDTH(FEET) = 7.26
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.87
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.78
STREET FLOW TRAVEL TIME(MIN.) = 2.60 Tc(MIN.) = 10.52
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.148
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.460
SUBAREA AREA(ACRES) = 4.06 SUBAREA RUNOFF(CFS) = 5.88
TOTAL AREA(ACRES) = 4.5 PEAK FLOW RATE(CFS) = 6.55

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.32 HALFSTREET FLOOD WIDTH(FEET) = 9.45
FLOW VELOCITY(FEET/SEC.) = 3.24 DEPTH*VELOCITY(FT*FT/SEC.) = 1.02
LONGEST FLOWPATH FROM NODE 510.00 TO NODE 512.00 = 533.00 FEET.

*****
FLOW PROCESS FROM NODE 512.00 TO NODE 504.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 731.00 DOWNSTREAM(FEET) = 730.00
FLOW LENGTH(FEET) = 120.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.60
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.55
PIPE TRAVEL TIME(MIN.) = 0.36 Tc(MIN.) = 10.87
LONGEST FLOWPATH FROM NODE 510.00 TO NODE 504.00 = 653.00 FEET.

*****
FLOW PROCESS FROM NODE 504.00 TO NODE 504.00 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.) = 10.87
RAINFALL INTENSITY(INCH/HR) = 3.11

```

TOTAL STREAM AREA(ACRES) = 4.52  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 6.55

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	15.05	11.60	3.040	10.97
2	6.55	10.87	3.113	4.52

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	20.66	10.87	3.113
2	21.44	11.60	3.040

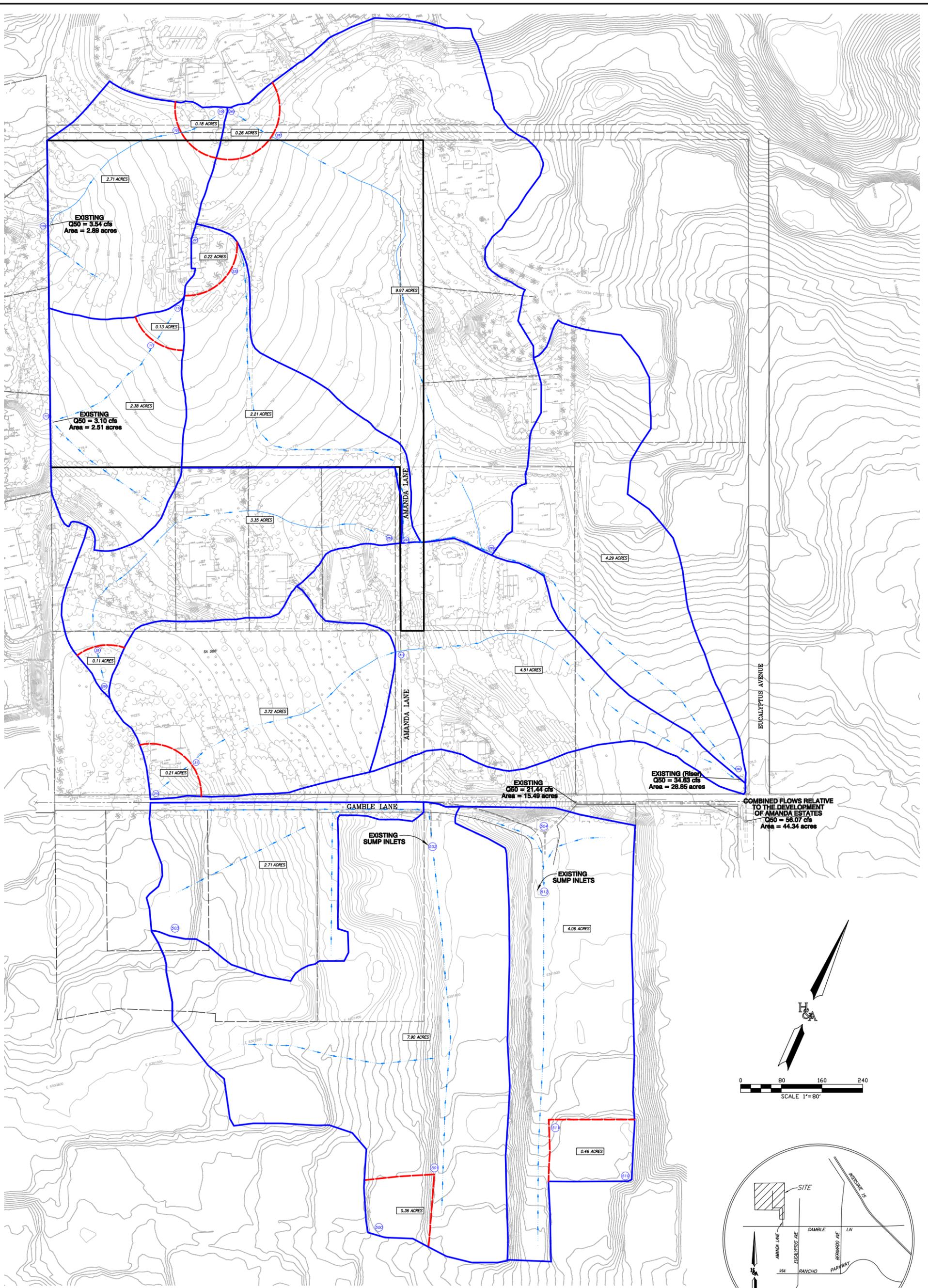
COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 21.44 Tc(MIN.) = 11.60  
TOTAL AREA(ACRES) = 15.5  
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 504.00 = 1092.00 FEET.

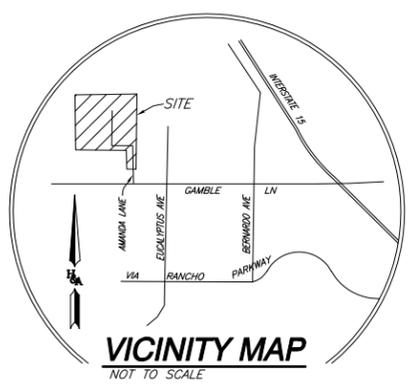
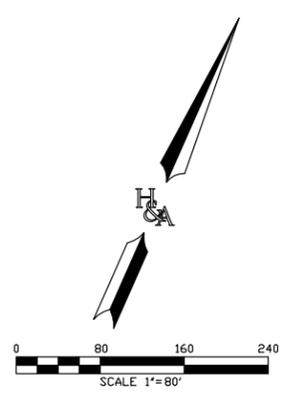
=====  
END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 15.5 TC(MIN.) = 11.60  
PEAK FLOW RATE(CFS) = 21.44

=====  
END OF RATIONAL METHOD ANALYSIS



COMBINED FLOWS RELATIVE TO THE DEVELOPMENT OF AMANDA ESTATES  
 Q50 = 56.07 cfs  
 Area = 44.34 acres



**LEGEND:**

	HYDROLOGY NODE
	WATERSHED AREA
	WATERSHED BOUNDARY
	SUB-WATERSHED BOUNDARY
	FLOW DIRECTION

PREPARED BY:  
  
**HUNSAKER & ASSOCIATES**  
 SAN DIEGO, INC.  
 PLANNING 9707 Waples Street  
 ENGINEERING San Diego, Ca 92121  
 SURVEYING PH858538-4500 FAX858538-1414

EXHIBIT 2  
 DEXESIONING & CONDITION  
 HYDROLOGY MAP  
**AMANDA ESTATES**  
 CITY OF ESCONDIDO, CALIFORNIA 92029

MAP  
**2**  
 OF  
**2**

## **PROPOSED CONDITION**

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003,1985,1981 HYDROLOGY MANUAL  
(c) Copyright 1982-2010 Advanced Engineering Software (aes)  
Ver. 17.0 Release Date: 07/01/2010 License ID 1239

Analysis prepared by:

Hunsaker & Associates San Diego, Inc.  
9707 Waples Street  
San Diego, CA 92121

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*

\* Amanda Lane \*  
\* PROPOSED CONDITION, 50 year return interval \*  
\* W.O. 2321-0018, DLN 1166 \*  
\*\*\*\*\*

FILE NAME: R:\1166\HYD\CALCS\AES\50PR.DAT  
TIME/DATE OF STUDY: 10:52 02/11/2015

-----  
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
-----

USER SPECIFIED STORM EVENT(YEAR) = 50.00  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90  
RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000

\*USER SPECIFIED:

NUMBER OF [TIME,INTENSITY] DATA PAIRS = 9

- 1) 5.000; 4.200
- 2) 10.000; 3.200
- 3) 15.000; 2.700
- 4) 20.000; 2.350
- 5) 25.000; 2.100
- 6) 30.000; 1.850
- 7) 40.000; 1.600
- 8) 50.000; 1.390
- 9) 60.000; 1.220

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF- CROWN TO		STREET-CROSSFALL:		CURB	GUTTER-GEOMETRIES:			MANNING
	WIDTH	CROSSFALL	IN-	OUT-/PARK-		HEIGHT	WIDTH	LIP	
====	(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<<<<<  
-----

\*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00  
UPSTREAM ELEVATION(FEET) = 846.00  
DOWNSTREAM ELEVATION(FEET) = 836.00  
ELEVATION DIFFERENCE(FEET) = 10.00  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.267  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.947  
SUBAREA RUNOFF(CFS) = 0.21  
TOTAL AREA(ACRES) = 0.15 TOTAL RUNOFF(CFS) = 0.21

\*\*\*\*\*

FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 53

-----  
>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<  
-----

>>>>TRAVELTIME THRU SUBAREA<<<<<

=====
ELEVATION DATA: UPSTREAM(FEET) = 836.00 DOWNSTREAM(FEET) = 772.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 380.00 CHANNEL SLOPE = 0.1684
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) = 0.21
FLOW VELOCITY(FEET/SEC) = 2.30 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 2.76 Tc(MIN.) = 9.02
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 102.00 = 480.00 FEET.

\*\*\*\*\*
FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 81
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.396
\*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
SUBAREA AREA(ACRES) = 1.28 SUBAREA RUNOFF(CFS) = 1.52
TOTAL AREA(ACRES) = 1.4 TOTAL RUNOFF(CFS) = 1.70
TC(MIN.) = 9.02

\*\*\*\*\*
FLOW PROCESS FROM NODE 110.00 TO NODE 111.00 IS CODE = 21
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
\*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 791.00
DOWNSTREAM ELEVATION(FEET) = 781.00
ELEVATION DIFFERENCE(FEET) = 10.00
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.267
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.947
SUBAREA RUNOFF(CFS) = 0.25
TOTAL AREA(ACRES) = 0.18 TOTAL RUNOFF(CFS) = 0.25

\*\*\*\*\*
FLOW PROCESS FROM NODE 111.00 TO NODE 112.00 IS CODE = 53
-----

>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 781.00 DOWNSTREAM(FEET) = 777.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 224.00 CHANNEL SLOPE = 0.0179
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) = 0.25
FLOW VELOCITY(FEET/SEC) = 0.75 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 4.99 Tc(MIN.) = 11.26
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 112.00 = 324.00 FEET.

\*\*\*\*\*
FLOW PROCESS FROM NODE 111.00 TO NODE 112.00 IS CODE = 81
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.074
\*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
SUBAREA AREA(ACRES) = 1.14 SUBAREA RUNOFF(CFS) = 1.23
TOTAL AREA(ACRES) = 1.3 TOTAL RUNOFF(CFS) = 1.42
TC(MIN.) = 11.26

+-----+
| |
| |
+-----+

\*\*\*\*\*
FLOW PROCESS FROM NODE 200.00 TO NODE 201.00 IS CODE = 21
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
\*USER SPECIFIED(SUBAREA):

```

USER-SPECIFIED RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 70.00
UPSTREAM ELEVATION(FEET) = 826.35
DOWNSTREAM ELEVATION(FEET) = 825.65
ELEVATION DIFFERENCE(FEET) = 0.70
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.283
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH = 70.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.543
SUBAREA RUNOFF(CFS) = 0.55
TOTAL AREA(ACRES) = 0.28 TOTAL RUNOFF(CFS) = 0.55

*****
FLOW PROCESS FROM NODE 201.00 TO NODE 202.00 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STANDARD CURB SECTION USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 825.65 DOWNSTREAM ELEVATION(FEET) = 767.50
STREET LENGTH(FEET) = 600.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

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

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.18
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.23
HALFSTREET FLOOD WIDTH(FEET) = 5.38
AVERAGE FLOW VELOCITY(FEET/SEC.) = 5.35
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.25
STREET FLOW TRAVEL TIME(MIN.) = 1.87 Tc(MIN.) = 10.15
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.185
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.550
SUBAREA AREA(ACRES) = 1.87 SUBAREA RUNOFF(CFS) = 3.28
TOTAL AREA(ACRES) = 2.2 PEAK FLOW RATE(CFS) = 3.77

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH(FEET) = 7.16
FLOW VELOCITY(FEET/SEC.) = 5.97 DEPTH*VELOCITY(FT*FT/SEC.) = 1.61
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 202.00 = 670.00 FEET.

*****
FLOW PROCESS FROM NODE 202.00 TO NODE 207.00 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.) = 10.15
RAINFALL INTENSITY(INCH/HR) = 3.18
TOTAL STREAM AREA(ACRES) = 2.15
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.77

*****
FLOW PROCESS FROM NODE 205.00 TO NODE 206.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 70.00
UPSTREAM ELEVATION(FEET) = 280.35
DOWNSTREAM ELEVATION(FEET) = 279.65
ELEVATION DIFFERENCE(FEET) = 0.70
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.283
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.543
SUBAREA RUNOFF(CFS) = 0.45

```

TOTAL AREA(ACRES) = 0.23 TOTAL RUNOFF(CFS) = 0.45

\*\*\*\*\*  
FLOW PROCESS FROM NODE 206.00 TO NODE 207.00 IS CODE = 61  
-----

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>(STANDARD CURB SECTION USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 279.65 DOWNSTREAM ELEVATION(FEET) = 267.50  
STREET LENGTH(FEET) = 442.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

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

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.28  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.24  
HALFSTREET FLOOD WIDTH(FEET) = 5.69  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.90  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.70  
STREET FLOW TRAVEL TIME(MIN.) = 2.54 Tc(MIN.) = 10.82  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.118  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .5500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.550  
SUBAREA AREA(ACRES) = 0.97 SUBAREA RUNOFF(CFS) = 1.66  
TOTAL AREA(ACRES) = 1.2 PEAK FLOW RATE(CFS) = 2.06

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH(FEET) = 7.26  
FLOW VELOCITY(FEET/SEC.) = 3.19 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.87  
LONGEST FLOWPATH FROM NODE 205.00 TO NODE 207.00 = 512.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 207.00 TO NODE 207.00 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.) = 10.82  
RAINFALL INTENSITY(INCH/HR) = 3.12  
TOTAL STREAM AREA(ACRES) = 1.20  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.06

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	3.77	10.15	3.185	2.15
2	2.06	10.82	3.118	1.20

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	5.70	10.15	3.185
2	5.74	10.82	3.118

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 5.74 Tc(MIN.) = 10.82  
TOTAL AREA(ACRES) = 3.4  
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 207.00 = 670.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 207.00 TO NODE 212.00 IS CODE = 31  
-----

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 762.00 DOWNSTREAM(FEET) = 761.00

FLOW LENGTH(FEET) = 77.00 MANNING'S N = 0.013  
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 9.1 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.44  
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 5.74  
PIPE TRAVEL TIME(MIN.) = 0.20 Tc(MIN.) = 11.02  
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 212.00 = 747.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 212.00 TO NODE 212.00 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.) = 11.02  
RAINFALL INTENSITY(INCH/HR) = 3.10  
TOTAL STREAM AREA(ACRES) = 3.35  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.74

\*\*\*\*\*

FLOW PROCESS FROM NODE 210.00 TO NODE 211.00 IS CODE = 21

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

-----  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .5500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 70.00  
UPSTREAM ELEVATION(FEET) = 825.35  
DOWNSTREAM ELEVATION(FEET) = 824.65  
ELEVATION DIFFERENCE(FEET) = 0.70  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.283  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 70.00  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.543  
SUBAREA RUNOFF(CFS) = 0.45  
TOTAL AREA(ACRES) = 0.23 TOTAL RUNOFF(CFS) = 0.45

\*\*\*\*\*

FLOW PROCESS FROM NODE 211.00 TO NODE 212.00 IS CODE = 61

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>(STANDARD CURB SECTION USED)<<<<<

-----  
UPSTREAM ELEVATION(FEET) = 824.65 DOWNSTREAM ELEVATION(FEET) = 767.00  
STREET LENGTH(FEET) = 690.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

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

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.67  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.22  
HALFSTREET FLOOD WIDTH(FEET) = 4.78  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 4.83  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 1.07  
STREET FLOW TRAVEL TIME(MIN.) = 2.38 Tc(MIN.) = 10.66  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.134  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .5500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.550  
SUBAREA AREA(ACRES) = 1.42 SUBAREA RUNOFF(CFS) = 2.45  
TOTAL AREA(ACRES) = 1.6 PEAK FLOW RATE(CFS) = 2.84

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.26 HALFSTREET FLOOD WIDTH(FEET) = 6.45  
FLOW VELOCITY(FEET/SEC.) = 5.32 DEPTH\*VELOCITY(FT\*FT/SEC.) = 1.36  
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 212.00 = 760.00 FEET.

```

*****
FLOW PROCESS FROM NODE 212.00 TO NODE 212.00 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.) = 10.66
RAINFALL INTENSITY(INCH/HR) = 3.13
TOTAL STREAM AREA(ACRES) = 1.65
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.84

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 5.74 11.02 3.098 3.35
2 2.84 10.66 3.134 1.65

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 8.52 10.66 3.134
2 8.56 11.02 3.098

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 8.56 Tc(MIN.) = 11.02
TOTAL AREA(ACRES) = 5.0
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 212.00 = 760.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 212.00 TO NODE 217.00 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.) = 11.02
RAINFALL INTENSITY(INCH/HR) = 3.10
TOTAL STREAM AREA(ACRES) = 5.00
PEAK FLOW RATE(CFS) AT CONFLUENCE = 8.56

```

```

*****
FLOW PROCESS FROM NODE 215.00 TO NODE 216.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 70.00
UPSTREAM ELEVATION(FEET) = 825.35
DOWNSTREAM ELEVATION(FEET) = 824.65
ELEVATION DIFFERENCE(FEET) = 0.70
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.283
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 70.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.543
SUBAREA RUNOFF(CFS) = 0.53
TOTAL AREA(ACRES) = 0.27 TOTAL RUNOFF(CFS) = 0.53

```

```

*****
FLOW PROCESS FROM NODE 216.00 TO NODE 217.00 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 824.65 DOWNSTREAM ELEVATION(FEET) = 767.00
STREET LENGTH(FEET) = 738.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

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) = 2.35  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.25  
HALFSTREET FLOOD WIDTH(FEET) = 5.94  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 4.98  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 1.22  
STREET FLOW TRAVEL TIME(MIN.) = 2.47 Tc(MIN.) = 10.75  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.125  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .5500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.550  
SUBAREA AREA(ACRES) = 2.12 SUBAREA RUNOFF(CFS) = 3.64  
TOTAL AREA(ACRES) = 2.4 PEAK FLOW RATE(CFS) = 4.11

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.28 HALFSTREET FLOOD WIDTH(FEET) = 7.87  
FLOW VELOCITY(FEET/SEC.) = 5.57 DEPTH\*VELOCITY(FT\*FT/SEC.) = 1.58  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 217.00 = 808.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 218.00 TO NODE 219.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<  
=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.125  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .2500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4990  
SUBAREA AREA(ACRES) = 0.49 SUBAREA RUNOFF(CFS) = 0.38  
TOTAL AREA(ACRES) = 2.9 TOTAL RUNOFF(CFS) = 4.49  
Tc(MIN.) = 10.75

\*\*\*\*\*  
FLOW PROCESS FROM NODE 217.00 TO NODE 217.00 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.) = 10.75  
RAINFALL INTENSITY(INCH/HR) = 3.12  
TOTAL STREAM AREA(ACRES) = 2.88  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.49

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	8.56	11.02	3.098	5.00
2	4.49	10.75	3.125	2.88

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	12.97	10.75	3.125
2	13.01	11.02	3.098

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 13.01 Tc(MIN.) = 11.02  
TOTAL AREA(ACRES) = 7.9  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 217.00 = 808.00 FEET.

+-----+  
| Detention Basin Analysis results: |  
| Q-out = 2.41 cfs |  
| |  
+-----+

\*\*\*\*\*  
FLOW PROCESS FROM NODE 219.00 TO NODE 219.00 IS CODE = 7  
-----

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

```

=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 11.02  RAIN INTENSITY(INCH/HOUR) = 3.10
TOTAL AREA(ACRES) = 7.88  TOTAL RUNOFF(CFS) = 2.41

*****
FLOW PROCESS FROM NODE 219.00 TO NODE 223.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 755.00  DOWNSTREAM(FEET) = 743.50
FLOW LENGTH(FEET) = 223.00  MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 4.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.34
ESTIMATED PIPE DIAMETER(INCH) = 18.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.41
PIPE TRAVEL TIME(MIN.) = 0.45  Tc(MIN.) = 11.47
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 223.00 = 1031.00 FEET.

*****
FLOW PROCESS FROM NODE 224.00 TO NODE 225.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.053
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.1049
SUBAREA AREA(ACRES) = 0.20  SUBAREA RUNOFF(CFS) = 0.21
TOTAL AREA(ACRES) = 8.1  TOTAL RUNOFF(CFS) = 2.59
TC(MIN.) = 11.47

*****
FLOW PROCESS FROM NODE 223.00 TO NODE 223.00 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.) = 11.47
RAINFALL INTENSITY(INCH/HR) = 3.05
TOTAL STREAM AREA(ACRES) = 8.08
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.59

*****
FLOW PROCESS FROM NODE 220.00 TO NODE 221.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .8700
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 767.50
DOWNSTREAM ELEVATION(FEET) = 762.50
ELEVATION DIFFERENCE(FEET) = 5.00
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 2.297
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 90.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.200
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) = 0.40
TOTAL AREA(ACRES) = 0.11  TOTAL RUNOFF(CFS) = 0.40

*****
FLOW PROCESS FROM NODE 221.00 TO NODE 223.00 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 762.50  DOWNSTREAM ELEVATION(FEET) = 744.00
STREET LENGTH(FEET) = 259.00  CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020

```

OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020  
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2  
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) = 0.95  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.16  
HALFSTREET FLOOD WIDTH(FEET) = 1.50  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 5.04  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.79  
STREET FLOW TRAVEL TIME(MIN.) = 0.86 Tc(MIN.) = 3.15  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.200  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .8700  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.870  
SUBAREA AREA(ACRES) = 0.30 SUBAREA RUNOFF(CFS) = 1.10  
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.50

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.17 HALFSTREET FLOOD WIDTH(FEET) = 2.24  
FLOW VELOCITY(FEET/SEC.) = 4.46 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.76  
LONGEST FLOWPATH FROM NODE 220.00 TO NODE 223.00 = 359.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 314.00 TO NODE 223.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<  
-----  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.200  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .8500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.8644  
SUBAREA AREA(ACRES) = 0.16 SUBAREA RUNOFF(CFS) = 0.57  
TOTAL AREA(ACRES) = 0.6 TOTAL RUNOFF(CFS) = 2.07  
TC(MIN.) = 3.15

\*\*\*\*\*  
FLOW PROCESS FROM NODE 223.00 TO NODE 223.00 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.) = 3.15  
RAINFALL INTENSITY(INCH/HR) = 4.20  
TOTAL STREAM AREA(ACRES) = 0.57  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.07

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.59	11.47	3.053	8.08
2	2.07	3.15	4.200	0.57

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	2.78	3.15	4.200
2	4.09	11.47	3.053

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 4.09 Tc(MIN.) = 11.47  
TOTAL AREA(ACRES) = 8.6  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 223.00 = 1031.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 223.00 TO NODE 223.00 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.) = 11.47  
RAINFALL INTENSITY(INCH/HR) = 3.05  
TOTAL STREAM AREA(ACRES) = 8.65  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.09

\*\*\*\*\*  
FLOW PROCESS FROM NODE 250.00 TO NODE 251.00 IS CODE = 21  
-----

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

=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00  
UPSTREAM ELEVATION(FEET) = 816.30  
DOWNSTREAM ELEVATION(FEET) = 810.00  
ELEVATION DIFFERENCE(FEET) = 6.30  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.310  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.738  
SUBAREA RUNOFF(CFS) = 0.14  
TOTAL AREA(ACRES) = 0.11 TOTAL RUNOFF(CFS) = 0.14

\*\*\*\*\*  
FLOW PROCESS FROM NODE 251.00 TO NODE 252.00 IS CODE = 53  
-----

>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<

>>>>TRAVELTIME THRU SUBAREA<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 810.00 DOWNSTREAM(FEET) = 743.50  
CHANNEL LENGTH THRU SUBAREA(FEET) = 755.00 CHANNEL SLOPE = 0.0881  
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION  
CHANNEL FLOW THRU SUBAREA(CFS) = 0.14  
FLOW VELOCITY(FEET/SEC) = 1.66 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)  
TRAVEL TIME(MIN.) = 7.57 Tc(MIN.) = 14.88  
LONGEST FLOWPATH FROM NODE 250.00 TO NODE 252.00 = 855.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 251.00 TO NODE 252.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.712  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4468  
SUBAREA AREA(ACRES) = 3.32 SUBAREA RUNOFF(CFS) = 4.05  
TOTAL AREA(ACRES) = 3.4 TOTAL RUNOFF(CFS) = 4.16  
TC(MIN.) = 14.88

\*\*\*\*\*  
FLOW PROCESS FROM NODE 313.00 TO NODE 252.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.712  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4472  
SUBAREA AREA(ACRES) = 0.57 SUBAREA RUNOFF(CFS) = 0.70  
TOTAL AREA(ACRES) = 4.0 TOTAL RUNOFF(CFS) = 4.85  
TC(MIN.) = 14.88

\*\*\*\*\*  
FLOW PROCESS FROM NODE 252.00 TO NODE 223.00 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.) = 14.88  
RAINFALL INTENSITY(INCH/HR) = 2.71  
TOTAL STREAM AREA(ACRES) = 4.00  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.85

\*\* CONFLUENCE DATA \*\*

STREAM	RUNOFF	Tc	INTENSITY	AREA
--------	--------	----	-----------	------

NUMBER	(CFS)	(MIN.)	(INCH/HOUR)	(ACRE)
1	4.09	11.47	3.053	8.65
2	4.85	14.88	2.712	4.00

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	7.83	11.47	3.053
2	8.49	14.88	2.712

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 8.49 Tc(MIN.) = 14.88  
TOTAL AREA(ACRES) = 12.6  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 223.00 = 1031.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 223.00 TO NODE 400.00 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 743.00 DOWNSTREAM(FEET) = 738.00  
FLOW LENGTH(FEET) = 512.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.9 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.27  
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 8.49  
PIPE TRAVEL TIME(MIN.) = 1.36 Tc(MIN.) = 16.24  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 400.00 = 1543.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 400.00 TO NODE 410.00 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 738.00 DOWNSTREAM(FEET) = 736.00  
FLOW LENGTH(FEET) = 40.00 MANNING'S N = 0.013  
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 7.7 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 11.75  
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 8.49  
PIPE TRAVEL TIME(MIN.) = 0.06 Tc(MIN.) = 16.30  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 410.00 = 1583.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 410.00 TO NODE 410.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<  
=====

```

+-----+
| Begin offsite hydrology. |
|                             |
+-----+

```

\*\*\*\*\*  
FLOW PROCESS FROM NODE 260.00 TO NODE 261.00 IS CODE = 21

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

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00  
UPSTREAM ELEVATION(FEET) = 840.00  
DOWNSTREAM ELEVATION(FEET) = 830.00  
ELEVATION DIFFERENCE(FEET) = 10.00  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.267  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.947  
SUBAREA RUNOFF(CFS) = 0.25  
TOTAL AREA(ACRES) = 0.18 TOTAL RUNOFF(CFS) = 0.25

\*\*\*\*\*  
FLOW PROCESS FROM NODE 261.00 TO NODE 262.00 IS CODE = 52

```

-----
>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 830.00 DOWNSTREAM(FEET) = 734.50
CHANNEL LENGTH THRU SUBAREA(FEET) = 1094.00 CHANNEL SLOPE = 0.0873
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) = 0.25
FLOW VELOCITY(FEET/SEC) = 4.43 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 4.11 Tc(MIN.) = 10.38
LONGEST FLOWPATH FROM NODE 260.00 TO NODE 262.00 = 1194.00 FEET.

*****
FLOW PROCESS FROM NODE 261.00 TO NODE 262.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.162
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3987
SUBAREA AREA(ACRES) = 6.69 SUBAREA RUNOFF(CFS) = 8.46
TOTAL AREA(ACRES) = 6.9 TOTAL RUNOFF(CFS) = 8.66
TC(MIN.) = 10.38

*****
FLOW PROCESS FROM NODE 262.00 TO NODE 263.00 IS CODE = 52
-----
>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 734.50 DOWNSTREAM(FEET) = 704.70
CHANNEL LENGTH THRU SUBAREA(FEET) = 670.00 CHANNEL SLOPE = 0.0445
CHANNEL FLOW THRU SUBAREA(CFS) = 8.66
FLOW VELOCITY(FEET/SEC) = 5.08 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 2.20 Tc(MIN.) = 12.58
LONGEST FLOWPATH FROM NODE 260.00 TO NODE 263.00 = 1864.00 FEET.

*****
FLOW PROCESS FROM NODE 262.00 TO NODE 263.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.942
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3992
SUBAREA AREA(ACRES) = 4.29 SUBAREA RUNOFF(CFS) = 5.05
TOTAL AREA(ACRES) = 11.2 TOTAL RUNOFF(CFS) = 13.11
TC(MIN.) = 12.58

*****
FLOW PROCESS FROM NODE 263.00 TO NODE 263.00 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.) = 12.58
RAINFALL INTENSITY(INCH/HR) = 2.94
TOTAL STREAM AREA(ACRES) = 11.16
PEAK FLOW RATE(CFS) AT CONFLUENCE = 13.11

*****
FLOW PROCESS FROM NODE 310.00 TO NODE 311.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4000
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 824.00
DOWNSTREAM ELEVATION(FEET) = 814.00
ELEVATION DIFFERENCE(FEET) = 10.00
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.849
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.030
SUBAREA RUNOFF(CFS) = 0.34

```

TOTAL AREA(ACRES) = 0.21 TOTAL RUNOFF(CFS) = 0.34

\*\*\*\*\*  
FLOW PROCESS FROM NODE 311.00 TO NODE 312.00 IS CODE = 53

>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	814.00	DOWNSTREAM(FEET) =	751.00
CHANNEL LENGTH THRU SUBAREA(FEET) =	477.00	CHANNEL SLOPE =	0.1321
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION			
CHANNEL FLOW THRU SUBAREA(CFS) =	0.34		
FLOW VELOCITY(FEET/SEC) =	2.04	(PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)	
TRAVEL TIME(MIN.) =	3.91	Tc(MIN.) =	9.76
LONGEST FLOWPATH FROM NODE	310.00	TO NODE	312.00 = 577.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 311.00 TO NODE 312.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) =	3.249		
*USER SPECIFIED(SUBAREA):			
USER-SPECIFIED RUNOFF COEFFICIENT =	.3500		
S.C.S. CURVE NUMBER (AMC II) =	0		
AREA-AVERAGE RUNOFF COEFFICIENT =	0.3526		
SUBAREA AREA(ACRES) =	3.82	SUBAREA RUNOFF(CFS) =	4.34
TOTAL AREA(ACRES) =	4.0	TOTAL RUNOFF(CFS) =	4.62
TC(MIN.) =	9.76		

\*\*\*\*\*  
FLOW PROCESS FROM NODE 312.00 TO NODE 314.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) =	3.249		
*USER SPECIFIED(SUBAREA):			
USER-SPECIFIED RUNOFF COEFFICIENT =	.8500		
S.C.S. CURVE NUMBER (AMC II) =	0		
AREA-AVERAGE RUNOFF COEFFICIENT =	0.3716		
SUBAREA AREA(ACRES) =	0.16	SUBAREA RUNOFF(CFS) =	0.44
TOTAL AREA(ACRES) =	4.2	TOTAL RUNOFF(CFS) =	5.06
TC(MIN.) =	9.76		

\*\*\*\*\*  
FLOW PROCESS FROM NODE 314.00 TO NODE 263.00 IS CODE = 52

>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	746.00	DOWNSTREAM(FEET) =	704.70
CHANNEL LENGTH THRU SUBAREA(FEET) =	734.00	CHANNEL SLOPE =	0.0563
CHANNEL FLOW THRU SUBAREA(CFS) =	5.06		
FLOW VELOCITY(FEET/SEC) =	5.02	(PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)	
TRAVEL TIME(MIN.) =	2.44	Tc(MIN.) =	12.19
LONGEST FLOWPATH FROM NODE	310.00	TO NODE	263.00 = 1311.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 314.00 TO NODE 263.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) =	2.981		
*USER SPECIFIED(SUBAREA):			
USER-SPECIFIED RUNOFF COEFFICIENT =	.4500		
S.C.S. CURVE NUMBER (AMC II) =	0		
AREA-AVERAGE RUNOFF COEFFICIENT =	0.4072		
SUBAREA AREA(ACRES) =	3.48	SUBAREA RUNOFF(CFS) =	4.67
TOTAL AREA(ACRES) =	7.7	TOTAL RUNOFF(CFS) =	9.31
TC(MIN.) =	12.19		

\*\*\*\*\*  
FLOW PROCESS FROM NODE 263.00 TO NODE 263.00 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.) =	12.19
RAINFALL INTENSITY(INCH/HR) =	2.98



DEPTH(FEET) = 0.36 HALFSTREET FLOOD WIDTH(FEET) = 10.00  
FLOW VELOCITY(FEET/SEC.) = 3.90 DEPTH\*VELOCITY(FT\*FT/SEC.) = 1.41  
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 502.00 = 780.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 502.00 TO NODE 502.00 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.) = 11.75  
RAINFALL INTENSITY(INCH/HR) = 3.02  
TOTAL STREAM AREA(ACRES) = 8.26  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 11.53

\*\*\*\*\*  
FLOW PROCESS FROM NODE 504.00 TO NODE 505.00 IS CODE = 21

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

=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4600  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 85.00  
UPSTREAM ELEVATION(FEET) = 831.70  
DOWNSTREAM ELEVATION(FEET) = 830.00  
ELEVATION DIFFERENCE(FEET) = 1.70  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.430  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.514  
SUBAREA RUNOFF(CFS) = 0.29  
TOTAL AREA(ACRES) = 0.18 TOTAL RUNOFF(CFS) = 0.29

\*\*\*\*\*  
FLOW PROCESS FROM NODE 505.00 TO NODE 502.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 830.00 DOWNSTREAM(FEET) = 765.00  
CHANNEL LENGTH THRU SUBAREA(FEET) = 788.00 CHANNEL SLOPE = 0.0825  
CHANNEL BASE(FEET) = 8.00 "Z" FACTOR = 2.000  
MANNING'S FACTOR = 0.022 MAXIMUM DEPTH(FEET) = 3.00  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.981

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .5200  
S.C.S. CURVE NUMBER (AMC II) = 0  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.25  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 3.49  
AVERAGE FLOW DEPTH(FEET) = 0.08 TRAVEL TIME(MIN.) = 3.76  
Tc(MIN.) = 12.19  
SUBAREA AREA(ACRES) = 2.53 SUBAREA RUNOFF(CFS) = 3.92  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.516  
TOTAL AREA(ACRES) = 2.7 PEAK FLOW RATE(CFS) = 4.17

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
DEPTH(FEET) = 0.11 FLOW VELOCITY(FEET/SEC.) = 4.54  
LONGEST FLOWPATH FROM NODE 504.00 TO NODE 502.00 = 873.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 502.00 TO NODE 502.00 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.) = 12.19  
RAINFALL INTENSITY(INCH/HR) = 2.98  
TOTAL STREAM AREA(ACRES) = 2.71  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.17

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	11.53	11.75	3.025	8.26
2	4.17	12.19	2.981	2.71

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	15.54	11.75	3.025
2	15.53	12.19	2.981

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 15.54 Tc(MIN.) = 11.75  
TOTAL AREA(ACRES) = 11.0  
LONGEST FLOWPATH FROM NODE 504.00 TO NODE 502.00 = 873.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 502.00 TO NODE 410.00 IS CODE = 31  
-----

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 760.00 DOWNSTREAM(FEET) = 736.00  
FLOW LENGTH(FEET) = 70.00 MANNING'S N = 0.013  
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.3 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 27.93  
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 15.54  
PIPE TRAVEL TIME(MIN.) = 0.04 Tc(MIN.) = 11.79  
LONGEST FLOWPATH FROM NODE 504.00 TO NODE 410.00 = 943.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 410.00 TO NODE 410.00 IS CODE = 11  
-----

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<<

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	15.54	11.79	3.021	10.97

LONGEST FLOWPATH FROM NODE 504.00 TO NODE 410.00 = 943.00 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	8.49	16.30	2.609	12.65

LONGEST FLOWPATH FROM NODE 215.00 TO NODE 410.00 = 1583.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	21.69	11.79	3.021
2	21.91	16.30	2.609

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 21.91 Tc(MIN.) = 16.30  
TOTAL AREA(ACRES) = 23.6

\*\*\*\*\*  
FLOW PROCESS FROM NODE 410.00 TO NODE 410.00 IS CODE = 12  
-----

>>>>CLEAR MEMORY BANK # 1 <<<<<<

\*\*\*\*\*  
FLOW PROCESS FROM NODE 410.00 TO NODE 513.00 IS CODE = 31  
-----

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 736.00 DOWNSTREAM(FEET) = 723.00  
FLOW LENGTH(FEET) = 281.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.7 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 14.44  
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 21.91  
PIPE TRAVEL TIME(MIN.) = 0.32 Tc(MIN.) = 16.62  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 513.00 = 1864.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 513.00 TO NODE 513.00 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.) = 16.62  
RAINFALL INTENSITY(INCH/HR) = 2.59  
TOTAL STREAM AREA(ACRES) = 23.62  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 21.91

\*\*\*\*\*  
FLOW PROCESS FROM NODE 510.00 TO NODE 511.00 IS CODE = 21  
-----

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

=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4600  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 85.00  
UPSTREAM ELEVATION(FEET) = 747.70  
DOWNSTREAM ELEVATION(FEET) = 746.00  
ELEVATION DIFFERENCE(FEET) = 1.70  
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.430  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.514  
SUBAREA RUNOFF(CFS) = 0.74  
TOTAL AREA(ACRES) = 0.46 TOTAL RUNOFF(CFS) = 0.74

\*\*\*\*\*  
FLOW PROCESS FROM NODE 511.00 TO NODE 512.00 IS CODE = 61  
-----

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>(STANDARD CURB SECTION USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 740.00 DOWNSTREAM ELEVATION(FEET) = 730.00  
STREET LENGTH(FEET) = 448.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 15.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2  
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0150  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.64  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.27  
HALFSTREET FLOOD WIDTH(FEET) = 7.21  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.85  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.77  
STREET FLOW TRAVEL TIME(MIN.) = 2.62 Tc(MIN.) = 11.05  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.095

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4600  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.460  
SUBAREA AREA(ACRES) = 4.06 SUBAREA RUNOFF(CFS) = 5.78  
TOTAL AREA(ACRES) = 4.5 PEAK FLOW RATE(CFS) = 6.44

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.31 HALFSTREET FLOOD WIDTH(FEET) = 9.34  
FLOW VELOCITY(FEET/SEC.) = 3.25 DEPTH\*VELOCITY(FT\*FT/SEC.) = 1.02  
LONGEST FLOWPATH FROM NODE 510.00 TO NODE 512.00 = 533.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 512.00 TO NODE 513.00 IS CODE = 31  
-----

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 723.00 DOWNSTREAM(FEET) = 721.00  
FLOW LENGTH(FEET) = 200.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.5 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.99  
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 6.44  
PIPE TRAVEL TIME(MIN.) = 0.56 Tc(MIN.) = 11.61  
LONGEST FLOWPATH FROM NODE 510.00 TO NODE 513.00 = 733.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 513.00 TO NODE 513.00 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.) = 11.61  
RAINFALL INTENSITY(INCH/HR) = 3.04  
TOTAL STREAM AREA(ACRES) = 4.52  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 6.44

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	21.91	16.62	2.586	23.62
2	6.44	11.61	3.039	4.52

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	21.73	11.61	3.039
2	27.39	16.62	2.586

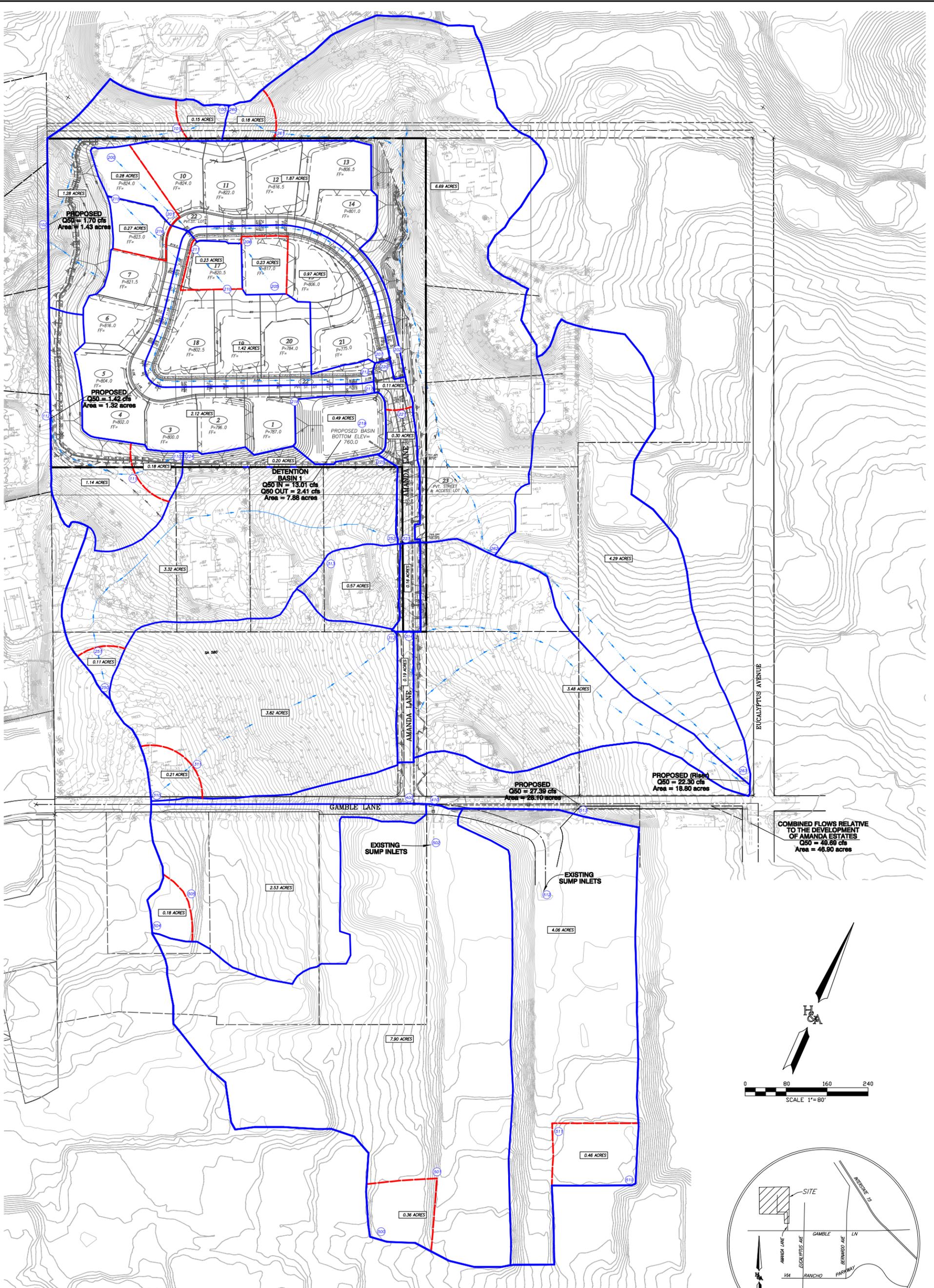
COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 27.39 Tc(MIN.) = 16.62  
TOTAL AREA(ACRES) = 28.1  
LONGEST FLOWPATH FROM NODE 215.00 TO NODE 513.00 = 1864.00 FEET.

=====

END OF STUDY SUMMARY:  
TOTAL AREA(ACRES) = 28.1 TC(MIN.) = 16.62  
PEAK FLOW RATE(CFS) = 27.39

=====

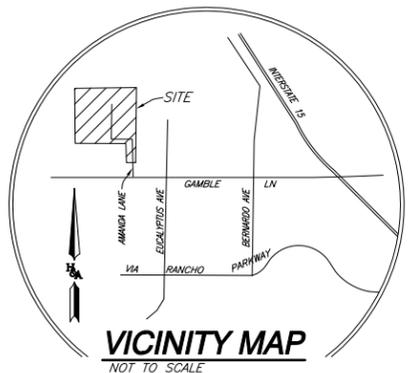
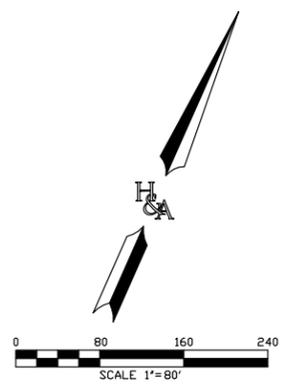
END OF RATIONAL METHOD ANALYSIS



**LEGEND:**

	HYDROLOGY NODE
	WATERSHED AREA
	WATERSHED BOUNDARY
	SUB-WATERSHED BOUNDARY
	FLOW DIRECTION

COMBINED FLOWS RELATIVE TO THE DEVELOPMENT OF AMANDA ESTATES  
 Q50 = 48.88 cfs  
 Area = 46.80 acres



PREPARED BY:  
  
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EXHIBIT 2  
 DEVELOPED CONDITION  
 HYDROLOGY MAP  
**AMANDA ESTATES**  
 CITY OF ESCONDIDO, CALIFORNIA 92029

MAP  
 2  
 OF  
 2

**Appendix 3 – Detention basin analysis**

Amanda Estates Detention Basin Analysis

<b>Watershed Model Schematic .....</b>	<b>1</b>
<b>50 - Year</b>	
<b>Summary Report.....</b>	<b>2</b>
<b>Hydrograph Reports.....</b>	<b>3</b>
Hydrograph No. 1, Manual, Amanda Lane Hydrograph.....	3
Hydrograph No. 2, Reservoir, Amanda Lane Detention.....	4
Pond Report - Amanda Lane Detention Basin.....	5

# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3



## Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	Manual	Amanda Lane Hydrograph
2	Reservoir	Amanda Lane Detention

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

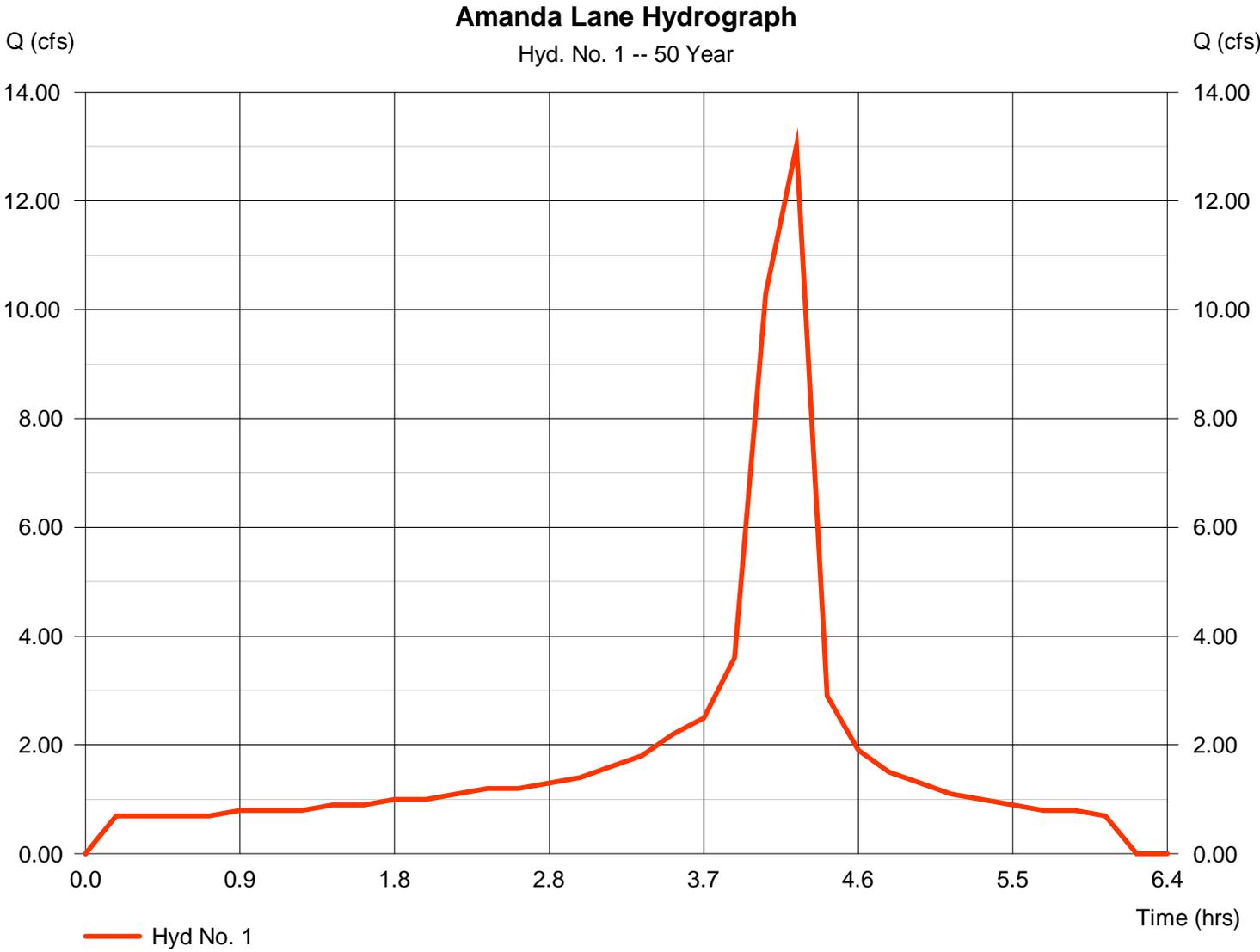
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	13.01	11	253	41,653	-----	-----	-----	Amanda Lane Hydrograph
2	Reservoir	2.406	11	264	41,609	1	762.75	31,275	Amanda Lane Detention
Amanda Lane Detention.gpw					Return Period: 50 Year			Wednesday, 05 / 7 / 2014	

# Hydrograph Report

## Hyd. No. 1

### Amanda Lane Hydrograph

Hydrograph type	= Manual	Peak discharge	= 13.01 cfs
Storm frequency	= 50 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 41,653 cuft



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

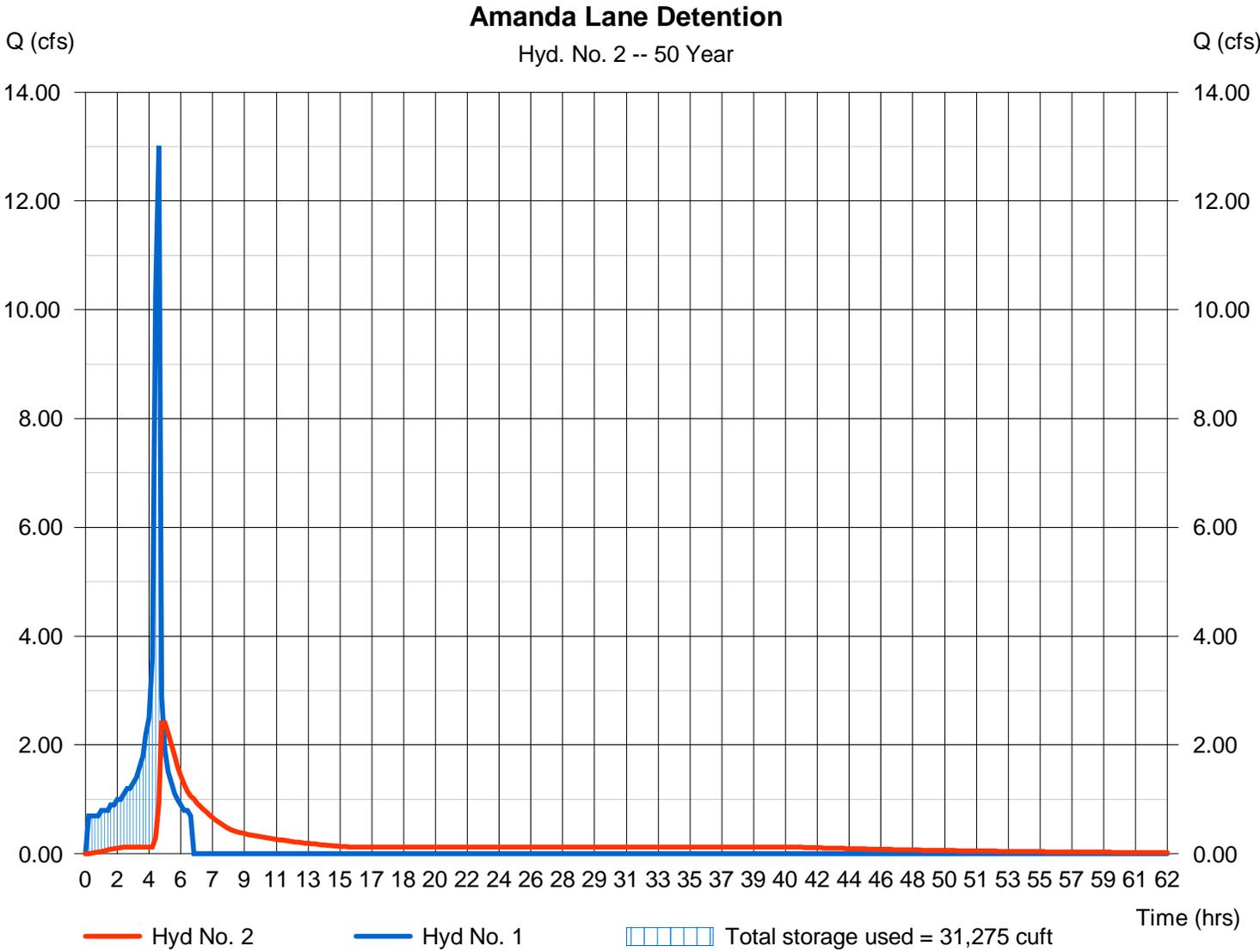
Wednesday, 05 / 7 / 2014

## Hyd. No. 2

### Amanda Lane Detention

Hydrograph type	= Reservoir	Peak discharge	= 2.406 cfs
Storm frequency	= 50 yrs	Time to peak	= 4.40 hrs
Time interval	= 11 min	Hyd. volume	= 41,609 cuft
Inflow hyd. No.	= 1 - Amanda Lane Hydrograph	Max. Elevation	= 762.75 ft
Reservoir name	= Amanda Lane Detention Basin	Max. Storage	= 31,275 cuft

Storage Indication method used.



## Pond No. 1 - Amanda Lane Detention Basin

### Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 760.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	760.00	10,317	0	0
0.50	760.50	10,720	5,258	5,258
1.00	761.00	11,122	5,460	10,718
1.50	761.50	11,537	5,664	16,382
2.00	762.00	11,952	5,871	22,253
2.50	762.50	12,380	6,082	28,335
3.00	763.00	12,807	6,296	34,631
3.50	763.50	13,248	6,513	41,144
4.00	764.00	13,688	6,733	47,877
4.50	764.50	14,141	6,956	54,833
5.00	765.00	14,593	7,182	62,016

### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	0.00	0.00
Span (in)	= 24.00	1.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 755.00	761.00	0.00	0.00
Length (ft)	= 100.00	0.50	0.00	0.00
Slope (%)	= 2.00	0.50	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)	Inactive	0.00	0.00	0.00
Crest El. (ft)	= 763.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
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).

### Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	760.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.50	5,258	760.50	0.00	0.00	---	---	0.00	---	---	---	---	0.119	0.119
1.00	10,718	761.00	0.00	0.00	---	---	0.00	---	---	---	---	0.119	0.119
1.50	16,382	761.50	0.00	0.00	---	---	0.00	---	---	---	---	0.120	0.120
2.00	22,253	762.00	0.00	0.00	---	---	0.00	---	---	---	---	0.415	0.415
2.50	28,335	762.50	0.00	0.00	---	---	0.00	---	---	---	---	1.064	1.064
3.00	34,631	763.00	0.00	0.00	---	---	0.00	---	---	---	---	3.938	3.938
3.50	41,144	763.50	0.00	0.00	---	---	0.00	---	---	---	---	8.762	8.762
4.00	47,877	764.00	0.00	0.00	---	---	0.00	---	---	---	---	14.87	14.87
4.50	54,833	764.50	0.00	0.00	---	---	0.00	---	---	---	---	22.03	22.03
5.00	62,016	765.00	0.00	0.00	---	---	0.00	---	---	---	---	30.10	30.10

RUN DATE 5/7/2014  
HYDROGRAPH FILE NAME Text1  
TIME OF CONCENTRATION 11 MIN.  
6 HOUR RAINFALL 2.75 INCHES  
BASIN AREA 7.88 ACRES  
RUNOFF COEFFICIENT 0.53  
PEAK DISCHARGE 13.01 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.7
TIME (MIN) = 22	DISCHARGE (CFS) = 0.7
TIME (MIN) = 33	DISCHARGE (CFS) = 0.7
TIME (MIN) = 44	DISCHARGE (CFS) = 0.7
TIME (MIN) = 55	DISCHARGE (CFS) = 0.8
TIME (MIN) = 66	DISCHARGE (CFS) = 0.8
TIME (MIN) = 77	DISCHARGE (CFS) = 0.8
TIME (MIN) = 88	DISCHARGE (CFS) = 0.9
TIME (MIN) = 99	DISCHARGE (CFS) = 0.9
TIME (MIN) = 110	DISCHARGE (CFS) = 1
TIME (MIN) = 121	DISCHARGE (CFS) = 1
TIME (MIN) = 132	DISCHARGE (CFS) = 1.1
TIME (MIN) = 143	DISCHARGE (CFS) = 1.2
TIME (MIN) = 154	DISCHARGE (CFS) = 1.2
TIME (MIN) = 165	DISCHARGE (CFS) = 1.3
TIME (MIN) = 176	DISCHARGE (CFS) = 1.4
TIME (MIN) = 187	DISCHARGE (CFS) = 1.6
TIME (MIN) = 198	DISCHARGE (CFS) = 1.8
TIME (MIN) = 209	DISCHARGE (CFS) = 2.2
TIME (MIN) = 220	DISCHARGE (CFS) = 2.5
TIME (MIN) = 231	DISCHARGE (CFS) = 3.6
TIME (MIN) = 242	DISCHARGE (CFS) = 10.3
TIME (MIN) = 253	DISCHARGE (CFS) = 13.01
TIME (MIN) = 264	DISCHARGE (CFS) = 2.9
TIME (MIN) = 275	DISCHARGE (CFS) = 1.9
TIME (MIN) = 286	DISCHARGE (CFS) = 1.5
TIME (MIN) = 297	DISCHARGE (CFS) = 1.3
TIME (MIN) = 308	DISCHARGE (CFS) = 1.1
TIME (MIN) = 319	DISCHARGE (CFS) = 1
TIME (MIN) = 330	DISCHARGE (CFS) = 0.9
TIME (MIN) = 341	DISCHARGE (CFS) = 0.8
TIME (MIN) = 352	DISCHARGE (CFS) = 0.8
TIME (MIN) = 363	DISCHARGE (CFS) = 0.7
TIME (MIN) = 374	DISCHARGE (CFS) = 0

AMANDA LANE

Basin Stage-Storage	
Depth (ft)	Area (sf)
0.0	10,317
0.5	10,720
1.0	11,122
1.5	11,537
2.0	11,952
2.5	12,380
3.0	12,807
3.5	13,248
4.0	13,688
4.5	14,141
5.0	14,593

Basin #1 Discharge

Discharge vs Elevation Table

Low orifice:	0.25 "	Top orifice:	4 "
Number:	1	Number:	2
Cg-low:	0.61	Cg-low:	0.61
Invert elev:	1.00 ft	Invert elev:	2.00 ft
Middle orifice:	3 "	Emergency inlet:	
number of orif:	2	Invert:	2.50 ft
Cg-middle:	0.61	Area (SF=2)	4.00 sq ft
Invert elev:	1.50 ft		

To account for LID outlet flow, add 0.119 cfs to this column for stage-discharge values used in detention analysis. See following sheet for LID outflow determination.



h (ft)	H/D-low	H/D-mid	H/D-top	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qtop-orif (cfs)	Qtop-weir (cfs)	Qtot-top (cfs)	Qemerg (cfs)	Qtot (cfs)
0.0	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.1	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.2	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.3	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.4	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.5	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.6	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.7	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.8	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.9	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.0	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.1	4.80	0.00	0.00	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.2	9.60	0.00	0.00	0.001	0.211	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
1.3	14.40	0.00	0.00	0.001	2.096	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
1.4	19.20	0.00	0.00	0.001	9.913	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
1.5	24.00	0.00	0.00	0.001	32.236	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
1.6	28.80	0.40	0.00	0.001	83.488	0.001	0.000	0.032	0.032	0.000	0.000	0.000	0.000	0.033
1.7	33.60	0.80	0.00	0.001	185.480	0.001	0.132	0.112	0.112	0.000	0.000	0.000	0.000	0.113
1.8	38.40	1.20	0.00	0.001	368.941	0.001	0.201	0.215	0.201	0.000	0.000	0.000	0.000	0.203
1.9	43.20	1.60	0.00	0.002	675.054	0.002	0.252	0.316	0.252	0.000	0.000	0.000	0.000	0.254
2.0	48.00	2.00	0.00	0.002	1156.986	0.002	0.294	0.391	0.294	0.000	0.000	0.000	0.000	0.296
2.1	52.80	2.40	0.30	0.002	1881.427	0.002	0.331	0.430	0.331	0.000	0.037	0.037	0.000	0.370
2.2	57.60	2.80	0.60	0.002	2930.120	0.002	0.364	0.439	0.364	0.156	0.138	0.138	0.000	0.504
2.3	62.40	3.20	0.90	0.002	4401.395	0.002	0.395	0.449	0.395	0.312	0.280	0.280	0.000	0.677
2.4	67.20	3.60	1.20	0.002	6411.703	0.002	0.423	0.517	0.423	0.413	0.442	0.413	0.000	0.838
2.5	72.00	4.00	1.50	0.002	9097.150	0.002	0.450	0.738	0.450	0.493	0.600	0.493	0.000	0.945
2.6	76.80	4.40	1.80	0.002	12615.034	0.002	0.475	1.249	0.475	0.562	0.734	0.562	0.221	1.260
2.7	81.60	4.80	2.10	0.002	17145.370	0.002	0.498	2.233	0.498	0.624	0.830	0.624	0.626	1.750
2.8	86.40	5.20	2.40	0.002	22892.432	0.002	0.521	3.930	0.521	0.680	0.883	0.680	1.150	2.353
2.9	91.20	5.60	2.70	0.002	30086.285	0.002	0.543	6.636	0.543	0.732	0.901	0.732	1.770	3.046
3.0	96.00	6.00	3.00	0.002	38984.315	0.002	0.564	10.717	0.564	0.780	0.906	0.780	2.473	3.819
3.1	100.80	6.40	3.30	0.002	49872.765	0.002	0.584	16.611	0.584	0.825	0.938	0.825	3.251	4.663
3.2	105.60	6.80	3.60	0.002	63068.273	0.002	0.603	24.831	0.603	0.869	1.061	0.869	4.097	5.571
3.3	110.40	7.20	3.90	0.003	78919.395	0.003	0.622	35.980	0.622	0.910	1.358	0.910	5.006	6.540
3.4	115.20	7.60	4.20	0.003	97808.152	0.003	0.640	50.749	0.640	0.949	1.944	0.949	5.973	7.565
3.5	120.00	8.00	4.50	0.003	#####	0.003	0.658	69.926	0.658	0.987	2.960	0.987	6.996	8.643
3.6	124.80	8.40	4.80	0.003	#####	0.003	0.675	94.402	0.675	1.023	4.584	1.023	8.071	9.772
3.7	129.60	8.80	5.10	0.003	#####	0.003	0.692	125.180	0.692	1.058	7.028	1.058	9.196	10.949
3.8	134.40	9.20	5.40	0.003	#####	0.003	0.709	163.374	0.709	1.092	10.542	1.092	10.370	12.173
3.9	139.20	9.60	5.70	0.003	#####	0.003	0.725	210.225	0.725	1.125	15.420	1.125	11.589	13.441
4.0	144.00	10.00	6.00	0.003	#####	0.003	0.741	267.097	0.741	1.157	22.001	1.157	12.852	14.753
4.1	148.80	10.40	6.30	0.003	#####	0.003	0.756	335.490	0.756	1.188	30.670	1.188	14.159	16.106
4.2	153.60	10.80	6.60	0.003	#####	0.003	0.771	417.046	0.771	1.218	41.866	1.218	15.507	17.499
4.3	158.40	11.20	6.90	0.003	#####	0.003	0.786	513.550	0.786	1.248	56.080	1.248	16.895	18.932
4.4	163.20	11.60	7.20	0.003	#####	0.003	0.801	626.941	0.801	1.277	73.861	1.277	18.322	20.403
4.5	168.00	12.00	7.50	0.003	#####	0.003	0.815	759.316	0.815	1.305	95.817	1.305	19.788	21.911
4.6	172.80	12.40	7.80	0.003	#####	0.003	0.829	912.938	0.829	1.333	122.620	1.333	21.290	23.455
4.7	177.60	12.80	8.10	0.003	#####	0.003	0.843	1090.239	0.843	1.360	155.009	1.360	22.829	25.034
4.8	182.40	13.20	8.40	0.003	#####	0.003	0.856	1293.829	0.856	1.386	193.789	1.386	24.403	26.649
4.9	187.20	13.60	8.70	0.003	#####	0.003	0.870	1526.502	0.870	1.413	239.840	1.413	26.011	28.297
5.0	192.00	14.00	9.00	0.003	#####	0.003	0.883	1791.239	0.883	1.438	294.116	1.438	27.654	29.978

LID Outlet #1			
ABMP=	10317	sq-ft	(Area above engineered fill/bio-retention section) (It can also be area of infiltration at the bottom)
Cg=	0.61		(coefficient of discharge of the bottom orifice)
Dorif=	1.8	in	(diameter in inches of the bottom orifice)
Aorifice=	0.01767	sq-ft	(area of orifice in sq-ft)
C <sub>SWMM</sub> =	0.1046		C coefficient to be inserted into SWMM
H-gravel=	2	ft	Depth of the gravel layer where water is ponding
	24	in	(In this case: superior bottom - mulch - ammended soil - invert of French drain) (760-3/12-18/12-756.75)
	22.2	in	
H-design=	1.850	ft	H-gravel minus radius of the discharge
Q <sub>orif-classic</sub> =	0.11766	cfs	
Q <sub>orif-SWMM</sub> =	0.11766	cfs	
Q <sub>diversion</sub> =	0.11884	cfs	1% additional to the Qorifice.



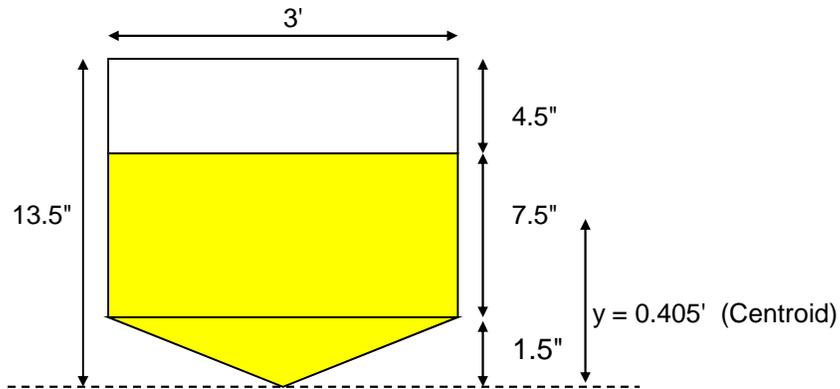
Outflow from LID underdrain.

## **Appendix 4 – Hydraulic Calculations**

STANDARD CATCH BASIN FLOW CAPACITY  
BROW DITCH CAPACITY RATING TABLES

# AMANDA LANE CATCH BASIN TYPE "F" CAPACITY CALCULATION

Dimensions obtained from City of San Diego Standard Drawings (Drawing D-7):



$$Q_{\max} = 0.6A\sqrt{(2gh)}$$

$$Q_{\max} = 0.6A\sqrt{(2gh)}$$

$$Q_{\max} = 0.6(1.875+0.1875)[\sqrt{(2)(32.2)(1.125-0.405)}]$$

$$Q_{\max} = \mathbf{8.42 \text{ cfs per opening}}$$

## Rating Table for Brow Ditch Capacity - 2x1

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient                      0.013  
Channel Slope                                1.00 %  
Diameter                                        2.00 ft  
Discharge                                       3.10 ft<sup>3</sup>/s

Channel Slope (%)	Normal Depth (ft)	Velocity (ft/s)	Flow Area (ft <sup>2</sup> )	Wetted Perimeter (ft)	Top Width (ft)
0.50	0.60	3.94	0.79	2.31	1.83
0.60	0.57	4.20	0.74	2.25	1.81
0.70	0.55	4.44	0.70	2.20	1.78
0.80	0.53	4.66	0.67	2.16	1.76
0.90	0.51	4.86	0.64	2.13	1.75
1.00	0.50	5.05	0.61	2.09	1.73
1.10	0.49	5.22	0.59	2.07	1.72
1.20	0.48	5.38	0.58	2.04	1.71
1.30	0.47	5.54	0.56	2.02	1.69
1.40	0.46	5.69	0.55	2.00	1.68
1.50	0.45	5.83	0.53	1.98	1.67
1.60	0.44	5.96	0.52	1.96	1.66
1.70	0.44	6.09	0.51	1.95	1.65
1.80	0.43	6.22	0.50	1.93	1.65
1.90	0.43	6.34	0.49	1.92	1.64
2.00	0.42	6.45	0.48	1.91	1.63
2.10	0.42	6.56	0.47	1.89	1.62
2.20	0.41	6.67	0.46	1.88	1.62
2.30	0.41	6.78	0.46	1.87	1.61
2.40	0.40	6.88	0.45	1.86	1.60
2.50	0.40	6.98	0.44	1.85	1.60
2.60	0.39	7.08	0.44	1.84	1.59
2.70	0.39	7.17	0.43	1.83	1.59
2.80	0.39	7.27	0.43	1.82	1.58
2.90	0.38	7.36	0.42	1.81	1.57

## Rating Table for Brow Ditch Capacity - 2x1

### Input Data

Channel Slope (%)	Normal Depth (ft)	Velocity (ft/s)	Flow Area (ft <sup>2</sup> )	Wetted Perimeter (ft)	Top Width (ft)
3.00	0.38	7.45	0.42	1.81	1.57
3.10	0.38	7.54	0.41	1.80	1.56
3.20	0.37	7.62	0.41	1.79	1.56
3.30	0.37	7.70	0.40	1.78	1.56
3.40	0.37	7.78	0.40	1.78	1.55
3.50	0.37	7.86	0.39	1.77	1.55
3.60	0.36	7.94	0.39	1.76	1.54
3.70	0.36	8.02	0.39	1.76	1.54
3.80	0.36	8.09	0.38	1.75	1.54
3.90	0.36	8.17	0.38	1.74	1.53
4.00	0.35	8.24	0.38	1.74	1.53
4.10	0.35	8.31	0.37	1.73	1.52
4.20	0.35	8.39	0.37	1.73	1.52
4.30	0.35	8.46	0.37	1.72	1.52
4.40	0.35	8.53	0.36	1.72	1.51
4.50	0.34	8.59	0.36	1.71	1.51
4.60	0.34	8.66	0.36	1.71	1.51
4.70	0.34	8.73	0.36	1.70	1.50
4.80	0.34	8.79	0.35	1.70	1.50
4.90	0.34	8.86	0.35	1.69	1.50
5.00	0.34	8.92	0.35	1.69	1.49
5.10	0.33	8.98	0.35	1.68	1.49
5.20	0.33	9.05	0.34	1.68	1.49
5.30	0.33	9.10	0.34	1.68	1.49
5.40	0.33	9.16	0.34	1.67	1.48
5.50	0.33	9.22	0.34	1.67	1.48
5.60	0.33	9.27	0.33	1.66	1.48
5.70	0.33	9.33	0.33	1.66	1.48
5.80	0.32	9.39	0.33	1.66	1.47
5.90	0.32	9.45	0.33	1.65	1.47
6.00	0.32	9.50	0.33	1.65	1.47

## Rating Table for Brow Ditch Capacity - 2.5x1.25

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient                      0.013  
Channel Slope                                1.00 %  
Diameter                                        2.50 ft  
Discharge                                      3.10 ft<sup>3</sup>/s

Channel Slope (%)	Normal Depth (ft)	Velocity (ft/s)	Flow Area (ft <sup>2</sup> )	Wetted Perimeter (ft)	Top Width (ft)
0.50	0.55	3.85	0.80	2.45	2.07
0.60	0.53	4.11	0.75	2.39	2.04
0.70	0.51	4.34	0.71	2.34	2.01
0.80	0.49	4.55	0.68	2.30	1.99
0.90	0.48	4.74	0.65	2.26	1.97
1.00	0.47	4.92	0.63	2.23	1.95
1.10	0.45	5.09	0.61	2.20	1.93
1.20	0.44	5.25	0.59	2.18	1.91
1.30	0.44	5.40	0.57	2.15	1.90
1.40	0.43	5.54	0.56	2.13	1.88
1.50	0.42	5.68	0.55	2.11	1.87
1.60	0.41	5.80	0.53	2.10	1.86
1.70	0.41	5.93	0.52	2.08	1.85
1.80	0.40	6.05	0.51	2.07	1.84
1.90	0.40	6.17	0.50	2.05	1.83
2.00	0.39	6.28	0.49	2.04	1.82
2.10	0.39	6.39	0.49	2.02	1.81
2.20	0.38	6.49	0.48	2.01	1.80
2.30	0.38	6.60	0.47	2.00	1.79
2.40	0.38	6.70	0.46	1.99	1.79
2.50	0.37	6.79	0.46	1.98	1.78
2.60	0.37	6.89	0.45	1.97	1.77
2.70	0.37	6.98	0.44	1.96	1.77
2.80	0.36	7.07	0.44	1.95	1.76
2.90	0.36	7.16	0.43	1.94	1.75

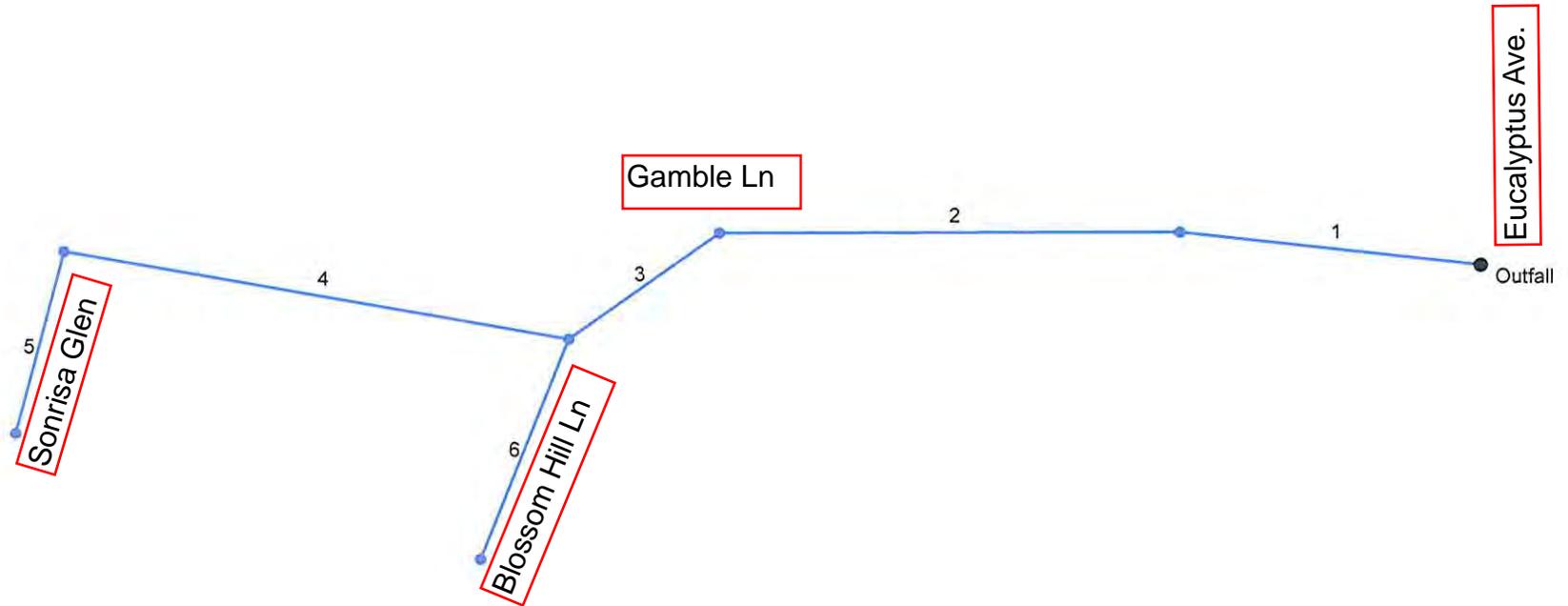
**Rating Table for Brow Ditch Capacity - 2.5x1.25**

**Input Data**

Channel Slope (%)	Normal Depth (ft)	Velocity (ft/s)	Flow Area (ft <sup>2</sup> )	Wetted Perimeter (ft)	Top Width (ft)
3.00	0.36	7.24	0.43	1.93	1.75
3.10	0.35	7.33	0.42	1.93	1.74
3.20	0.35	7.40	0.42	1.92	1.74
3.30	0.35	7.49	0.41	1.91	1.73
3.40	0.35	7.57	0.41	1.90	1.73
3.50	0.34	7.65	0.41	1.90	1.72
3.60	0.34	7.72	0.40	1.89	1.72
3.70	0.34	7.80	0.40	1.88	1.71
3.80	0.34	7.87	0.39	1.88	1.71
3.90	0.33	7.94	0.39	1.87	1.70
4.00	0.33	8.01	0.39	1.86	1.70
4.10	0.33	8.09	0.38	1.86	1.69
4.20	0.33	8.15	0.38	1.85	1.69
4.30	0.33	8.22	0.38	1.85	1.68
4.40	0.32	8.29	0.37	1.84	1.68
4.50	0.32	8.36	0.37	1.84	1.68
4.60	0.32	8.42	0.37	1.83	1.67
4.70	0.32	8.49	0.37	1.83	1.67
4.80	0.32	8.53	0.36	1.82	1.67
4.90	0.32	8.59	0.36	1.82	1.66
5.00	0.31	8.65	0.36	1.81	1.66
5.10	0.31	8.72	0.36	1.81	1.66
5.20	0.31	8.78	0.35	1.81	1.65
5.30	0.31	8.84	0.35	1.80	1.65
5.40	0.31	8.89	0.35	1.80	1.65
5.50	0.31	8.95	0.35	1.79	1.64
5.60	0.31	9.01	0.34	1.79	1.64
5.70	0.31	9.07	0.34	1.78	1.64
5.80	0.30	9.12	0.34	1.78	1.63
5.90	0.30	9.18	0.34	1.78	1.63
6.00	0.30	9.23	0.34	1.77	1.63

GAMBLE LANE  
EXISTING CONDITION HYDRAULIC ANALYSIS

# Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



# Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	24	21.86	697.02	697.90	0.88	1.33	16.38	0.95	698.85	0.000	137.43	705.00	706.67	1.67**	2.80	7.80	0.95	707.62	0.000	0.000	n/a	0.15	n/a
2	24	21.86	705.30	706.67	1.37	2.29	9.54	0.95	707.62	0.000	209.86	719.97	721.64	1.67**	2.80	7.80	0.95	722.59	0.000	0.000	n/a	0.63	n/a
3	24	21.86	719.97	723.95	2.00	3.14	6.96	0.75	724.70	0.935	84.360	720.56	724.74	2.00	3.14	6.96	0.75	725.49	0.934	0.934	0.788	0.75	0.56
4	18	15.54	720.56	725.38	1.50	1.73	8.80	1.20	726.58	2.191	233.00	745.25	746.67 j	1.42**	1.73	8.99	1.26	747.92	1.893	2.042	n/a	1.00	1.26
5	18	15.54	745.25	746.75	1.50*	1.77	8.80	1.20	747.95	2.191	85.980	746.11	748.63	1.50	1.77	8.79	1.20	749.84	2.190	2.190	1.883	1.00	1.20
6	24	6.44	720.56	725.38	2.00	3.14	2.05	0.07	725.44	0.081	108.10	721.66	725.46	2.00	3.14	2.05	0.07	725.53	0.081	0.081	0.088	1.00	0.07

Project File: TM SD PRE.stm

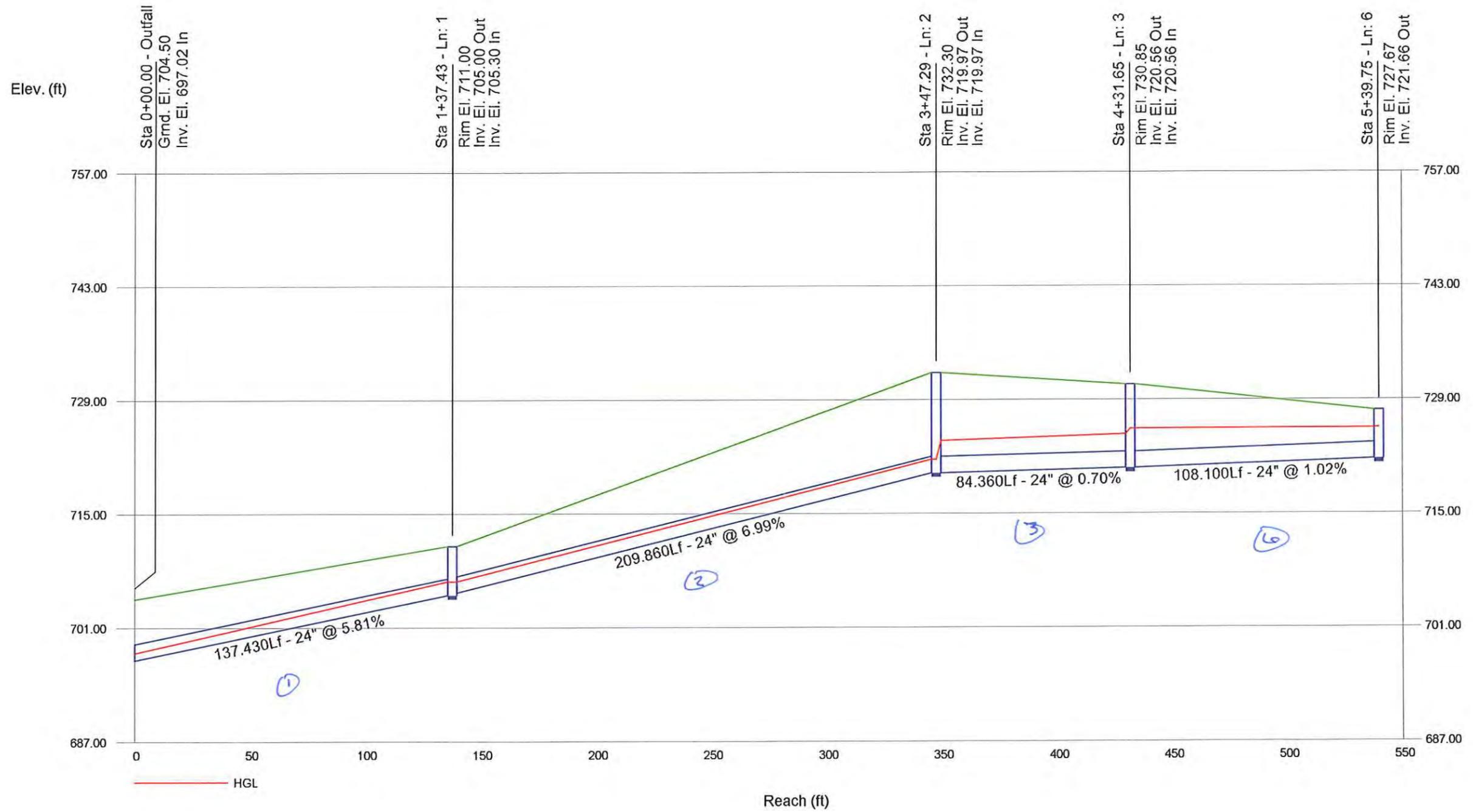
Number of lines: 6

Run Date: 3/24/2014

Notes: \* Normal depth assumed.; \*\* Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box

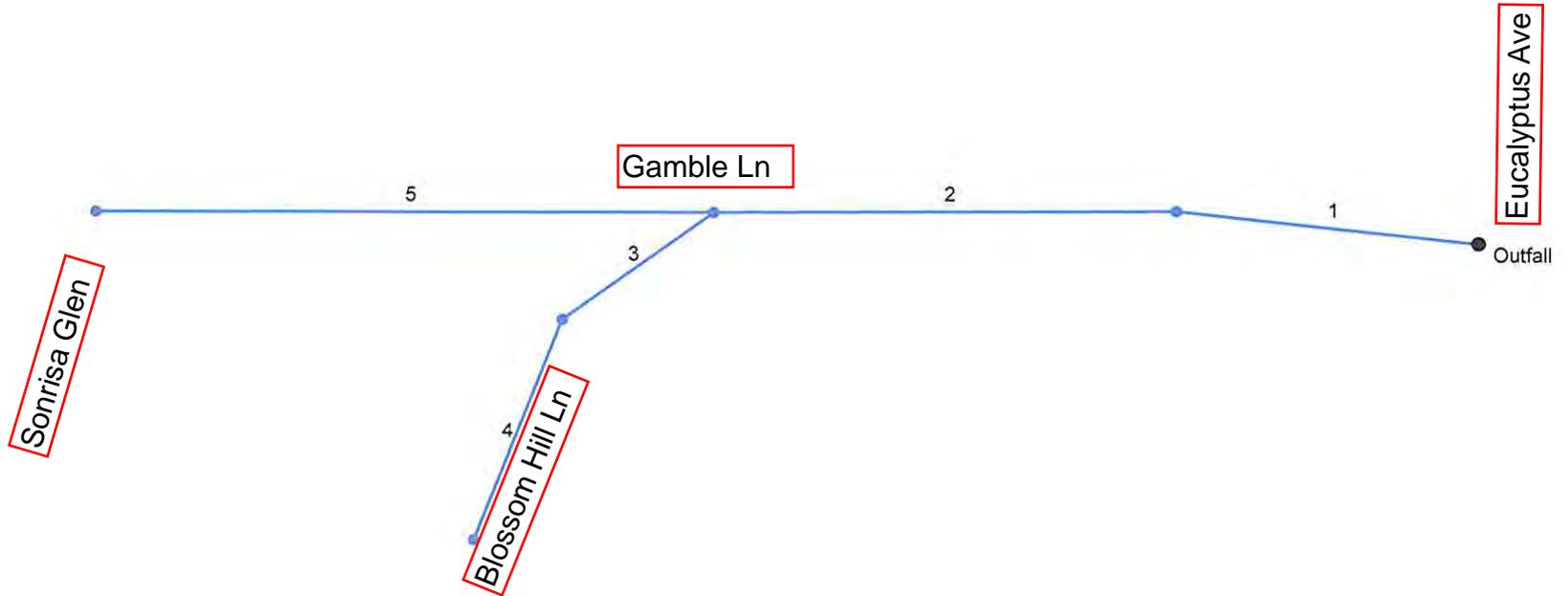


# Storm Sewer Profile



GAMBLE LANE  
PROPOSED CONDITION HYDRAULIC ANALYSIS

# Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



# Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	24	26.27	697.02	698.00	0.98	1.53	17.18	1.22	699.22	0.000	137.43	705.00	706.79	1.79**	2.97	8.85	1.22	708.01	0.000	0.000	n/a	0.15	n/a
2	24	26.27	705.30	706.79	1.49	2.51	10.46	1.22	708.01	1.371	209.86	719.97	721.76	1.79**	2.97	8.85	1.22	722.98	1.209	1.290	n/a	0.63	n/a
3	24	6.44	719.97	721.77	1.80	1.37	2.17	0.35	722.11	0.935	84.36	720.56	721.46	0.90**	1.37	4.71	0.35	721.80	0.934	0.934	n/a	0.60	0.21
4	24	6.44	720.56	721.46	0.90*	1.37	4.71	0.35	721.80	2.191	108.10	721.66	722.56	0.90**	1.37	4.71	0.35	722.90	1.893	2.042	n/a	1.00	0.35
5	24	20.79	719.97	721.77	1.80	2.71	6.77	0.86	722.62	2.191	280.00	729.77	731.38 j	1.61**	2.71	7.43	0.86	732.24	2.190	2.190	n/a	1.00	n/a

Project File: TM SD POST.stm

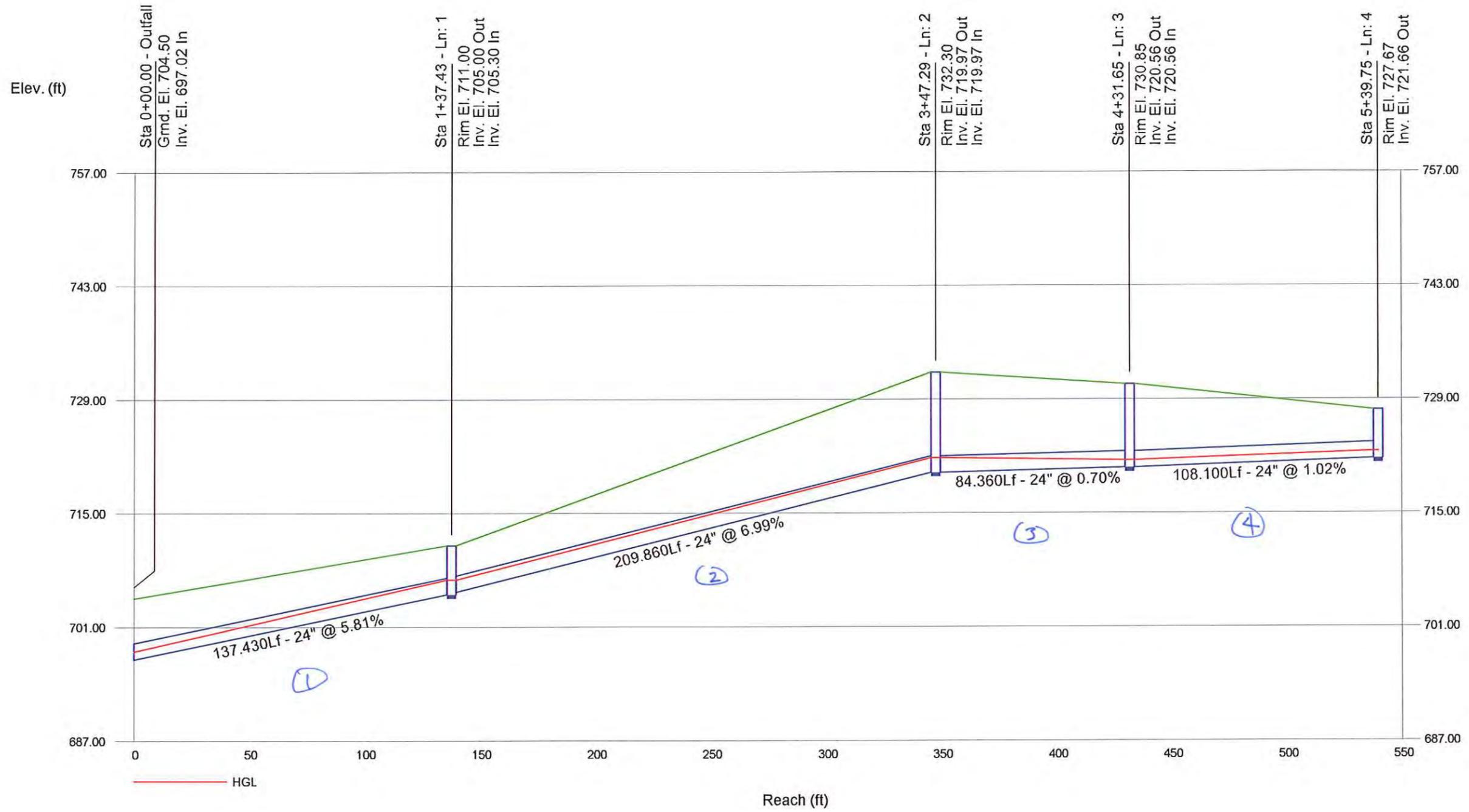
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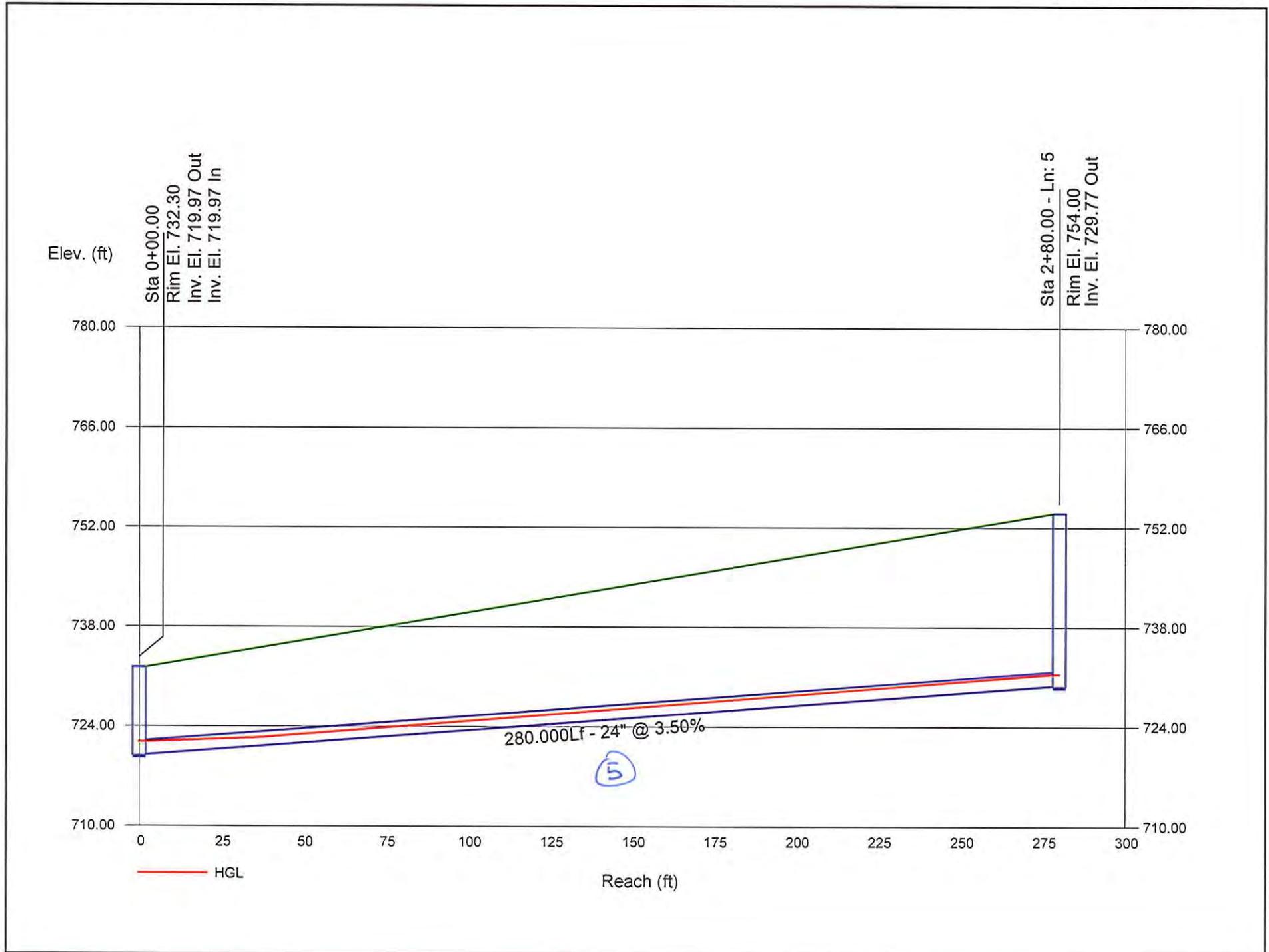
Notes: \* Normal depth assumed.; \*\* Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box



# Storm Sewer Profile

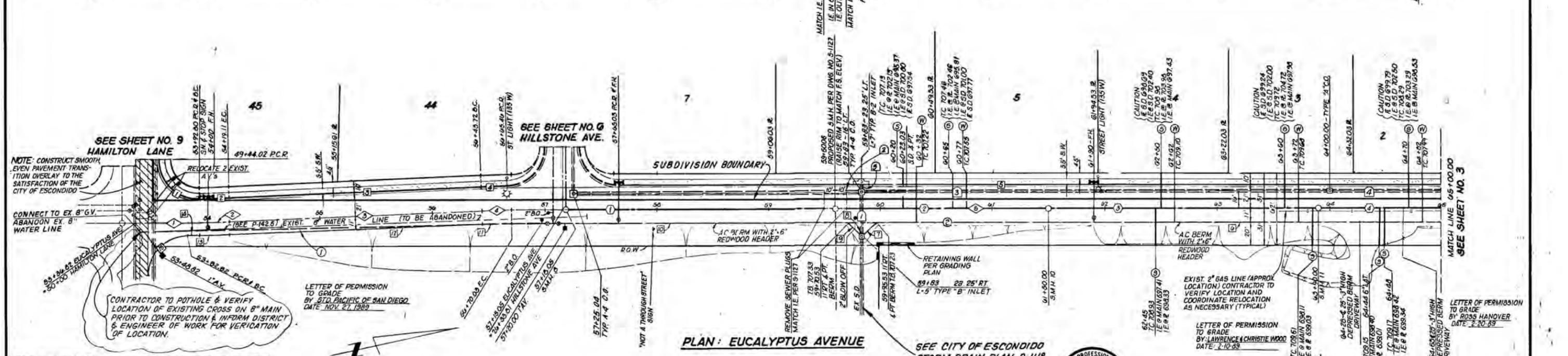
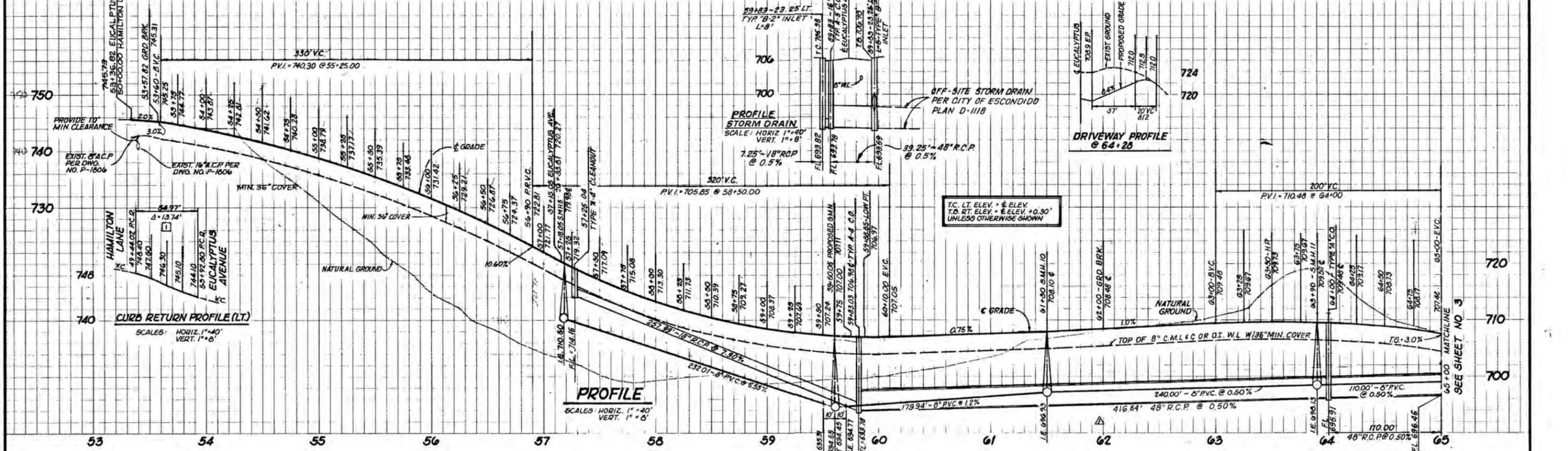


# Storm Sewer Profile



**Appendix 5 – Gamble Lane Storm Drain Reference Plans**





NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
15	Δ-90°01'00"	35'	54.99'	4" A.C. BERM (TO FIT EXIST)
14	N12°12'55"E		9.90'	4" A.C. BERM
13	Δ-02°30'45"	611'	26.79'	
12	N09°42'13"E		22.61'	
11	Δ-02°30'45"	569'	25.63'	
10	N12°12'55"E		300.50'	
9	N57°12'58"E		14.14'	A.C. BERM TRANSITION 10'-6"
8	N12°12'58"E		5.00'	FACE OF INLET
7	N32°47'02"W		18.14'	A.C. BERM TRANSITION 6'-10"
6	N12°12'55"E		26.27'	4" A.C. BERM (SEE NOTE)
5	N12°12'55"E		704.97'	6" TYPE 10" CURB & GUTTER
4	Δ-02°14'35"	621'	22.50'	
3	N09°42'13"E		22.61'	
2	Δ-02°30'45"	579'	25.39'	
1	Δ-09°50'52"	35'	54.97'	6" TYPE 10" CURB & GUTTER

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
4	N12°12'55"E		110.00'	5" P.V.C.
3	N12°12'55"E		240.00'	
2	N12°12'55"E		179.94'	
1	N12°12'55"E		232.01'	5" P.V.C.

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
2	N12°12'58"E		792.95'	8" CMLC 1064 DR O.T. CL 360
1	N10°30'48"E		370.16'	8" CMLC 1064 DR O.T. CL 360

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
5	N77°47'02"W		7.25'	18" R.C.P.
4	N12°12'58"E		100.00'	48" R.C.P.
3	N12°12'58"E		416.84'	48" R.C.P.
2	N12°12'58"E		257.99'	18" R.C.P.
1	N77°47'02"W		59.25'	48" R.C.P. (1350'-DI)

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
5	N12°12'55"E		829.97'	
4	Δ-02°30'45"	600'	26.31'	
3	N09°42'13"E		22.61'	
2	Δ-02°30'45"	600'	26.31'	
1	N12°12'55"E		55.90'	

**CONSTRUCTION RECORD**

Contractor: \_\_\_\_\_ Inspector: \_\_\_\_\_ Date Completed: \_\_\_\_\_

**REFERENCES**

Date: \_\_\_\_\_ By: \_\_\_\_\_ REVISIONS

App'd: \_\_\_\_\_ Date: \_\_\_\_\_

**BENCH MARK**

ON BERNARDO RD IN ESCONDIDO 90 FT SE OF INT W/ JAMBLE LANE, 3 FT EAST OF PP #11452, CONE MON. W/ BRASS DISK STAMPES 502 ELEV. = 457.463

**SCALE**

45 SHOWN

Office: \_\_\_\_\_ Traffic: \_\_\_\_\_

Designed By: \_\_\_\_\_ Drawn By: \_\_\_\_\_ Checked By: \_\_\_\_\_

Submitted: 9-3-98 Approved: 9-3-98

By: *Paul A. Thomas* By: *Paul A. Thomas*

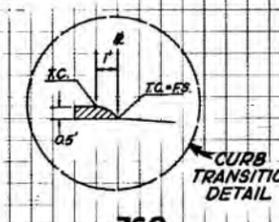
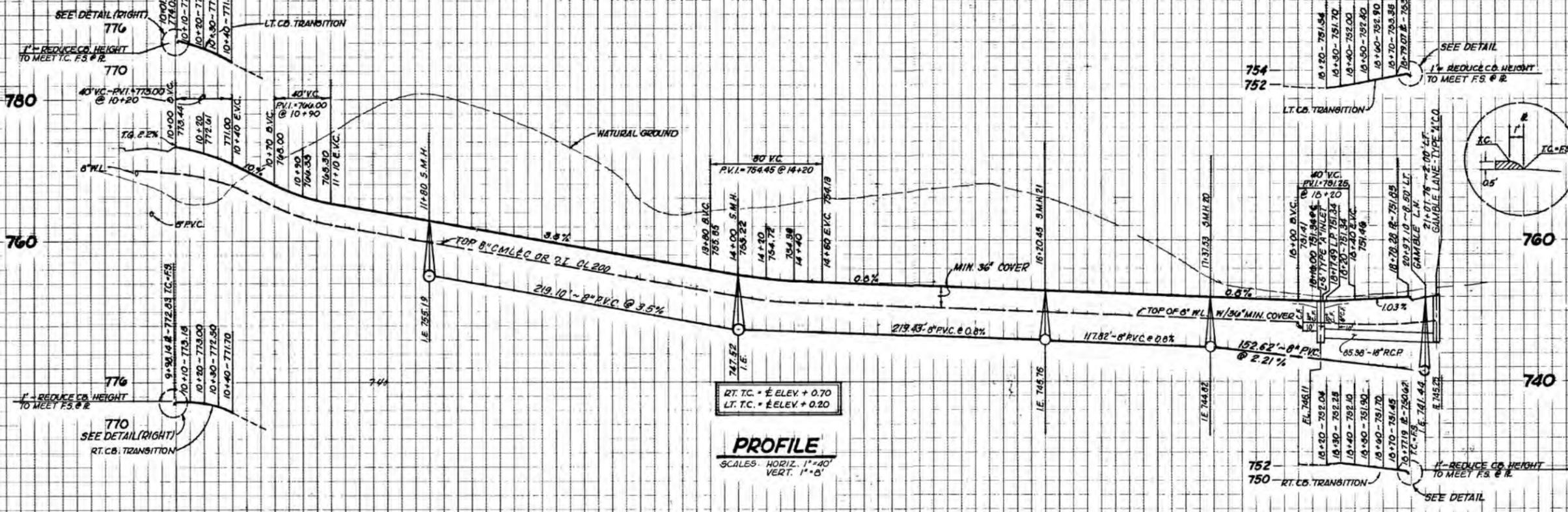
Fel Anst City Engineer Asst. Director of Public Works

**CITY OF ESCONDIDO DEPT. OF PUBLIC WORKS**

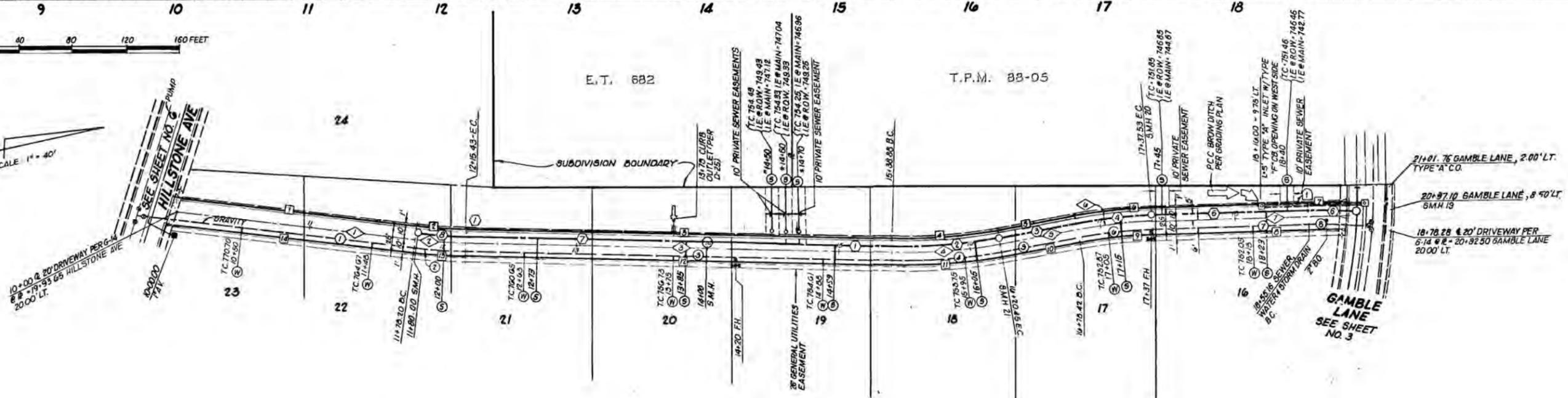
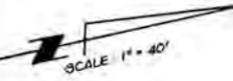
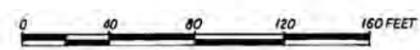
PLANS FOR THE IMPROVEMENT OF ESCONDIDO TRACT NO. 692

**EUCALYPTUS AVENUE**

Drawing No. **P-1929** Sheet 2 of 11



**PROFILE**  
 SCALES: HORIZ. 1"=40'  
 VERT. 1"=8'



**PLAN: SONRIBA GLEN (PRIVATE)**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
14	N19°03'00"E		150.06'	6" TYPE 'G' CURB
15	Δ-05°20'00"	410'	38.10'	
12	N13°45'00"E		323.45'	
11	Δ-11°41'00"	410'	33.60'	
10	N02°04'00"E		57.97'	
9	Δ-05°26'00"	390'	57.63'	
8	N10°32'00"E		139.66'	6" TYPE 'G' CURB
7	N10°32'00"E		141.54'	6" TYPE 'G' CURB & GUTTER
6	Δ-05°26'00"	410'	90.39'	
5	N02°04'00"E		57.97'	
4	Δ-11°41'00"	390'	79.53'	
3	N13°45'00"E		323.45'	
2	Δ-05°20'00"	390'	34.30'	
1	N19°05'00"E		179.34'	6" TYPE 'G' CURB & GUTTER

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
8	Δ-05°20'00"	385'	34.53'	
7	N13°45'00"E		184.57'	
6	Δ-07°10'40"	411'	34.39'	
5	N10°32'00"E		117.63'	
4	Δ-08°25'00"	405'	59.85'	
3	N02°04'00"E		57.97'	
2	Δ-11°41'00"	395'	80.55'	
1	N13°45'00"E		138.88'	8" PVC

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
8	Δ-5°45'11"	400'	40.51'	8" CMLC 10GA OR D.I. CL 360
7	N10°32'00"E		117.63'	
6	Δ-05°20'00"	394'	58.22'	
5	N02°04'00"E		57.97'	
4	Δ-11°41'00"	400'	62.79'	
3	N18°45'00"E		323.45'	
2	Δ-05°20'00"	400'	37.79'	
1	N19°05'00"E		207.80'	8" CMLC 10GA OR D.I. CL 360

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
2	Δ-06°27'06"	415.75'		
1	N10°32'00"E		39.16'	18" RCP (1350 D)

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
7	N10°32'00"E		140.75'	
6	Δ-05°26'00"	400'	69.11'	
5	N02°04'00"E		57.97'	
4	Δ-11°41'00"	400'	61.67'	
3	N13°45'00"E		323.45'	
2	Δ-05°20'00"	400'	37.23'	
1	N19°05'00"E		178.20'	

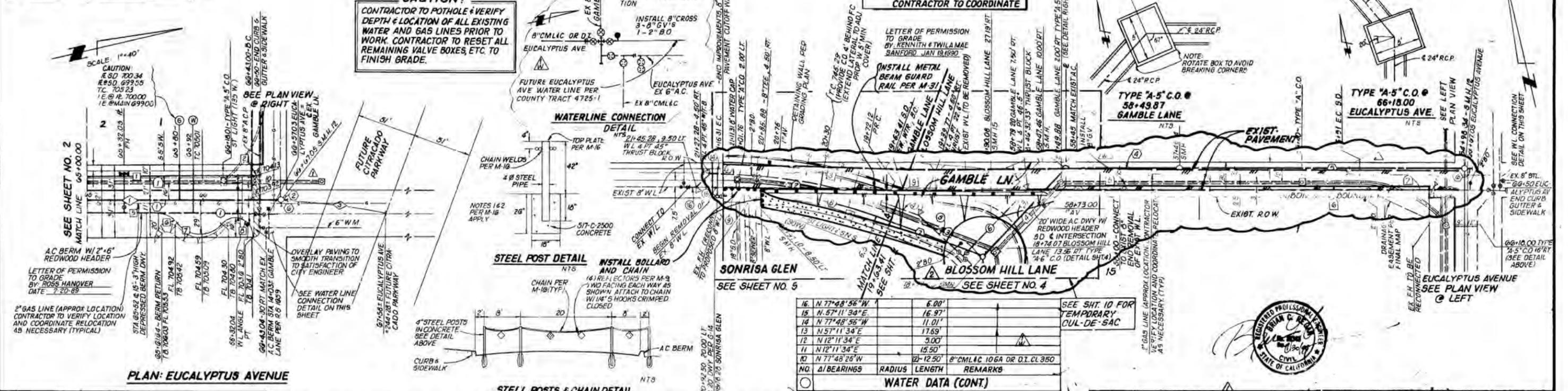
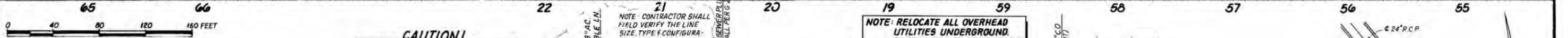
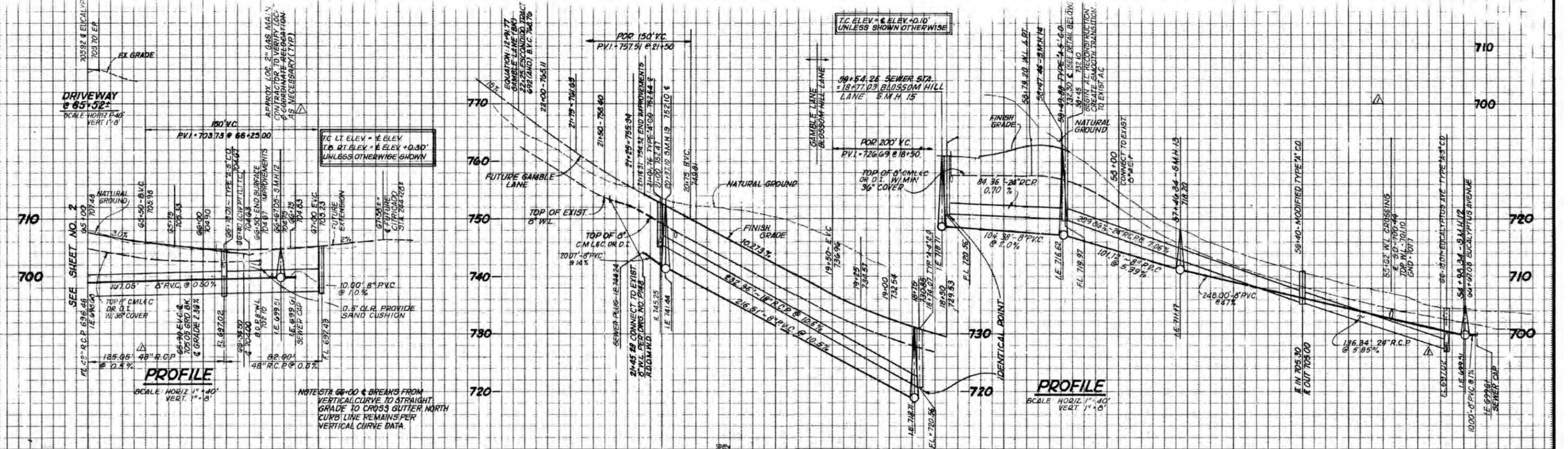
Date	By	WATER REVISIONS	App'd	Date
		REVISION W/L TYPE		

RINCON DEL DIABLO MUNICIPAL WATER DISTRICT  
 FRED ADJARIAN GENERAL MANAGER  
 DISTRICT ENGINEER R.C.E. NO. 19928  
 DATE 1/10/90  
 DATE 1/9/90



CONSTRUCTION RECORD	REFERENCES	Date	By	REVISIONS	App'd	Date	BENCH MARK	SCALE	Office	Designed By	Drawn By	Checked By	Submitted	Approved	CITY OF ESCONDIDO DEPT. OF PUBLIC WORKS	Drawing No.	
							ON BERNHARD RD IN ESCONDIDO 50 FT SE OF INT W/ GAMBLE LANE, 3 FT EAST OF PP #114452, CONC MON N/2885 DISK STAMP 68 502 ELEV + 957.463	AS SHOWN						9-3-98	7-3-98	PLANS FOR THE IMPROVEMENT OF: ESCONDIDO TRACT NO. 692	P-1929
<p>Plans Prepared Under Supervision Of          For Asst City Engineer          Director Of Public Works</p>																	





**PLAN: EUCALYPTUS AVENUE**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
1	N 12°12'58"E	143.00	6.21	6" TYPE 'B' CURB & GUTTER
2	Δ-0°40'08"	700	10.00	6" TYPE 'B' CURB & GUTTER
3	Δ-2°51'44"	117.26	10.12	6" TYPE 'B' CURB & GUTTER
4	N 12°12'58"E	61.64	6.16	6" A.C. BERM
5	N 55°39'01"E	104.36	10.12	6" TYPE 'B' CURB & GUTTER
6	N 77°48'26"W	248.00	10.12	6" TYPE 'B' CURB & GUTTER
7	N 56°56'59"E	85.52	10.12	6" TYPE 'B' CURB & GUTTER
8	Δ-18°14'18"	411.50	18.83	6" TYPE 'B' CURB & GUTTER
9	Δ-2°37'17"	811.50	18.83	6" TYPE 'B' CURB & GUTTER

**SEWER DATA**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
1	N 12°12'58"E	167.05	10.00	8" PVC
2	Δ-18°14'18"	411.50	18.83	8" PVC
3	N 55°39'01"E	104.36	10.12	8" PVC
4	N 77°48'26"W	248.00	10.12	8" PVC
5	N 56°56'59"E	85.52	10.12	8" PVC
6	Δ-18°14'18"	411.50	18.83	8" PVC
7	Δ-2°37'17"	811.50	18.83	8" PVC

**WATER DATA (CONT.)**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
1	N 12°12'58"E	132.04	10.00	8" CMLC 10GA OR D.I. CL 350
2	Δ-18°14'18"	411.50	18.83	8" CMLC 10GA OR D.I. CL 350
3	N 55°39'01"E	104.36	10.12	8" CMLC 10GA OR D.I. CL 350
4	N 77°48'26"W	248.00	10.12	8" CMLC 10GA OR D.I. CL 350
5	N 56°56'59"E	85.52	10.12	8" CMLC 10GA OR D.I. CL 350
6	Δ-18°14'18"	411.50	18.83	8" CMLC 10GA OR D.I. CL 350
7	Δ-2°37'17"	811.50	18.83	8" CMLC 10GA OR D.I. CL 350

**STORM DRAIN DATA**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
1	N 12°12'58"E	132.04	10.00	18" RCP (1350 D)
2	Δ-18°14'18"	411.50	18.83	18" RCP (1350 D)
3	N 55°39'01"E	104.36	10.12	18" RCP (1350 D)
4	N 77°48'26"W	248.00	10.12	18" RCP (1350 D)
5	N 56°56'59"E	85.52	10.12	18" RCP (1350 D)
6	Δ-18°14'18"	411.50	18.83	18" RCP (1350 D)
7	Δ-2°37'17"	811.50	18.83	18" RCP (1350 D)

**€ DATA**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
1	N 12°12'58"E	167.05	10.00	6" TYPE 'B' CURB & GUTTER
2	Δ-0°40'08"	700	10.00	6" TYPE 'B' CURB & GUTTER
3	Δ-2°51'44"	117.26	10.12	6" TYPE 'B' CURB & GUTTER
4	N 12°12'58"E	61.64	6.16	6" A.C. BERM
5	N 55°39'01"E	104.36	10.12	6" TYPE 'B' CURB & GUTTER
6	N 77°48'26"W	248.00	10.12	6" TYPE 'B' CURB & GUTTER
7	N 56°56'59"E	85.52	10.12	6" TYPE 'B' CURB & GUTTER
8	Δ-18°14'18"	411.50	18.83	6" TYPE 'B' CURB & GUTTER
9	Δ-2°37'17"	811.50	18.83	6" TYPE 'B' CURB & GUTTER

**CONSTRUCTION RECORD**

CONTRACTOR	INSPECTOR	DATE COMPLETED	DATE	BY	REVISIONS	APPROVED	DATE	BENCH MARK	SCALE	OFFICE	DESIGNED BY	DRAWN BY	CHECKED BY	SUBMITTED	APPROVED	CITY OF ESCONDIDO DEPT. OF PUBLIC WORKS	DRAWING NO.
								ON BERNARDO RD IN ESCONDIDO 90 FT SE OF INT W/ GAMBLE LANE, 5 FT EAST OF PP #10492, CONC. MON #136365 ONK 375447-53 347 ELEV = 457.463	Horizontal					9-3-98	9-3-98	PLANS FOR THE IMPROVEMENT OF: ESCONDIDO TRACT NO. 692 EUCALYPTUS AVENUE AND GAMBLE LANE BLOSSOM HILL LANE TEMPORARY CUL-DE-SAC	P-1929

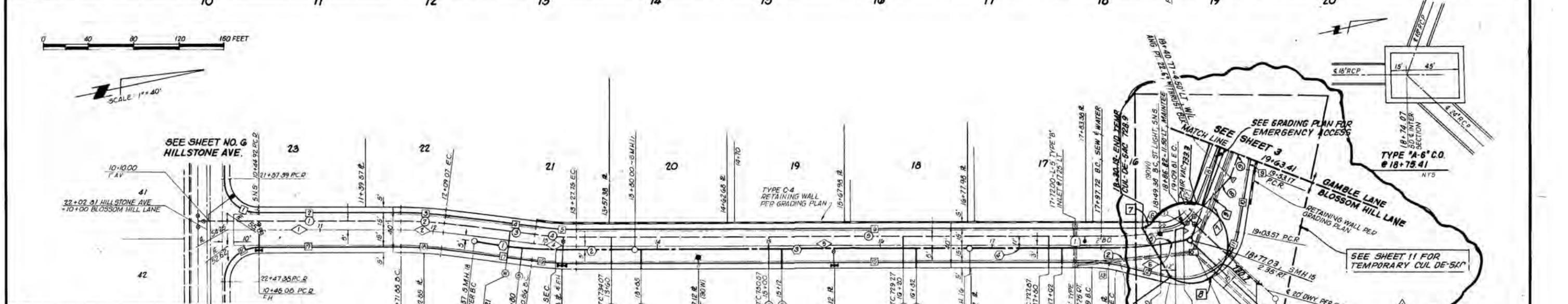
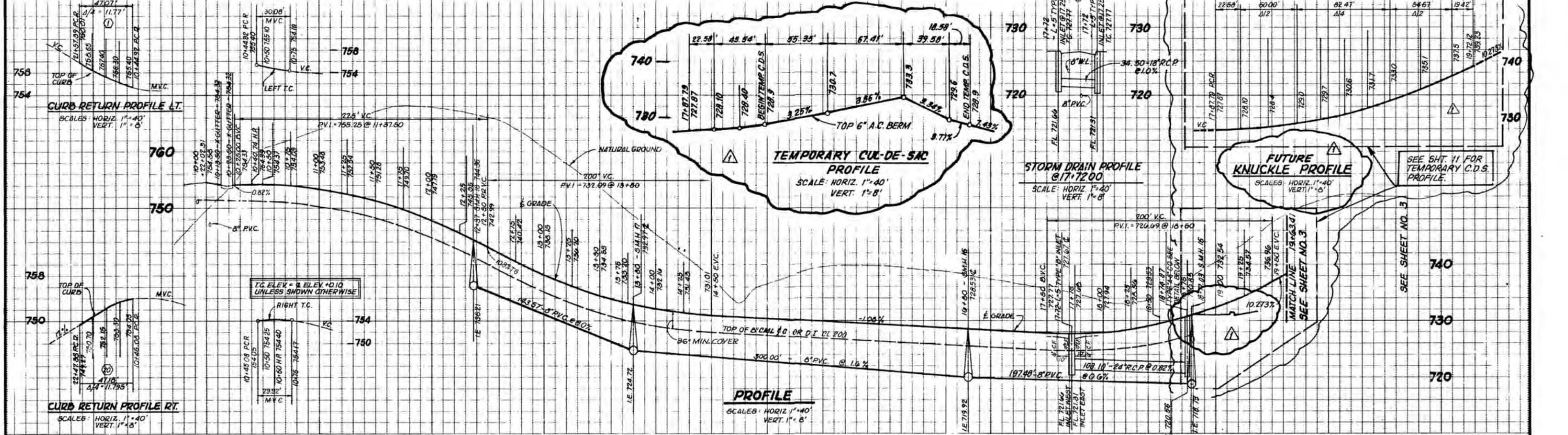
**WATER REVISIONS**

DATE	BY	REVISIONS	APP'D	DATE
11/10/90		REVISE DETAIL ADD G.V., REVISE WIL TYPE		11/10/90

**CITY OF ESCONDIDO DEPT. OF PUBLIC WORKS**

PLANS FOR THE IMPROVEMENT OF: ESCONDIDO TRACT NO. 692 EUCALYPTUS AVENUE AND GAMBLE LANE BLOSSOM HILL LANE TEMPORARY CUL-DE-SAC

Sheet 10 of 11



NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
20	Δ-90°00'02"	30'	47.16'	6" TYPE "G" CURB & GUTTER
19	N12°17'52"E		126.00'	
18	Δ-07°06'00"	205'	35.33'	
17	N19°24'00"E		61.49'	
16	Δ-07°06'00"	315'	39.05'	
15	N12°17'52"E		460.04'	6" TYPE "G" CURB & GUTTER
14				NOT USED
13	Δ-12°56'10"	100'	22.58'	6" TYPE "G" CURB & GUTTER
12	N25°14'02"E		50.00'	
11	Δ-94°30'00"	30'	52.87'	
10	N68°20'01"W		31.87'	
9	Δ-5°33'53"	135'	3.21'	6" TYPE "G" CURB & GUTTER
8	N52°56'10"W		59.00'	
7	Δ-26°50'08"	35.00'	162.39'	6" TYPE "A" A.C. BERM
6	Δ-52°08'24"	20.00'	18.32'	
5	N12°17'52"E		502.44'	6" TYPE "G" CURB & GUTTER
4	Δ-07°06'00"	315'	39.05'	
3	N12°16'30"E		300.00'	
2	N12°17'52"E		179.90'	
1	Δ-09°50'50"	30'	47.07'	6" TYPE "G" CURB & GUTTER

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
8	N 26°50'08" W	35.00'	162.39'	6" TYPE "A" A.C. BERM
7	Δ-52°08'24"	20.00'	18.32'	
6	N 12°17'52" E		502.44'	6" TYPE "G" CURB & GUTTER

**TEMPORARY CUL-DE-SAC DATA**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
6	N 56°56'59" W		85.52'	2" PVC
5	Δ-12°11'14"	375'	79.76'	2" PVC
4	N 12°17'52" E		117.72'	8" PVC
3	Δ-19°24'00" E		30.20'	
2	Δ-07°06'00" E		61.49'	
1	Δ-07°06'00" E	300'	35.16'	

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
8	N 56°56'59" W		22.65'	
7	N 34°20'59" W		32.04'	
6	Δ-11°20'12"	364'	72.02'	8" CML4C 106A OR D.I. CL 350
5	N 12°17'52" E		469.97'	
4	Δ-19°24'00" E		30.20'	
3	Δ-19°24'00" E		61.49'	
2	Δ-07°06'00" E		35.16'	
1	N 12°17'52" E		179.90'	6" CML4C 106A OR D.I. CL 350

**WATER DATA**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
7	N 56°56'59" W		53.60'	
6	Δ-09°14'51"	50'	60.43'	
5	N 12°17'52" E		52'63"	
4	Δ-07°06'00" E	300'	37.19'	
3	N 19°24'00" E		61.49'	
2	Δ-07°06'00" E	300'	37.19'	
1	N 12°17'52" E		171.88'	

**STORM DRAIN DATA**

NO.	Δ/BEARING	RADIUS	LENGTH	REMARKS
7	N 56°56'59" W		53.60'	
6	Δ-09°14'51"	50'	60.43'	
5	N 12°17'52" E		52'63"	
4	Δ-07°06'00" E	300'	37.19'	
3	N 19°24'00" E		61.49'	
2	Δ-07°06'00" E	300'	37.19'	
1	N 12°17'52" E		171.88'	

**Σ DATA**

<b>CONSTRUCTION RECORD</b> Contractor: _____ Inspector: _____ Date Completed: _____	<b>REFERENCES</b> Date: _____ By: _____ App'd: _____ Date: _____	<b>REVISIONS</b> App'd: _____ Date: _____ BENCH MARK 90 FT S.E. OF INT. W/ GAMBLE LANE, 3 FT EAST OF PP #10452, CONC. MON. W/ 2868 CHK. STAMP E3 502 ELEV. +657.403	<b>SCALE</b> AS SHOWN Office: _____ Traffic: _____	<b>DESIGNED BY</b> _____ Drawn By: _____ Checked By: _____	<b>SUBMITTED</b> 9-3-98 By: <i>John N...</i> City Engineer	<b>APPROVED</b> 9-3-98 By: <i>Richard A. ...</i> Director of Public Works	<b>CITY OF ESCONDIDO DEPT. OF PUBLIC WORKS</b> PLANS FOR THE IMPROVEMENT OF ESCONDIDO TRACT NO. 692 <b>BLOSSOM HILL LANE - TEMPORARY CUL-DE-SAC</b>	<b>DRAWING NO.</b> <b>P-1929</b> Sheet 11 of 11 J.N. 909
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