

**PRELIMINARY HYDROLOGY STUDY
FOR VAN VLIET SITE**

**TTM No. 20161 ('A' MAP)
TTM No. 20169, 20170, 20171, 20172,
20173, 20270, & 20271**

**IN THE
CITY OF CHINO**

**PREPARED FOR:
LEWIS MANAGEMENT CORP.**

PREPARED BY:

LKING

ENGINEERS / SURVEYORS



March 28, 2019

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SECTION 1: DISCUSSION

1.1 Introduction

The purpose to this report is to provide a preliminary hydrology study for the Van Vliet site, tentative tract maps 20169, 20170, 20171, 20172, 20173, 2070, and 20271 which are subdivided from the "A" map 20161 (Figure 2). The proposed development consists of multi-family units and 89 single-family units. The project is bounded by Pine Avenue to the south, Bickmore Avenue to the north, and existing detention basin and earthen trapezoidal channel to the east (Figure 1). The Meadow Square Apartment Homes are the only development that existed in the vicinity of the project site.

The onsite hydrology analysis for each tentative map will be calculated to determine limits of the proposed storm drain system and catch basin location to convey runoff to existing storm drain facilities. The proposed overall drainage pattern of this project is in conformance to an approved hydrology study for Tract 17571 (Approved Hydrology Map, Section 3.1). The existing retention basin and proposed submersible pumps will be used to reduce post-development peak flow to less than eighty percent of the pre-development peak flow. This pump will be sized to empty the basin within 24-hour period. A preliminary pumping station design and location will be addressed in a separate design report

1.2 Existing Condition

The entire site currently drains into an existing retention basin via storm drain system and catch basins. There is an existing storm drain main in Meadowhouse Avenue, pipe diameter varies from 36 inch to 54 inch Reinforced Concrete Pipe (RCP), which outlet to existing retention basin. The basin is 230' wide X 280' long and 14' deep with a retention volume of 9.60 ac-ft. The basin spillway with a weir length of 95-feet is located near southwest corner of the site. Most of the remaining lots are in a mass graded condition except the Meadow Square Apartment Homes which located at the northeast corner of Pine Avenue and Meadowhouse Avenue. Flows from these undeveloped lots are captured by temporary corrugated steel pipe riser and outlet into the existing storm drain system.

1.3 Summary of Analysis

The following Table 1 shows the results of the unit hydrograph and flood routing analysis. At a pumping rate of 10.5 cfs, the water surface elevation in the basin is 566.51' which is 0.5' below the existing spillway elevation of 567.0'. The drain time calculation is based on a runoff volume of 8.73 ac-ft remains in the basin at the time period of 24.67-hours as indicated in the flood hydrograph routing calculations. It takes 10.06 hours to empty the basin at a constant rate of pumping of 10.5 cfs.

Table 1

Unit Hydrograph Results:	
Q100 (cfs) Post-Development	135.4
Q100 (cfs), 80% of Pre-development Condition	50.9
Basin Routing Results	
Outflow to Pine Ave by Pumping (cfs)	10.5
Storage in Basin (ac-ft)	9.92
Depth of water in basin (ft)	12.01
Drain time (hrs)	10.06
Basin Storage Capacity (ac-ft)	10.46
Bottom basin elevation (ft)	554.5

The onsite storm drain systems and catch basins are proposed to convey runoff in locations where streets or other drainage facilities exceed their designated capacity or unable to drain as in sump condition (see Hydrology Map). Since the proposed onsite drainage patterns for these tentative tract maps are in conformance with an approved hydrology map for the parent Tract 17571, the proposed improvements shall not adversely impact the existing storm drain system.

The proposed storm drain system is introduced when street flow depth exceeds top of curb in a 10-year storm or the road right-of-way in a 100-year storm. For private alleys, storm drain is introduced when runoff exceeds top of curb.

1.4 Methodology

Rational Method: Rational Method Hydrology was prepared to calculate the peak storm water runoff and to identify the storm drain sizing requirements for the on-site drainage facilities. The Rational Method Hydrology study was prepared for the project site using the criteria set forth in the San Bernardino County Hydrology Manual, dated August 1986 and City of Chino drainage guidelines. The Advanced Engineering Software (AES) hydrological computer software was used in the preparation of the analysis.

Unit Hydrograph Routing: For the purpose of evaluating the total volume of storm water discharge for the project site, the Unit Hydrograph Method was utilized, whereas, the Rational Method only provides the peak discharge rates. A unit hydrograph was used to calculate the volume for a 24-hour storm duration. All calculations and studies were completed using CivilDesign, Version 6.0 hydrology software.

TABLE 2 - VAN VLIET SITE
Basin Volume Calculation

Cul. Depth (ft)	elevation (ft)	depth (ft)	area (sf)	volume (ft ³)	volume (ac-ft)	Cul. Volume (ac-ft)
0	554.5		0			
0.5	555	0.5	8680	4340	0.05	0.05
1.5	556	1	30573	19627	0.45	0.50
2.5	557	1	32117	31345	0.72	1.22
3.5	558	1	33677	32897	0.76	1.98
4.5	559	1	35260	34469	0.79	2.77
5.5	560	1	36869	36065	0.83	3.59
6.5	561	1	38498	37684	0.87	4.46
7.5	562	1	40155	39327	0.90	5.36
8.5	563	1	41847	41001	0.94	6.30
9.5	564	1	43534	42691	0.98	7.28
10.5	565	1	45293	44414	1.02	8.30
11.5	566	1	47050	46172	1.06	9.36
12.5	567	1	48858	47954	1.10	10.46

TABLE 3 - VAN VLIET SITE
 Depth, Flow v.s. Storage

	Elevation (ft)	Depth (ft)	Storage (ac-ft)	Flow (cfs)
1	554.5	0	0	0
2	555	0.5	0.05	10.8
3	556	1.5	0.5	10.8
4	557	2.5	1.22	10.8
5	558	3.5	1.98	10.8
6	559	4.5	2.77	10.8
7	560	5.5	3.59	10.8
8	561	6.5	4.46	10.8
9	562	7.5	5.36	10.8
10	563	8.5	6.3	10.8
11	564	9.5	7.28	10.8
12	565	10.5	8.3	10.8
13	566	11.5	9.36	10.8
14	567	12.5	10.46	10.8

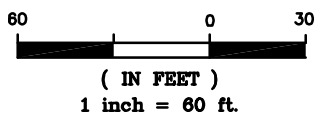
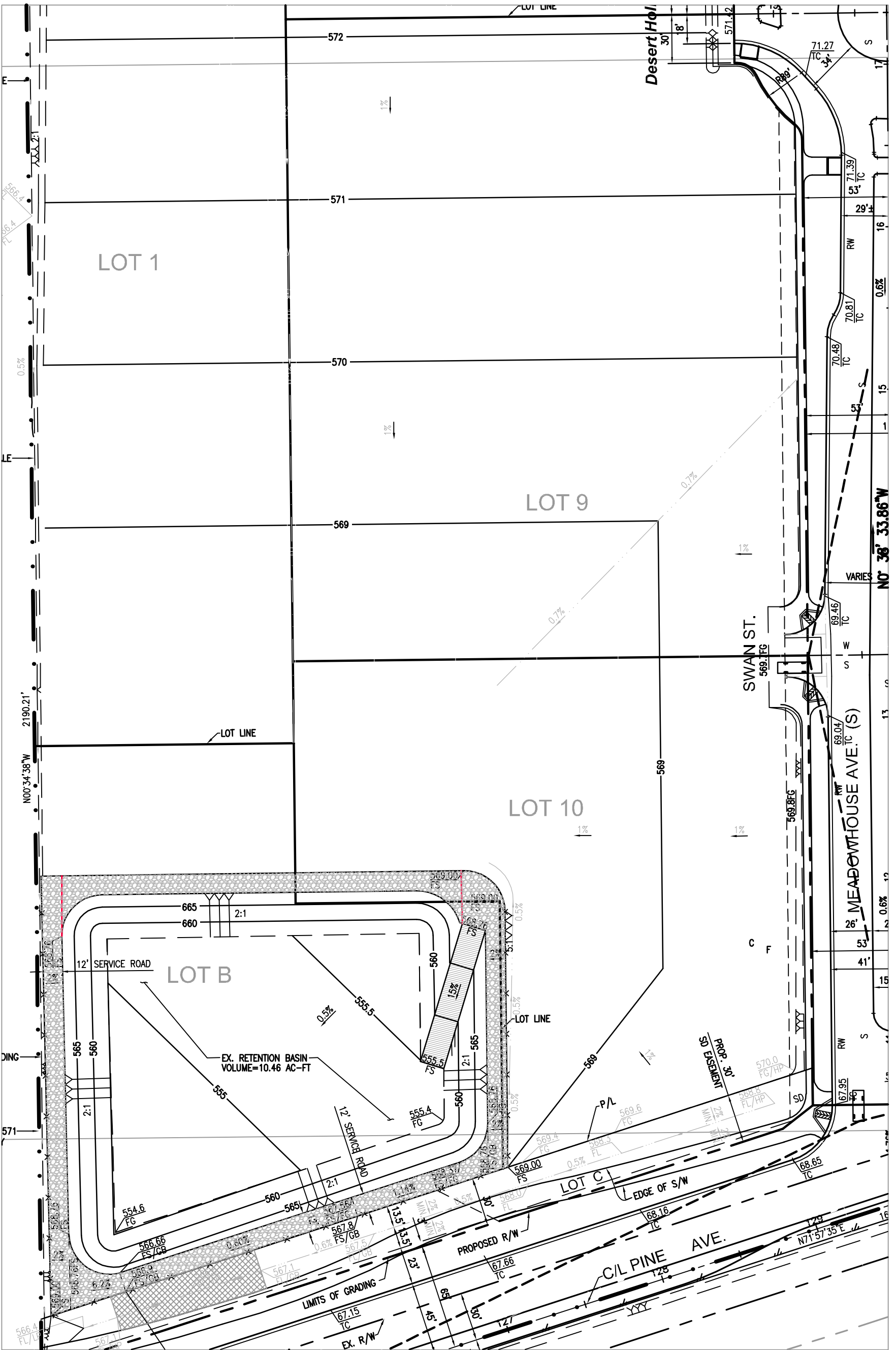


EXHIBIT 'B'
 EXISTING RETENTION BASIN
 TRACT NO. 17571



Map data ©2018 Google 1 mi

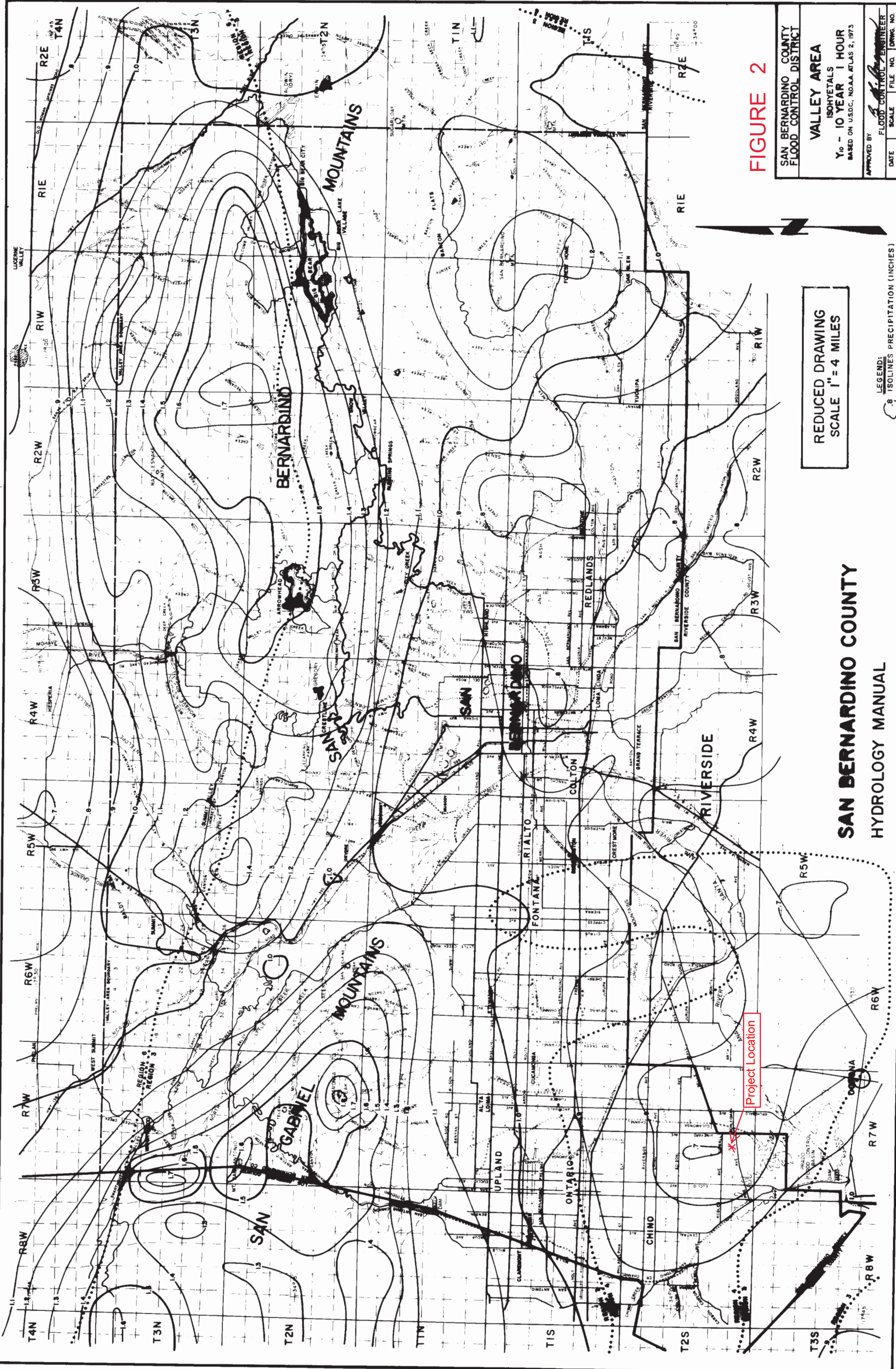


FIGURE 2

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

VALLEY AREA
ISOHYETALS
Y₁₀ - 10 YEAR 1 HOUR
BASED ON USDC, NOAA ATLAS 2, 1973

APPROVED BY: *[Signature]*
FLOOD CONTROL ENGINEER

DATE: 1982
SCALE: 1" = 4 MILES
FILE NO. DRWG. NO. 100-1

REDUCED DRAWING
SCALE 1" = 4 MILES

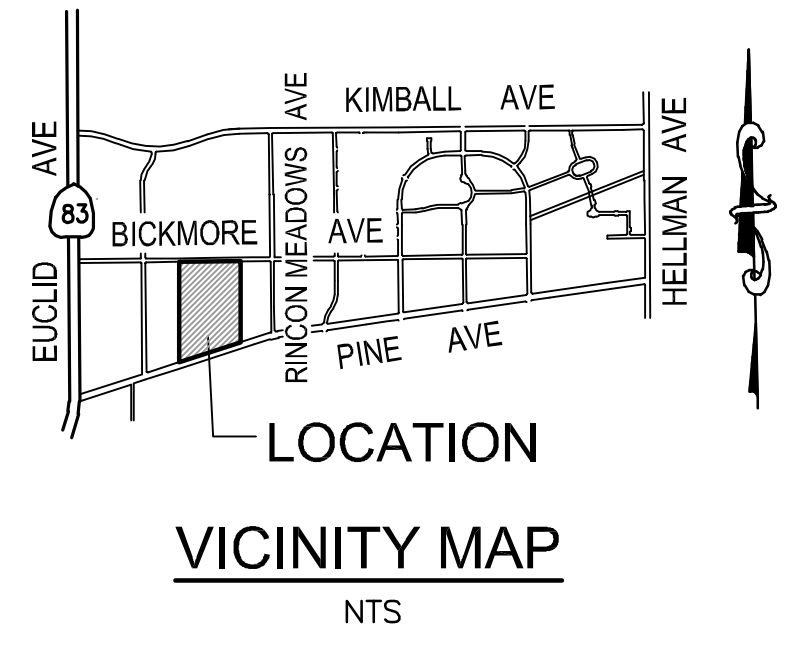
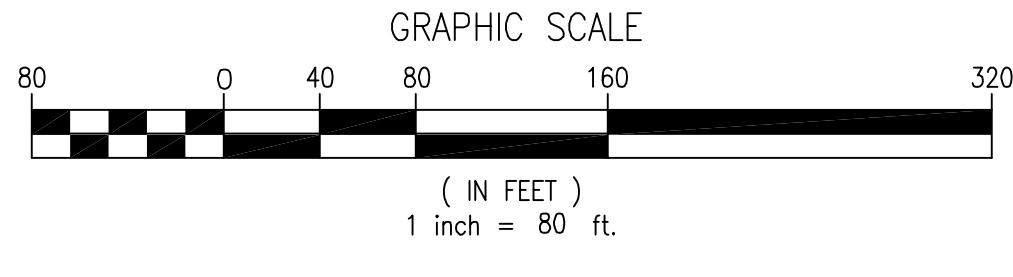
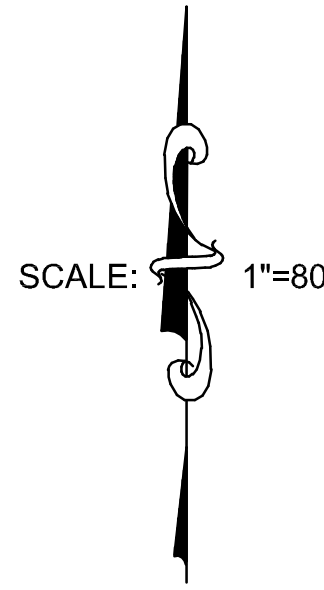
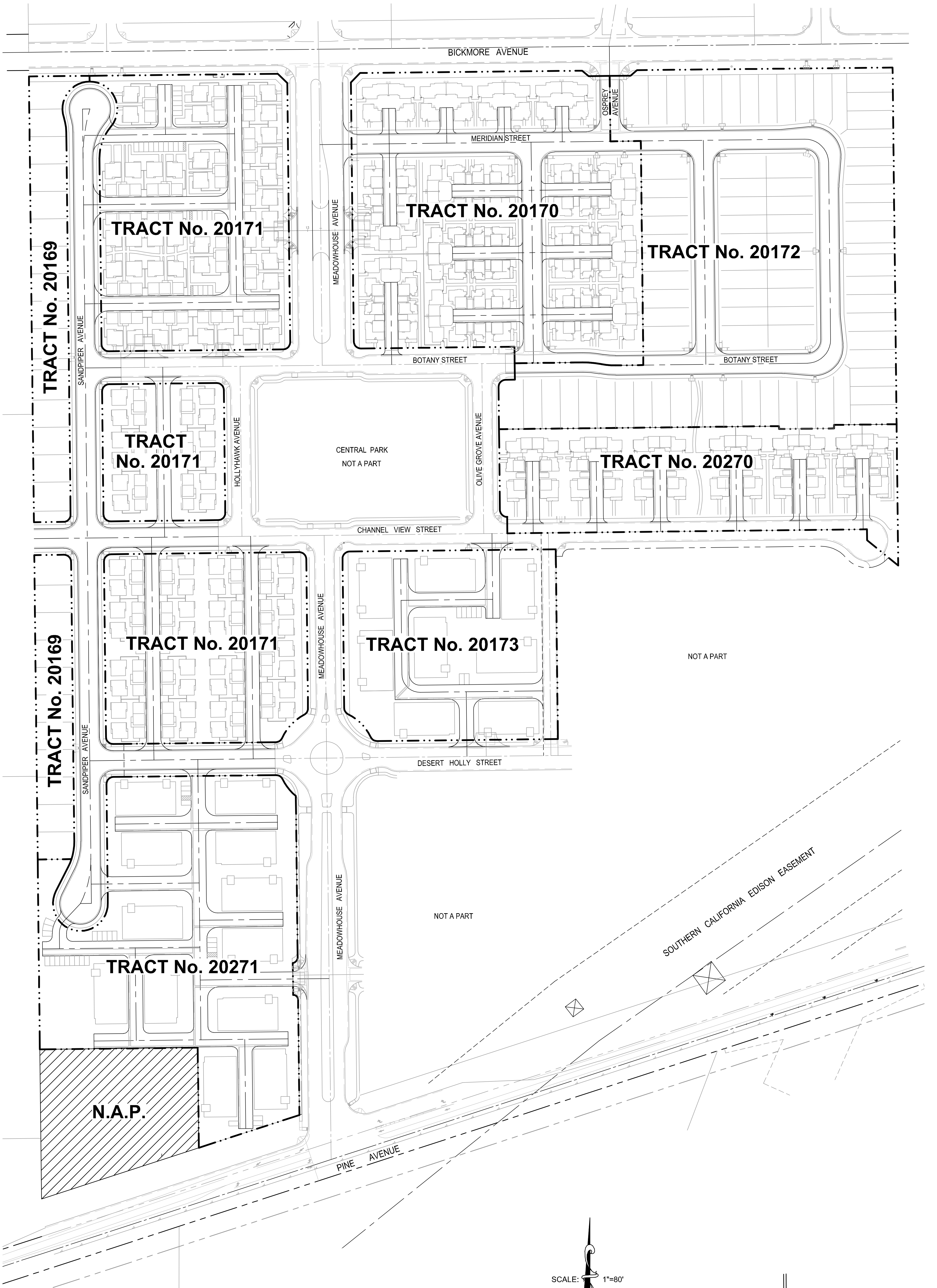
SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

LEGEND:
ISOLINES PRECIPITATION (INCHES)

COMPOSITE MAP
TRACT No. 20161

L.D. KING, INC.

MARCH 2019



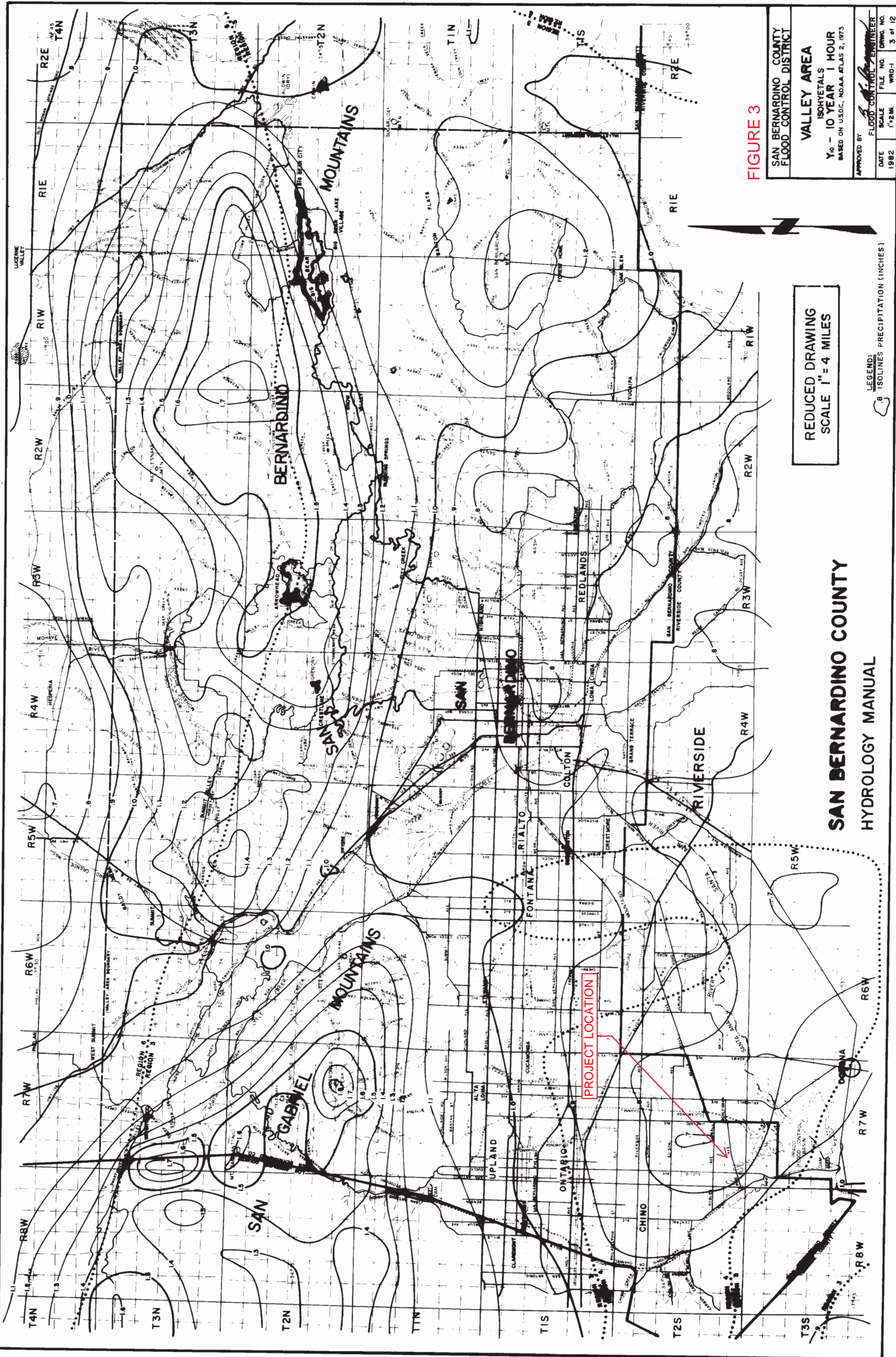


FIGURE 3

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT	
VALLEY AREA ISOHYETALS Y ₁₀ - 10 YEAR 1 HOUR BASED ON U.S.D.C. NOAA ATLAS 2, 1973	
APPROVED BY	FLOOD CONTROL ENGINEER
DATE	FILE NO. DRWG. NO.
1982	1"=2 MI. WRD-1 3 of 12

REDUCED DRAWING
SCALE 1" = 4 MILES

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

LEGEND:
8 ISOLINES PRECIPITATION (INCHES)

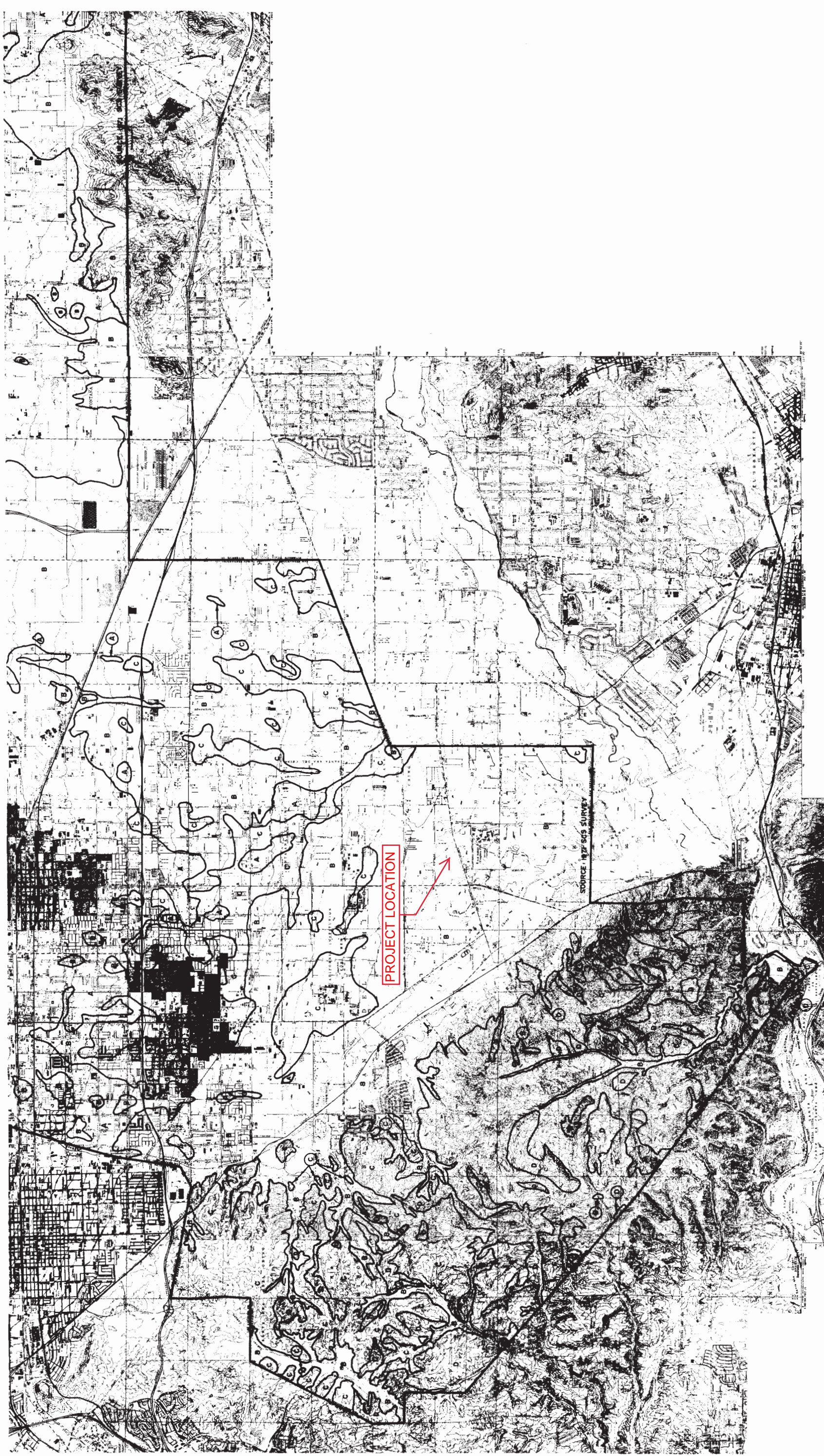


FIGURE 4

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

SCALE REDUCED BY 1/2

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-C AREA

LEGEND

- SOIL GROUP BOUNDARY
- A SOIL GROUP DESIGNATION
- BOUNDARY OF INDICATED SOURCE

SCALE 1:49,000

SOURCE: 1977 SCS SURVEY

INDEX MAP

C-1	C-2
C-3	C-4

SAN BERNARDINO COUNTY

SECTION 2: HYDROLOGY CALCULATIONS

- 2.1 Rational Method: Developed Condition (10 & 100-year Storm)
- 2.2 Rational Method: Existing Condition (100-year Storm)
- 2.3 Retention Basin Flood Routing Analysis – Interim Condition
- 2.4 Unit Hydrograph: Developed Condition (100-Year Storm)
- 2.5 Street Capacity Calculation

SECTION 2.1

Rational Method: Developed Condition
(10 & 100 Year-Storm)

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
(c) Copyright 1983-2012 Advanced Engineering Software (aes)
Ver. 18.2 Release Date: 05/08/2012 License ID 1470

Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
* VAN VLIET: TTM 20261 ('A'MAP);20169;20170;20171;20172;20173;20270;20271 *
* Q100 *
* FILE:481252I *

FILE NAME: 481252I.DAT
TIME/DATE OF STUDY: 09:08 03/28/2019

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

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

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 24.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 0.750
100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 1.100
COMPUTED RAINFALL INTENSITY DATA:
STORM EVENT = 100.00 1-HOUR INTENSITY(INCH/HOUR) = 1.1000
SLOPE OF INTENSITY DURATION CURVE = 0.6000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL
Table with 9 columns: NO., WIDTH (FT), CROSSFALL (FT), IN- / OUT- / SIDE / SIDE / WAY, HEIGHT (FT), WIDTH (FT), LIP (FT), HIKE (FT), FACTOR (n). Row 1: 1, 18.0, 12.0, 0.020/0.020/0.020, 0.50, 2.00, 0.0313, 0.167, 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.50 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.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

+-----+
| SUB 'A-1' |
| | |
+-----+

FLOW PROCESS FROM NODE 1.00 TO NODE 1.10 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 485.00
ELEVATION DATA: UPSTREAM(FEET) = 582.90 DOWNSTREAM(FEET) = 579.42

481252I-100

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.912
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.902
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
RESIDENTIAL "8-10 DWELLINGS/ACRE"	B	1.00	0.42	0.400	76	11.91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
 SUBAREA RUNOFF(CFS) = 2.46
 TOTAL AREA(ACRES) = 1.00 PEAK FLOW RATE(CFS) = 2.46

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+-----+
| SUB 'A-1.1' |
+-----+

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 FLOW PROCESS FROM NODE 1.10 TO NODE 2.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>(STREET TABLE SECTION # 1 USED)<<<<<
 =====
 UPSTREAM ELEVATION(FEET) = 579.42 DOWNSTREAM ELEVATION(FEET) = 577.40
 STREET LENGTH(FEET) = 380.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 12.00
 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) = 4.90
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.45
 HALFSTREET FLOOD WIDTH(FEET) = 14.67
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.09
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.95
 STREET FLOW TRAVEL TIME(MIN.) = 3.03 Tc(MIN.) = 14.94
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.533
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	B	2.29	0.42	0.400	76

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
 SUBAREA AREA(ACRES) = 2.29 SUBAREA RUNOFF(CFS) = 4.87
 EFFECTIVE AREA(ACRES) = 3.29 AREA-AVERAGED Fm(INCH/HR) = 0.17
 AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.40
 TOTAL AREA(ACRES) = 3.3 PEAK FLOW RATE(CFS) = 7.00

END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.50 HALFSTREET FLOOD WIDTH(FEET) = 17.02
 FLOW VELOCITY(FEET/SEC.) = 2.27 DEPTH*VELOCITY(FT*FT/SEC.) = 1.13
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 2.00 = 865.00 FEET.

 FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 31

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

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 385.00
ELEVATION DATA: UPSTREAM(FEET) = 581.20 DOWNSTREAM(FEET) = 579.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.267
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.000
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
CONDOMINIUMS B 1.45 0.42 0.350 76 11.27
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA RUNOFF(CFS) = 3.72
TOTAL AREA(ACRES) = 1.45 PEAK FLOW RATE(CFS) = 3.72

FLOW PROCESS FROM NODE 5.20 TO NODE 5.40 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 583.30 DOWNSTREAM(FEET) = 572.10
FLOW LENGTH(FEET) = 425.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 24.000
DEPTH OF FLOW IN 24.0 INCH PIPE IS 5.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.22
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.72
PIPE TRAVEL TIME(MIN.) = 0.98 Tc(MIN.) = 12.25
LONGEST FLOWPATH FROM NODE 5.10 TO NODE 5.40 = 810.00 FEET.

FLOW PROCESS FROM NODE 5.40 TO NODE 5.40 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.) = 12.25
RAINFALL INTENSITY(INCH/HR) = 2.85
AREA-AVERAGED Fm(INCH/HR) = 0.15
AREA-AVERAGED Fp(INCH/HR) = 0.42
AREA-AVERAGED Ap = 0.35
EFFECTIVE STREAM AREA(ACRES) = 1.45
TOTAL STREAM AREA(ACRES) = 1.45
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.72

+-----+
| SUB 'A-5' |
+-----+

FLOW PROCESS FROM NODE 1.00 TO NODE 5.30 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 420.00
ELEVATION DATA: UPSTREAM(FEET) = 582.90 DOWNSTREAM(FEET) = 581.19

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 12.596
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.806
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc

481252I-100

LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN	(MIN.)
RESIDENTIAL						
"8-10 DWELLINGS/ACRE"	B	1.45	0.42	0.400	76	12.60
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42						
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400						
SUBAREA RUNOFF(CFS) = 3.44						
TOTAL AREA(ACRES) = 1.45 PEAK FLOW RATE(CFS) = 3.44						

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+-----+
| SUB 'A-5.1' |
+-----+

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FLOW PROCESS FROM NODE 5.30 TO NODE 5.40 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 581.19	DOWNSTREAM ELEVATION(FEET) = 578.10
STREET LENGTH(FEET) = 400.00	CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00	

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 12.00
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) = 4.65						
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:						
STREET FLOW DEPTH(FEET) = 0.42						
HALFSTREET FLOOD WIDTH(FEET) = 13.27						
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.39						
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.01						
STREET FLOW TRAVEL TIME(MIN.) = 2.79 Tc(MIN.) = 15.39						
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.489						
SUBAREA LOSS RATE DATA(AMC III):						
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS						
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN						
CONDOMINIUMS B 1.15 0.42 0.350 76						
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42						
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350						
SUBAREA AREA(ACRES) = 1.15 SUBAREA RUNOFF(CFS) = 2.42						
EFFECTIVE AREA(ACRES) = 2.60 AREA-AVERAGED Fm(INCH/HR) = 0.16						
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.38						
TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 5.45						

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.44 HALFSTREET FLOOD WIDTH(FEET) = 14.20
FLOW VELOCITY(FEET/SEC.) = 2.47 DEPTH*VELOCITY(FT*FT/SEC.) = 1.09
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.40 = 820.00 FEET.

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+-----+
| SUB 'A-5.2' |
+-----+

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FLOW PROCESS FROM NODE 5.40 TO NODE 5.40 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 15.39

481252I-100

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.489
 SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 CONDOMINIUMS B 0.61 0.42 0.350 76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
 SUBAREA AREA(ACRES) = 0.61 SUBAREA RUNOFF(CFS) = 1.29
 EFFECTIVE AREA(ACRES) = 3.21 AREA-AVERAGED Fm(INCH/HR) = 0.16
 AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.37
 TOTAL AREA(ACRES) = 3.2 PEAK FLOW RATE(CFS) = 6.73

 FLOW PROCESS FROM NODE 5.40 TO NODE 5.40 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 15.39
 RAINFALL INTENSITY(INCH/HR) = 2.49
 AREA-AVERAGED Fm(INCH/HR) = 0.16
 AREA-AVERAGED Fp(INCH/HR) = 0.42
 AREA-AVERAGED Ap = 0.37
 EFFECTIVE STREAM AREA(ACRES) = 3.21
 TOTAL STREAM AREA(ACRES) = 3.21
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 6.73

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	3.72	12.25	2.854	0.42(0.15)	0.35	1.5	5.10
2	6.73	15.39	2.489	0.42(0.16)	0.37	3.2	1.00

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	9.92	12.25	2.854	0.42(0.15)	0.36	4.0	5.10
2	9.95	15.39	2.489	0.42(0.15)	0.37	4.7	1.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 9.95 Tc(MIN.) = 15.39
 EFFECTIVE AREA(ACRES) = 4.66 AREA-AVERAGED Fm(INCH/HR) = 0.15
 AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.37
 TOTAL AREA(ACRES) = 4.7
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.40 = 820.00 FEET.

+-----+
 | SUB 'A-6' |
 +-----+

 FLOW PROCESS FROM NODE 5.10 TO NODE 5.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 150.00
 ELEVATION DATA: UPSTREAM(FEET) = 578.00 DOWNSTREAM(FEET) = 571.10

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.885

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SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	B	0.43	0.42	0.350	76	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA RUNOFF(CFS) = 1.83
TOTAL AREA(ACRES) = 0.43 PEAK FLOW RATE(CFS) = 1.83

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+-----+
| SUB 'A-7' |
+-----+

```

FLOW PROCESS FROM NODE 8.00 TO NODE 9.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 800.00
ELEVATION DATA: UPSTREAM(FEET) = 580.00 DOWNSTREAM(FEET) = 575.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 12.160
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.866

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	B	0.95	0.42	0.100	76	12.16
CONDOMINIUMS	B	3.07	0.42	0.350	76	14.40

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.291
SUBAREA RUNOFF(CFS) = 9.93
TOTAL AREA(ACRES) = 4.02 PEAK FLOW RATE(CFS) = 9.93

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+-----+
| SUB 'A-8' |
+-----+

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FLOW PROCESS FROM NODE 9.00 TO NODE 9.00 IS CODE = 82

>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 480.00
ELEVATION DATA: UPSTREAM(FEET) = 579.00 DOWNSTREAM(FEET) = 575.69

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.510
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.962

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	B	1.14	0.42	0.350	76	11.51

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA AREA(ACRES) = 1.14 INITIAL SUBAREA RUNOFF(CFS) = 2.89

** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
MAINLINE Tc(MIN.) = 12.16
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.866
SUBAREA AREA(ACRES) = 1.14 SUBAREA RUNOFF(CFS) = 2.79
EFFECTIVE AREA(ACRES) = 5.16 AREA-AVERAGED Fm(INCH/HR) = 0.13
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.30

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TOTAL AREA(ACRES) = 5.2 PEAK FLOW RATE(CFS) = 12.71

+-----+
| SUB 'A-9' |
+-----+

FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 360.00
ELEVATION DATA: UPSTREAM(FEET) = 575.90 DOWNSTREAM(FEET) = 573.17

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.500
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.553
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL B 0.48 0.42 0.100 76 8.50
CONDOMINIUMS B 1.11 0.42 0.350 76 10.07
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.275
SUBAREA RUNOFF(CFS) = 4.92
TOTAL AREA(ACRES) = 1.59 PEAK FLOW RATE(CFS) = 4.92

FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 565.20 DOWNSTREAM(FEET) = 562.40
FLOW LENGTH(FEET) = 460.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 24.000
DEPTH OF FLOW IN 24.0 INCH PIPE IS 8.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.63
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.92
PIPE TRAVEL TIME(MIN.) = 1.65 Tc(MIN.) = 10.15
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 820.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 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) = 3.19
AREA-AVERAGED Fm(INCH/HR) = 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.42
AREA-AVERAGED Ap = 0.27
EFFECTIVE STREAM AREA(ACRES) = 1.59
TOTAL STREAM AREA(ACRES) = 1.59
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.92

+-----+
| SUB 'A-10' |
+-----+

Page 8

FLOW PROCESS FROM NODE 12.10 TO NODE 12.20 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 595.00
ELEVATION DATA: UPSTREAM(FEET) = 575.10 DOWNSTREAM(FEET) = 570.45

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.330
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.161
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL B 0.62 0.42 0.100 76 10.33
CONDOMINIUMS B 2.63 0.42 0.350 76 12.23
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.302
SUBAREA RUNOFF(CFS) = 8.87
TOTAL AREA(ACRES) = 3.25 PEAK FLOW RATE(CFS) = 8.87

FLOW PROCESS FROM NODE 12.20 TO NODE 12.00 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.) = 10.33
RAINFALL INTENSITY(INCH/HR) = 3.16
AREA-AVERAGED Fm(INCH/HR) = 0.13
AREA-AVERAGED Fp(INCH/HR) = 0.42
AREA-AVERAGED Ap = 0.30
EFFECTIVE STREAM AREA(ACRES) = 3.25
TOTAL STREAM AREA(ACRES) = 3.25
PEAK FLOW RATE(CFS) AT CONFLUENCE = 8.87

** CONFLUENCE DATA **

Table with 8 columns: STREAM NUMBER, Q (CFS), Tc (MIN.), Intensity (INCH/HR), Fp(Fm) (INCH/HR), Ap, Ae (ACRES), HEADWATER NODE. Rows 1 and 2.

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

** PEAK FLOW RATE TABLE **

Table with 8 columns: STREAM NUMBER, Q (CFS), Tc (MIN.), Intensity (INCH/HR), Fp(Fm) (INCH/HR), Ap, Ae (ACRES), HEADWATER NODE. Rows 1 and 2.

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 13.74 Tc(MIN.) = 10.33
EFFECTIVE AREA(ACRES) = 4.84 AREA-AVERAGED Fm(INCH/HR) = 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.29
TOTAL AREA(ACRES) = 4.8
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 820.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 561.00 DOWNSTREAM(FEET) = 559.80
FLOW LENGTH(FEET) = 305.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 27.0 INCH PIPE IS 17.4 INCHES

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PIPE-FLOW VELOCITY(FEET/SEC.) = 5.08
ESTIMATED PIPE DIAMETER(INCH) = 27.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 13.74
PIPE TRAVEL TIME(MIN.) = 1.00 Tc(MIN.) = 11.33
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 1125.00 FEET.

-----+-----
| SUB 'A-11' |
| |
-----+-----

FLOW PROCESS FROM NODE 13.00 TO NODE 13.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 11.33
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.990
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" B 3.35 0.42 0.400 76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 3.35 SUBAREA RUNOFF(CFS) = 8.51
EFFECTIVE AREA(ACRES) = 8.19 AREA-AVERAGED Fm(INCH/HR) = 0.14
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.34
TOTAL AREA(ACRES) = 8.2 PEAK FLOW RATE(CFS) = 20.99

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	21.06	11.15	3.019	0.42(0.14)	0.34	8.1	10.00
2	20.99	11.33	2.990	0.42(0.14)	0.34	8.2	12.10

NEW PEAK FLOW DATA ARE:
PEAK FLOW RATE(CFS) = 21.06 Tc(MIN.) = 11.15
AREA-AVERAGED Fm(INCH/HR) = 0.14 AREA-AVERAGED Fp(INCH/HR) = 0.42
AREA-AVERAGED Ap = 0.34 EFFECTIVE AREA(ACRES) = 8.13

FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 559.80 DOWNSTREAM(FEET) = 555.20
FLOW LENGTH(FEET) = 300.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 16.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.38
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 21.06
PIPE TRAVEL TIME(MIN.) = 0.53 Tc(MIN.) = 11.69
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 1425.00 FEET.

-----+-----
| SUB 'A-12' |
| |
-----+-----

FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 11.69
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.935

SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
CONDOMINIUMS	B	0.35	0.42	0.350	76

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
 SUBAREA AREA(ACRES) = 0.35 SUBAREA RUNOFF(CFS) = 0.88
 EFFECTIVE AREA(ACRES) = 8.48 AREA-AVERAGED Fm(INCH/HR) = 0.14
 AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.34
 TOTAL AREA(ACRES) = 8.5 PEAK FLOW RATE(CFS) = 21.32

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+-----+
| SUB 'A-13' |
+-----+
  
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FLOW PROCESS FROM NODE 15.10 TO NODE 15.20 IS CODE = 21

```

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
  
```

```

=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 410.00
ELEVATION DATA: UPSTREAM(FEET) = 572.20 DOWNSTREAM(FEET) = 569.60
  
```

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.989
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.046
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	B	1.74	0.42	0.350	76	10.99

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
 SUBAREA RUNOFF(CFS) = 4.54
 TOTAL AREA(ACRES) = 1.74 PEAK FLOW RATE(CFS) = 4.54

FLOW PROCESS FROM NODE 15.20 TO NODE 15.00 IS CODE = 31

```

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

```

=====
ELEVATION DATA: UPSTREAM(FEET) = 563.60 DOWNSTREAM(FEET) = 562.60
FLOW LENGTH(FEET) = 140.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 24.000
DEPTH OF FLOW IN 24.0 INCH PIPE IS 8.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.80
ESTIMATED PIPE DIAMETER(INCH) = 24.00      NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.54
PIPE TRAVEL TIME(MIN.) = 0.49      Tc(MIN.) = 11.48
LONGEST FLOWPATH FROM NODE 15.10 TO NODE 15.00 = 550.00 FEET.
  
```

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+-----+
| SUB 'A-14' |
+-----+
  
```

FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 82

```

>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
  
```

```

=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 240.00
ELEVATION DATA: UPSTREAM(FEET) = 572.02 DOWNSTREAM(FEET) = 570.56
  
```

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Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.945
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.446
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	B	1.86	0.42	0.350	76	8.94

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
 SUBAREA AREA(ACRES) = 1.86 INITIAL SUBAREA RUNOFF(CFS) = 5.52

** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) = 11.48
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.968
 SUBAREA AREA(ACRES) = 1.86 SUBAREA RUNOFF(CFS) = 4.72
 EFFECTIVE AREA(ACRES) = 3.60 AREA-AVERAGED Fm(INCH/HR) = 0.15
 AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.35
 TOTAL AREA(ACRES) = 3.6 PEAK FLOW RATE(CFS) = 9.14

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+-----+
| SUB 'A-16' |
+-----+

```

 FLOW PROCESS FROM NODE 17.00 TO NODE 18.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
 =====
 INITIAL SUBAREA FLOW-LENGTH(FEET) = 400.00
 ELEVATION DATA: UPSTREAM(FEET) = 576.04 DOWNSTREAM(FEET) = 573.46

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.845
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.070
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	B	1.19	0.42	0.350	76	10.84

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
 SUBAREA RUNOFF(CFS) = 3.13
 TOTAL AREA(ACRES) = 1.19 PEAK FLOW RATE(CFS) = 3.13

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+-----+
| SUB 'A-17' |
+-----+

```

 FLOW PROCESS FROM NODE 19.00 TO NODE 20.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
 =====
 INITIAL SUBAREA FLOW-LENGTH(FEET) = 660.00
 ELEVATION DATA: UPSTREAM(FEET) = 578.90 DOWNSTREAM(FEET) = 575.56

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.745
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.927
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	B	0.48	0.42	0.100	76	11.74
CONDOMINIUMS	B	2.86	0.42	0.350	76	13.91

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SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.42

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.314

SUBAREA RUNOFF(CFS) = 8.40

TOTAL AREA(ACRES) = 3.34 PEAK FLOW RATE(CFS) = 8.40

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 3.3 TC(MIN.) = 11.74

EFFECTIVE AREA(ACRES) = 3.34 AREA-AVERAGED F_m (INCH/HR) = 0.13

AREA-AVERAGED F_p (INCH/HR) = 0.42 AREA-AVERAGED A_p = 0.314

PEAK FLOW RATE(CFS) = 8.40

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END OF RATIONAL METHOD ANALYSIS

↑

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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***** DESCRIPTION OF STUDY *****
* VAN VLIET: TTM 20261 ('A'MAP);20169;20170;20171;20172;20173;20270;20271 *
* Q10 *
* FILE:481252I *

FILE NAME: 481252I.DAT
TIME/DATE OF STUDY: 09:08 03/28/2019

=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 10.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 24.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 0.750
100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 1.100
COMPUTED RAINFALL INTENSITY DATA:
STORM EVENT = 10.00 1-HOUR INTENSITY(INCH/HOUR) = 0.7575
SLOPE OF INTENSITY DURATION CURVE = 0.6000

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL
Table with 9 columns: NO., WIDTH (FT), CROSSFALL (FT), IN- / OUT- / SIDE / SIDE / WAY, HEIGHT (FT), WIDTH (FT), LIP (FT), HIKE (FT), FACTOR (n). Row 1: 1, 18.0, 12.0, 0.020/0.020/0.020, 0.50, 2.00, 0.0312, 0.167, 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.50 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.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

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| SUB 'A-1' |
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FLOW PROCESS FROM NODE 1.00 TO NODE 1.10 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 485.00
ELEVATION DATA: UPSTREAM(FEET) = 582.90 DOWNSTREAM(FEET) = 579.42

481252I-10

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.912
 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.998
 SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
RESIDENTIAL "8-10 DWELLINGS/ACRE"	B	1.00	0.75	0.400	56	11.91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
 SUBAREA RUNOFF(CFS) = 1.53
 TOTAL AREA(ACRES) = 1.00 PEAK FLOW RATE(CFS) = 1.53

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+-----+
| SUB 'A-1.1' |
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 FLOW PROCESS FROM NODE 1.10 TO NODE 2.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 579.42 DOWNSTREAM ELEVATION(FEET) = 577.40
 STREET LENGTH(FEET) = 380.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 12.00
 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) = 3.00
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.40
 HALFSTREET FLOOD WIDTH(FEET) = 11.95
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.85
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.74
 STREET FLOW TRAVEL TIME(MIN.) = 3.42 Tc(MIN.) = 15.33
 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.717

SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	B	2.29	0.75	0.400	56

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
 SUBAREA AREA(ACRES) = 2.29 SUBAREA RUNOFF(CFS) = 2.92
 EFFECTIVE AREA(ACRES) = 3.29 AREA-AVERAGED Fm(INCH/HR) = 0.30
 AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.40
 TOTAL AREA(ACRES) = 3.3 PEAK FLOW RATE(CFS) = 4.20

END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.43 HALFSTREET FLOOD WIDTH(FEET) = 13.83
 FLOW VELOCITY(FEET/SEC.) = 2.00 DEPTH*VELOCITY(FT*FT/SEC.) = 0.87
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 2.00 = 865.00 FEET.

 FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 31

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

481252I-10

ELEVATION DATA: UPSTREAM(FEET) = 571.40 DOWNSTREAM(FEET) = 570.80
FLOW LENGTH(FEET) = 55.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 24.000
DEPTH OF FLOW IN 24.0 INCH PIPE IS 7.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.47
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.20
PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 15.50
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 920.00 FEET.

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| SUB 'A-2' |
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FLOW PROCESS FROM NODE 3.00 TO NODE 3.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 15.50
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.706
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
CONDOMINIUMS B 1.84 0.75 0.350 56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA AREA(ACRES) = 1.84 SUBAREA RUNOFF(CFS) = 2.39
EFFECTIVE AREA(ACRES) = 5.13 AREA-AVERAGED Fm(INCH/HR) = 0.29
AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.38
TOTAL AREA(ACRES) = 5.1 PEAK FLOW RATE(CFS) = 6.56

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| SUB 'A-5' |
| | |
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FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 15.50
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.706
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" B 4.05 0.75 0.400 56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 4.05 SUBAREA RUNOFF(CFS) = 5.13
EFFECTIVE AREA(ACRES) = 9.18 AREA-AVERAGED Fm(INCH/HR) = 0.29
AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.39
TOTAL AREA(ACRES) = 9.2 PEAK FLOW RATE(CFS) = 11.69

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| SUB 'A-4' |
| | |
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FLOW PROCESS FROM NODE 5.10 TO NODE 5.20 IS CODE = 21

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

481252I-10

LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN	(MIN.)
RESIDENTIAL						
"8-10 DWELLINGS/ACRE"	B	1.45	0.75	0.400	56	12.60
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75						
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400						
SUBAREA RUNOFF(CFS) = 2.13						
TOTAL AREA(ACRES) = 1.45 PEAK FLOW RATE(CFS) = 2.13						

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+-----+
| SUB 'A-5.1' |
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FLOW PROCESS FROM NODE 5.30 TO NODE 5.40 IS CODE = 62

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>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<

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UPSTREAM ELEVATION(FEET) = 581.19 DOWNSTREAM ELEVATION(FEET) = 578.10
STREET LENGTH(FEET) = 400.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 12.00
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

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**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.87
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.37
HALFSTREET FLOOD WIDTH(FEET) = 10.73
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.14
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.80
STREET FLOW TRAVEL TIME(MIN.) = 3.11 Tc(MIN.) = 15.71
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.693
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
CONDOMINIUMS B 1.15 0.75 0.350 56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA AREA(ACRES) = 1.15 SUBAREA RUNOFF(CFS) = 1.48
EFFECTIVE AREA(ACRES) = 2.60 AREA-AVERAGED Fm(INCH/HR) = 0.28
AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.38
TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 3.30

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END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.39 HALFSTREET FLOOD WIDTH(FEET) = 11.48
FLOW VELOCITY(FEET/SEC.) = 2.19 DEPTH*VELOCITY(FT*FT/SEC.) = 0.85
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.40 = 820.00 FEET.

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| SUB 'A-5.2' |
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FLOW PROCESS FROM NODE 5.40 TO NODE 5.40 IS CODE = 81

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>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 15.71

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481252I-10

* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.693
 SUBAREA LOSS RATE DATA(AMC II):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 CONDOMINIUMS B 0.61 0.75 0.350 56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
 SUBAREA AREA(ACRES) = 0.61 SUBAREA RUNOFF(CFS) = 0.79
 EFFECTIVE AREA(ACRES) = 3.21 AREA-AVERAGED Fm(INCH/HR) = 0.28
 AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.37
 TOTAL AREA(ACRES) = 3.2 PEAK FLOW RATE(CFS) = 4.09

 FLOW PROCESS FROM NODE 5.40 TO NODE 5.40 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 15.71
 RAINFALL INTENSITY(INCH/HR) = 1.69
 AREA-AVERAGED Fm(INCH/HR) = 0.28
 AREA-AVERAGED Fp(INCH/HR) = 0.75
 AREA-AVERAGED Ap = 0.37
 EFFECTIVE STREAM AREA(ACRES) = 3.21
 TOTAL STREAM AREA(ACRES) = 3.21
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.09

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	2.35	12.39	1.952	0.75(0.26)	0.35	1.5	5.10
2	4.09	15.71	1.693	0.75(0.28)	0.37	3.2	1.00

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.17	12.39	1.952	0.75(0.27)	0.36	4.0	5.10
2	6.08	15.71	1.693	0.75(0.27)	0.37	4.7	1.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 6.17 Tc(MIN.) = 12.39
 EFFECTIVE AREA(ACRES) = 3.98 AREA-AVERAGED Fm(INCH/HR) = 0.27
 AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.36
 TOTAL AREA(ACRES) = 4.7
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.40 = 820.00 FEET.

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SUB 'A-6'
 +-----+

 FLOW PROCESS FROM NODE 5.10 TO NODE 5.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 150.00
 ELEVATION DATA: UPSTREAM(FEET) = 578.00 DOWNSTREAM(FEET) = 571.10

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.364

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SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	B	0.43	0.75	0.350	56	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA RUNOFF(CFS) = 1.20
TOTAL AREA(ACRES) = 0.43 PEAK FLOW RATE(CFS) = 1.20

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| SUB 'A-7' |
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FLOW PROCESS FROM NODE 8.00 TO NODE 9.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 800.00
ELEVATION DATA: UPSTREAM(FEET) = 580.00 DOWNSTREAM(FEET) = 575.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 12.160
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.974

SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	B	0.95	0.75	0.100	56	12.16
CONDOMINIUMS	B	3.07	0.75	0.350	56	14.40

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.291
SUBAREA RUNOFF(CFS) = 6.35
TOTAL AREA(ACRES) = 4.02 PEAK FLOW RATE(CFS) = 6.35

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| SUB 'A-8' |
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FLOW PROCESS FROM NODE 9.00 TO NODE 9.00 IS CODE = 82

>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 480.00
ELEVATION DATA: UPSTREAM(FEET) = 579.00 DOWNSTREAM(FEET) = 575.69

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.510
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.040

SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	B	1.14	0.75	0.350	56	11.51

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA AREA(ACRES) = 1.14 INITIAL SUBAREA RUNOFF(CFS) = 1.82

** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
MAINLINE Tc(MIN.) = 12.16
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.974
SUBAREA AREA(ACRES) = 1.14 SUBAREA RUNOFF(CFS) = 1.76
EFFECTIVE AREA(ACRES) = 5.16 AREA-AVERAGED Fm(INCH/HR) = 0.23
AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.30

FLOW PROCESS FROM NODE 12.10 TO NODE 12.20 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 595.00
ELEVATION DATA: UPSTREAM(FEET) = 575.10 DOWNSTREAM(FEET) = 570.45

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.330
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.177
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL B 0.62 0.75 0.100 56 10.33
CONDOMINIUMS B 2.63 0.75 0.350 56 12.23
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.302
SUBAREA RUNOFF(CFS) = 5.71
TOTAL AREA(ACRES) = 3.25 PEAK FLOW RATE(CFS) = 5.71

FLOW PROCESS FROM NODE 12.20 TO NODE 12.00 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.) = 10.33
RAINFALL INTENSITY(INCH/HR) = 2.18
AREA-AVERAGED Fm(INCH/HR) = 0.23
AREA-AVERAGED Fp(INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.30
EFFECTIVE STREAM AREA(ACRES) = 3.25
TOTAL STREAM AREA(ACRES) = 3.25
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.71

** CONFLUENCE DATA **
Table with 8 columns: STREAM NUMBER, Q (CFS), Tc (MIN.), Intensity (INCH/HR), Fp(Fm) (INCH/HR), Ap, Ae (ACRES), HEADWATER NODE. Rows 1 and 2.

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

** PEAK FLOW RATE TABLE **
Table with 8 columns: STREAM NUMBER, Q (CFS), Tc (MIN.), Intensity (INCH/HR), Fp(Fm) (INCH/HR), Ap, Ae (ACRES), HEADWATER NODE. Rows 1 and 2.

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 8.91 Tc(MIN.) = 10.33
EFFECTIVE AREA(ACRES) = 4.83 AREA-AVERAGED Fm(INCH/HR) = 0.22
AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.29
TOTAL AREA(ACRES) = 4.8
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 820.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 561.00 DOWNSTREAM(FEET) = 559.80
FLOW LENGTH(FEET) = 305.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 24.000

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DEPTH OF FLOW IN 24.0 INCH PIPE IS 14.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.58
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 8.91
PIPE TRAVEL TIME(MIN.) = 1.11 Tc(MIN.) = 11.44
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 1125.00 FEET.

| SUB 'A-11' |

FLOW PROCESS FROM NODE 13.00 TO NODE 13.00 IS CODE = 81

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

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MAINLINE Tc(MIN.) =	11.44				
* 10 YEAR RAINFALL INTENSITY(INCH/HR) =	2.048				
SUBAREA LOSS RATE DATA(AMC II):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN
RESIDENTIAL					
"8-10 DWELLINGS/ACRE"	B	3.35	0.75	0.400	56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400					
SUBAREA AREA(ACRES) = 3.35		SUBAREA RUNOFF(CFS) = 5.27			
EFFECTIVE AREA(ACRES) = 8.18		AREA-AVERAGED Fm(INCH/HR) = 0.25			
AREA-AVERAGED Fp(INCH/HR) = 0.75		AREA-AVERAGED Ap = 0.34			
TOTAL AREA(ACRES) = 8.2		PEAK FLOW RATE(CFS) = 13.23			

FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) =	559.80	DOWNSTREAM(FEET) =	555.20
FLOW LENGTH(FEET) =	300.00	MANNING'S N =	0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 24.000			
DEPTH OF FLOW IN 24.0 INCH PIPE IS 12.0 INCHES			
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.45			
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1			
PIPE-FLOW(CFS) = 13.23			
PIPE TRAVEL TIME(MIN.) = 0.59 Tc(MIN.) = 12.03			
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 1425.00 FEET.			

| SUB 'A-12' |

FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) =	12.03				
* 10 YEAR RAINFALL INTENSITY(INCH/HR) =	1.986				
SUBAREA LOSS RATE DATA(AMC II):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN
CONDOMINIUMS	B	0.35	0.75	0.350	56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350					
SUBAREA AREA(ACRES) = 0.35		SUBAREA RUNOFF(CFS) = 0.54			
EFFECTIVE AREA(ACRES) = 8.53		AREA-AVERAGED Fm(INCH/HR) = 0.25			

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AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.34
TOTAL AREA(ACRES) = 8.5 PEAK FLOW RATE(CFS) = 13.32

-----+
| SUB 'A-13' |
| |
-----+-----

FLOW PROCESS FROM NODE 15.10 TO NODE 15.20 IS CODE = 21

-----+-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 410.00
ELEVATION DATA: UPSTREAM(FEET) = 572.20 DOWNSTREAM(FEET) = 569.60

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.989
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.097
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
CONDOMINIUMS B 1.74 0.75 0.350 56 10.99
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
SUBAREA RUNOFF(CFS) = 2.87
TOTAL AREA(ACRES) = 1.74 PEAK FLOW RATE(CFS) = 2.87

FLOW PROCESS FROM NODE 15.20 TO NODE 15.00 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 563.60 DOWNSTREAM(FEET) = 562.60
FLOW LENGTH(FEET) = 140.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 24.000
DEPTH OF FLOW IN 24.0 INCH PIPE IS 6.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.22
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.87
PIPE TRAVEL TIME(MIN.) = 0.55 Tc(MIN.) = 11.54
LONGEST FLOWPATH FROM NODE 15.10 TO NODE 15.00 = 550.00 FEET.

-----+-----
| SUB 'A-14' |
| |
-----+-----

FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 82

-----+-----
>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 240.00
ELEVATION DATA: UPSTREAM(FEET) = 572.02 DOWNSTREAM(FEET) = 570.56

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.945
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.373
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
CONDOMINIUMS B 1.86 0.75 0.350 56 8.94
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75

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AREA-AVERAGED F_p (INCH/HR) = 0.75 AREA-AVERAGED A_p = 0.314
PEAK FLOW RATE(CFS) = 5.35

=====

END OF RATIONAL METHOD ANALYSIS

↑

SECTION 2.2

Rational Method: Existing Condition (100-Year Storm)

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
(c) Copyright 1983-2012 Advanced Engineering Software (aes)
Ver. 18.2 Release Date: 05/08/2012 License ID 1470

Analysis prepared by:

LD King
10390 Commerce Center Drive
Rancho Cucamonga CA 91730

***** DESCRIPTION OF STUDY *****
* VAN FLEIT: TTM 20161 ('A' MAP), 20169 thr. 20173 *
* Q100 EXISTING CONDITION *
* FILE: 481252EX *

FILE NAME: 481252EX.DAT
TIME/DATE OF STUDY: 06:25 12/11/2018

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

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

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 24.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 0.750
100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 1.100
COMPUTED RAINFALL INTENSITY DATA:
STORM EVENT = 100.00 1-HOUR INTENSITY(INCH/HOUR) = 1.1000
SLOPE OF INTENSITY DURATION CURVE = 0.6000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL
Table with 9 columns: NO., WIDTH (FT), CROSSFALL (FT), IN- / OUT- / SIDE / SIDE / WAY, HEIGHT (FT), WIDTH (FT), LIP (FT), HIKE (FT), FACTOR (n). Row 1: 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.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

+-----+
| SUBAREA 'A-1' |
| | |
+-----+

FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 313.00
ELEVATION DATA: UPSTREAM(FEET) = 582.00 DOWNSTREAM(FEET) = 581.00

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Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 22.189
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.998
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL FAIR COVER "MEADOWS"	B	3.74	0.26	1.000	87	22.19

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 SUBAREA RUNOFF(CFS) = 5.85
 TOTAL AREA(ACRES) = 3.74 PEAK FLOW RATE(CFS) = 5.85

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+-----+
| SUBAREA 'A-2' |
+-----+

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*****
FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE = 91

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-----
>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<
=====

```

UPSTREAM NODE ELEVATION(FEET) = 581.00
 DOWNSTREAM NODE ELEVATION(FEET) = 578.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 313.00
 "V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.100
 PAVEMENT LIP(FEET) = 0.010 MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
 MAXIMUM DEPTH(FEET) = 1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.819
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "MEADOWS"	B	3.76	0.26	1.000	87

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 8.49
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.39
 AVERAGE FLOW DEPTH(FEET) = 0.43 FLOOD WIDTH(FEET) = 34.55
 "V" GUTTER FLOW TRAVEL TIME(MIN.) = 3.75 Tc(MIN.) = 25.94
 SUBAREA AREA(ACRES) = 3.76 SUBAREA RUNOFF(CFS) = 5.28
 EFFECTIVE AREA(ACRES) = 7.50 AREA-AVERAGED Fm(INCH/HR) = 0.26
 AREA-AVERAGED Fp(INCH/HR) = 0.26 AREA-AVERAGED Ap = 1.00
 TOTAL AREA(ACRES) = 7.5 PEAK FLOW RATE(CFS) = 10.53

END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) = 0.46 FLOOD WIDTH(FEET) = 37.68
 FLOW VELOCITY(FEET/SEC.) = 1.46 DEPTH*VELOCITY(FT*FT/SEC) = 0.66
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 626.00 FEET.

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+-----+
| SUBAREA 'A-3' |
+-----+

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*****
FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE = 91

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>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<
=====

```

UPSTREAM NODE ELEVATION(FEET) = 578.00
 DOWNSTREAM NODE ELEVATION(FEET) = 576.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 313.00
 "V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.100
 PAVEMENT LIP(FEET) = 0.010 MANNING'S N = .0350

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PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
 MAXIMUM DEPTH(FEET) = 1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.670
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "MEADOWS"	B	3.76	0.26	1.000	87

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 12.91
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.31
 AVERAGE FLOW DEPTH(FEET) = 0.52 FLOOD WIDTH(FEET) = 44.11
 "V" GUTTER FLOW TRAVEL TIME(MIN.) = 3.99 Tc(MIN.) = 29.92
 SUBAREA AREA(ACRES) = 3.76 SUBAREA RUNOFF(CFS) = 4.77
 EFFECTIVE AREA(ACRES) = 11.26 AREA-AVERAGED Fm(INCH/HR) = 0.26
 AREA-AVERAGED Fp(INCH/HR) = 0.26 AREA-AVERAGED Ap = 1.00
 TOTAL AREA(ACRES) = 11.3 PEAK FLOW RATE(CFS) = 14.29

END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) = 0.54 FLOOD WIDTH(FEET) = 45.85
 FLOW VELOCITY(FEET/SEC.) = 1.34 DEPTH*VELOCITY(FT*FT/SEC) = 0.72
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 939.00 FEET.

```

+-----+
| SUBAREA 'A-4' |
+-----+

```

 FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 91

```

-----
>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<
-----

```

UPSTREAM NODE ELEVATION(FEET) = 576.00
 DOWNSTREAM NODE ELEVATION(FEET) = 574.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 313.00
 "V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.100
 PAVEMENT LIP(FEET) = 0.010 MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
 MAXIMUM DEPTH(FEET) = 1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.555
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "MEADOWS"	B	3.75	0.26	1.000	87

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 16.47
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.39
 AVERAGE FLOW DEPTH(FEET) = 0.56 FLOOD WIDTH(FEET) = 48.46
 "V" GUTTER FLOW TRAVEL TIME(MIN.) = 3.76 Tc(MIN.) = 33.68
 SUBAREA AREA(ACRES) = 3.75 SUBAREA RUNOFF(CFS) = 4.37
 EFFECTIVE AREA(ACRES) = 15.01 AREA-AVERAGED Fm(INCH/HR) = 0.26
 AREA-AVERAGED Fp(INCH/HR) = 0.26 AREA-AVERAGED Ap = 1.00
 TOTAL AREA(ACRES) = 15.0 PEAK FLOW RATE(CFS) = 17.50

END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) = 0.58 FLOOD WIDTH(FEET) = 49.67
 FLOW VELOCITY(FEET/SEC.) = 1.40 DEPTH*VELOCITY(FT*FT/SEC) = 0.81
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 1252.00 FEET.

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+-----+
| SUBAREA 'A-5' |
+-----+

```

 FLOW PROCESS FROM NODE 5.00 TO NODE 6.00 IS CODE = 91

>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<

```

=====
UPSTREAM NODE ELEVATION(FEET) = 574.00
DOWNSTREAM NODE ELEVATION(FEET) = 570.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 553.00
"V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.100
PAVEMENT LIP(FEET) = 0.010 MANNING'S N = .0350
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
MAXIMUM DEPTH(FEET) = 1.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.407
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
NATURAL FAIR COVER
"MEADOWS" B 3.97 0.26 1.000 87
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 19.55
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.50
AVERAGE FLOW DEPTH(FEET) = 0.59 FLOOD WIDTH(FEET) = 50.72
"V" GUTTER FLOW TRAVEL TIME(MIN.) = 6.13 Tc(MIN.) = 39.81
SUBAREA AREA(ACRES) = 3.97 SUBAREA RUNOFF(CFS) = 4.10
EFFECTIVE AREA(ACRES) = 18.98 AREA-AVERAGED Fm(INCH/HR) = 0.26
AREA-AVERAGED Fp(INCH/HR) = 0.26 AREA-AVERAGED Ap = 1.00
TOTAL AREA(ACRES) = 19.0 PEAK FLOW RATE(CFS) = 19.59
    
```

END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) = 0.59 FLOOD WIDTH(FEET) = 50.72
 FLOW VELOCITY(FEET/SEC.) = 1.51 DEPTH*VELOCITY(FT*FT/SEC) = 0.89
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 6.00 = 1805.00 FEET.

```

+-----+
| SUBAREA 'A-6' |
|               |
+-----+
    
```

 FLOW PROCESS FROM NODE 7.00 TO NODE 8.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

```

=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 820.00
ELEVATION DATA: UPSTREAM(FEET) = 577.00 DOWNSTREAM(FEET) = 573.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 29.970
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.668
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
NATURAL FAIR COVER
"MEADOWS" B 6.43 0.26 1.000 87 29.97
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF(CFS) = 8.15
TOTAL AREA(ACRES) = 6.43 PEAK FLOW RATE(CFS) = 8.15
    
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```

+-----+
| SUBAREA 'A-7' |
|               |
+-----+
    
```


END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) = 0.55 FLOOD WIDTH(FEET) = 46.54
 FLOW VELOCITY(FEET/SEC.) = 1.34 DEPTH*VELOCITY(FT*FT/SEC) = 0.73
 LONGEST FLOWPATH FROM NODE 7.00 TO NODE 10.00 = 1850.00 FEET.

```

+-----+
| SUBAREA 'A-9' |
+-----+
    
```

 FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 900.00
 ELEVATION DATA: UPSTREAM(FEET) = 582.00 DOWNSTREAM(FEET) = 572.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 26.385
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.801
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL FAIR COVER "MEADOWS"	B	4.57	0.26	1.000	87	26.38

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 SUBAREA RUNOFF(CFS) = 6.34
 TOTAL AREA(ACRES) = 4.57 PEAK FLOW RATE(CFS) = 6.34

 FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 52

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 572.00 DOWNSTREAM(FEET) = 571.30
 CHANNEL LENGTH THRU SUBAREA(FEET) = 250.00 CHANNEL SLOPE = 0.0028
 CHANNEL FLOW THRU SUBAREA(CFS) = 6.34
 FLOW VELOCITY(FEET/SEC) = 1.18 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) = 3.53 Tc(MIN.) = 29.91
 LONGEST FLOWPATH FROM NODE 11.00 TO NODE 13.00 = 1150.00 FEET.

```

+-----+
| SUBAREA 'A-10' |
+-----+
    
```

 FLOW PROCESS FROM NODE 13.00 TO NODE 13.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 29.91
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.670
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "MEADOWS"	B	5.45	0.26	1.000	87

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 SUBAREA AREA(ACRES) = 5.45 SUBAREA RUNOFF(CFS) = 6.92
 EFFECTIVE AREA(ACRES) = 10.02 AREA-AVERAGED Fm(INCH/HR) = 0.26
 AREA-AVERAGED Fp(INCH/HR) = 0.26 AREA-AVERAGED Ap = 1.00

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TOTAL AREA(ACRES) = 10.0 PEAK FLOW RATE(CFS) = 12.72

FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 52

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

=====

ELEVATION DATA: UPSTREAM(FEET) =	571.30	DOWNSTREAM(FEET) =	570.50
CHANNEL LENGTH THRU SUBAREA(FEET) =	420.00	CHANNEL SLOPE =	0.0019
CHANNEL FLOW THRU SUBAREA(CFS) =	12.72		
FLOW VELOCITY(FEET/SEC) =	1.16	(PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)	
TRAVEL TIME(MIN.) =	6.03	Tc(MIN.) =	35.95
LONGEST FLOWPATH FROM NODE	11.00	TO NODE	14.00 = 1570.00 FEET.

+-----+
| SUBAREA 'A-11' |
+-----+

FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) =	35.95				
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =	1.496				
SUBAREA LOSS RATE DATA(AMC III):					
DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "MEADOWS"	B	12.52	0.26	1.000	87
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000					
SUBAREA AREA(ACRES) =	12.52	SUBAREA RUNOFF(CFS) =	13.93		
EFFECTIVE AREA(ACRES) =	22.54	AREA-AVERAGED Fm(INCH/HR) =	0.26		
AREA-AVERAGED Fp(INCH/HR) =	0.26	AREA-AVERAGED Ap =	1.00		
TOTAL AREA(ACRES) =	22.5	PEAK FLOW RATE(CFS) =	25.07		

FLOW PROCESS FROM NODE 14.00 TO NODE 15.00 IS CODE = 52

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

=====

ELEVATION DATA: UPSTREAM(FEET) =	570.50	DOWNSTREAM(FEET) =	566.90
CHANNEL LENGTH THRU SUBAREA(FEET) =	840.00	CHANNEL SLOPE =	0.0043
CHANNEL FLOW THRU SUBAREA(CFS) =	25.07		
FLOW VELOCITY(FEET/SEC) =	2.09	(PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)	
TRAVEL TIME(MIN.) =	6.71	Tc(MIN.) =	42.66
LONGEST FLOWPATH FROM NODE	11.00	TO NODE	15.00 = 2410.00 FEET.

+-----+
| SUBAREA 'A-12' |
+-----+

FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) =	42.66				
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =	1.350				
SUBAREA LOSS RATE DATA(AMC III):					
DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN

481252EX

NATURAL FAIR COVER

"MEADOWS" B 11.33 0.26 1.000 87
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.26
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 1.000
SUBAREA AREA(ACRES) = 11.33 SUBAREA RUNOFF(CFS) = 11.11
EFFECTIVE AREA(ACRES) = 33.87 AREA-AVERAGED F_m (INCH/HR) = 0.26
AREA-AVERAGED F_p (INCH/HR) = 0.26 AREA-AVERAGED A_p = 1.00
TOTAL AREA(ACRES) = 33.9 PEAK FLOW RATE(CFS) = 33.22

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 33.9 TC(MIN.) = 42.66
EFFECTIVE AREA(ACRES) = 33.87 AREA-AVERAGED F_m (INCH/HR)= 0.26
AREA-AVERAGED F_p (INCH/HR) = 0.26 AREA-AVERAGED A_p = 1.000
PEAK FLOW RATE(CFS) = 33.22

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END OF RATIONAL METHOD ANALYSIS

↑

SECTION 2.3

Retention Basin Flood Routing Analysis - Interim Condition

vf01

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 1998
Study date: 03/11/19

VAN FLEIT: TTM 20161 ('A' MAP); 20169, 20170, 20171, 20172, 20173
100-YEAR STORM
FILE:VF100
USING EXISTING BASIN

***** HYDROGRAPH INFORMATION *****

From study/file name: VF100.rte
*****HYDROGRAPH DATA*****
Number of intervals = 298
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 135.444 (CFS)
Total volume = 28.500 (Ac.Ft)
Status of hydrographs being held in storage
Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
Peak (CFS) 0.000 0.000 0.000 0.000 0.000
Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000

+++++
Process from Point/Station 1.000 to Point/Station 1.000
**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 298
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:
Basin Depth Storage Outflow (S-0*dt/2) (S+0*dt/2)
(Ft.) (Ac.Ft) (CFS) (Ac.Ft) (Ac.Ft)

0.000	0.000	0.000	0.000	0.000
0.500	0.050	10.500	0.014	0.086
1.500	0.500	10.501	0.464	0.536
2.500	1.220	10.502	1.184	1.256
3.500	1.980	10.503	1.944	2.016
4.500	2.770	10.504	2.734	2.806
5.500	3.590	10.505	3.554	3.626
6.500	4.460	10.506	4.424	4.496
7.500	5.360	10.507	5.324	5.396
8.500	6.300	10.508	6.264	6.336
9.500	7.280	10.509	7.244	7.316
10.500	8.300	10.510	8.264	8.336
11.500	9.360	10.511	9.324	9.396
12.500	10.460	10.512	10.424	10.496

Hydrograph Detention Basin Routing

vf01

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0	33.9	67.72	101.58	135.44	Depth (Ft.)
0.083	0.16	0.07	0.000	0					0.00
0.167	0.99	0.49	0.002	0					0.02
0.250	2.56	1.57	0.007	0					0.07
0.333	4.58	3.25	0.015	OI					0.15
0.417	5.89	4.92	0.023	0					0.23
0.500	6.56	6.02	0.029	0					0.29
0.583	6.90	6.62	0.032	0					0.32
0.667	7.04	6.91	0.033	0					0.33
0.750	7.10	7.05	0.034	0					0.34
0.833	7.16	7.12	0.034	0					0.34
0.917	7.22	7.18	0.034	0					0.34
1.000	7.24	7.22	0.034	0					0.34
1.083	7.26	7.24	0.034	0					0.34
1.167	7.28	7.26	0.035	0					0.35
1.250	7.30	7.28	0.035	0					0.35
1.333	7.32	7.30	0.035	0					0.35
1.417	7.34	7.32	0.035	0					0.35
1.500	7.36	7.34	0.035	0					0.35
1.583	7.38	7.36	0.035	0					0.35
1.667	7.40	7.38	0.035	0					0.35
1.750	7.42	7.40	0.035	0					0.35
1.833	7.44	7.43	0.035	0					0.35
1.917	7.46	7.45	0.035	0					0.35
2.000	7.48	7.47	0.036	0					0.36
2.083	7.51	7.49	0.036	0					0.36
2.167	7.53	7.51	0.036	0					0.36
2.250	7.55	7.53	0.036	0					0.36
2.333	7.57	7.56	0.036	0					0.36
2.417	7.59	7.58	0.036	0					0.36
2.500	7.62	7.60	0.036	0					0.36
2.583	7.64	7.62	0.036	0					0.36
2.667	7.66	7.65	0.036	0					0.36
2.750	7.69	7.67	0.037	0					0.37
2.833	7.71	7.69	0.037	0					0.37
2.917	7.73	7.72	0.037	0					0.37
3.000	7.76	7.74	0.037	0					0.37
3.083	7.78	7.77	0.037	0					0.37
3.167	7.81	7.79	0.037	0					0.37
3.250	7.83	7.82	0.037	0					0.37
3.333	7.86	7.84	0.037	0					0.37
3.417	7.88	7.87	0.037	0					0.37
3.500	7.91	7.89	0.038	0					0.38
3.583	7.93	7.92	0.038	0					0.38
3.667	7.96	7.94	0.038	0					0.38
3.750	7.99	7.97	0.038	0					0.38
3.833	8.01	8.00	0.038	0					0.38
3.917	8.04	8.02	0.038	0					0.38
4.000	8.07	8.05	0.038	0					0.38
4.083	8.09	8.08	0.038	0					0.38
4.167	8.12	8.10	0.039	0					0.39
4.250	8.15	8.13	0.039	0					0.39
4.333	8.18	8.16	0.039	0					0.39
4.417	8.21	8.19	0.039	0					0.39
4.500	8.24	8.22	0.039	0					0.39
4.583	8.27	8.25	0.039	0					0.39
4.667	8.30	8.27	0.039	0					0.39
4.750	8.32	8.30	0.040	0					0.40
4.833	8.36	8.33	0.040	0					0.40
4.917	8.39	8.36	0.040	0					0.40
5.000	8.42	8.39	0.040	0					0.40
5.083	8.45	8.43	0.040	0					0.40
5.167	8.48	8.46	0.040	OI					0.40
5.250	8.51	8.49	0.040	0					0.40
5.333	8.54	8.52	0.041	0					0.41

vf01

5.417	8.58	8.55	0.041	0				0.41
5.500	8.61	8.59	0.041	0				0.41
5.583	8.64	8.62	0.041	0				0.41
5.667	8.68	8.65	0.041	0				0.41
5.750	8.71	8.69	0.041	0				0.41
5.833	8.74	8.72	0.042	0				0.42
5.917	8.78	8.75	0.042	0				0.42
6.000	8.81	8.79	0.042	0				0.42
6.083	8.85	8.83	0.042	0				0.42
6.167	8.89	8.86	0.042	0				0.42
6.250	8.92	8.90	0.042	0				0.42
6.333	8.96	8.93	0.043	0				0.43
6.417	9.00	8.97	0.043	0				0.43
6.500	9.04	9.01	0.043	0				0.43
6.583	9.07	9.05	0.043	0				0.43
6.667	9.11	9.09	0.043	0				0.43
6.750	9.15	9.13	0.043	0				0.43
6.833	9.19	9.16	0.044	0				0.44
6.917	9.23	9.21	0.044	0				0.44
7.000	9.27	9.25	0.044	0				0.44
7.083	9.32	9.29	0.044	0				0.44
7.167	9.36	9.33	0.044	0				0.44
7.250	9.40	9.37	0.045	0				0.45
7.333	9.44	9.41	0.045	0				0.45
7.417	9.49	9.46	0.045	0				0.45
7.500	9.53	9.50	0.045	0				0.45
7.583	9.58	9.55	0.045	0				0.45
7.667	9.62	9.59	0.046	0				0.46
7.750	9.67	9.64	0.046	0				0.46
7.833	9.72	9.69	0.046	0				0.46
7.917	9.77	9.73	0.046	0				0.46
8.000	9.82	9.78	0.047	0				0.47
8.083	9.86	9.83	0.047	0				0.47
8.167	9.92	9.88	0.047	0				0.47
8.250	9.97	9.93	0.047	0				0.47
8.333	10.02	9.98	0.048	0				0.48
8.417	10.07	10.03	0.048	0				0.48
8.500	10.12	10.09	0.048	0				0.48
8.583	10.18	10.14	0.048	0				0.48
8.667	10.23	10.20	0.049	0				0.49
8.750	10.29	10.25	0.049	0				0.49
8.833	10.35	10.31	0.049	0				0.49
8.917	10.40	10.36	0.049	0				0.49
9.000	10.46	10.42	0.050	0				0.50
9.083	10.52	10.48	0.050	0				0.50
9.167	10.58	10.50	0.050	0				0.50
9.250	10.65	10.50	0.051	0				0.50
9.333	10.71	10.50	0.052	0				0.51
9.417	10.77	10.50	0.054	0				0.51
9.500	10.84	10.50	0.056	0				0.51
9.583	10.91	10.50	0.059	0				0.52
9.667	10.97	10.50	0.062	0				0.53
9.750	11.04	10.50	0.065	0				0.53
9.833	11.11	10.50	0.069	0				0.54
9.917	11.19	10.50	0.074	0				0.55
10.000	11.26	10.50	0.079	0				0.56
10.083	11.33	10.50	0.084	0				0.58
10.167	11.41	10.50	0.090	0				0.59
10.250	11.49	10.50	0.097	0				0.60
10.333	11.57	10.50	0.104	0				0.62
10.417	11.65	10.50	0.111	0				0.64
10.500	11.73	10.50	0.120	0				0.65
10.583	11.82	10.50	0.128	0				0.67
10.667	11.90	10.50	0.138	0				0.70
10.750	11.99	10.50	0.148	0				0.72
10.833	12.08	10.50	0.158	0				0.74
10.917	12.18	10.50	0.170	0				0.77
11.000	12.27	10.50	0.181	0				0.79
11.083	12.37	10.50	0.194	0				0.82

vf01

11.167	12.47	10.50	0.207	0						0.85
11.250	12.57	10.50	0.221	0						0.88
11.333	12.67	10.50	0.236	0						0.91
11.417	12.78	10.50	0.251	OI						0.95
11.500	12.89	10.50	0.267	OI						0.98
11.583	13.00	10.50	0.284	OI						1.02
11.667	13.12	10.50	0.302	OI						1.06
11.750	13.24	10.50	0.320	OI						1.10
11.833	13.36	10.50	0.339	OI						1.14
11.917	13.49	10.50	0.359	OI						1.19
12.000	13.62	10.50	0.381	OI						1.23
12.083	13.79	10.50	0.403	OI						1.28
12.167	14.12	10.50	0.426	OI						1.34
12.250	14.64	10.50	0.453	OI						1.40
12.333	15.27	10.50	0.484	OI						1.46
12.417	15.73	10.50	0.518	OI						1.53
12.500	16.04	10.50	0.555	OI						1.58
12.583	16.27	10.50	0.594	OI						1.63
12.667	16.47	10.50	0.635	OI						1.69
12.750	16.64	10.50	0.676	OI						1.74
12.833	16.83	10.50	0.719	OI						1.80
12.917	17.02	10.50	0.764	O I						1.87
13.000	17.21	10.50	0.809	O I						1.93
13.083	17.40	10.50	0.856	O I						1.99
13.167	17.60	10.50	0.904	O I						2.06
13.250	17.80	10.50	0.954	O I						2.13
13.333	18.02	10.50	1.005	O I						2.20
13.417	18.25	10.50	1.057	O I						2.27
13.500	18.48	10.50	1.111	O I						2.35
13.583	18.73	10.50	1.167	O I						2.43
13.667	18.99	10.50	1.225	O I						2.51
13.750	19.25	10.50	1.284	O I						2.58
13.833	19.54	10.50	1.345	O I						2.66
13.917	19.83	10.50	1.409	O I						2.75
14.000	20.14	10.50	1.474	O I						2.83
14.083	20.47	10.50	1.541	O I						2.92
14.167	20.82	10.50	1.611	O I						3.01
14.250	21.20	10.50	1.684	O I						3.11
14.333	21.62	10.50	1.759	O I						3.21
14.417	22.04	10.50	1.837	O I						3.31
14.500	22.49	10.50	1.918	O I						3.42
14.583	22.96	10.50	2.002	O I						3.53
14.667	23.46	10.50	2.089	O I						3.64
14.750	24.00	10.50	2.180	O I						3.75
14.833	24.58	10.50	2.275	O I						3.87
14.917	25.21	10.50	2.375	O I						4.00
15.000	25.90	10.50	2.478	O I						4.13
15.083	26.65	10.50	2.587	O I						4.27
15.167	27.49	10.50	2.701	O I						4.41
15.250	28.41	10.50	2.821	O I						4.56
15.333	29.46	10.50	2.948	O I						4.72
15.417	30.39	10.50	3.082	O I						4.88
15.500	30.58	10.50	3.219	O I						5.05
15.583	29.90	10.50	3.355	O I						5.21
15.667	28.93	10.50	3.486	O I						5.37
15.750	29.38	10.51	3.614	O I						5.53
15.833	31.49	10.51	3.751	O I						5.69
15.917	35.28	10.51	3.909	O I						5.87
16.000	42.36	10.51	4.104	O I						6.09
16.083	59.03	10.51	4.381	O I						6.41
16.167	93.71	10.51	4.834	O I						6.92
16.250	125.37	10.51	5.516	O I						7.67
16.333	135.44	10.51	6.342	O I						8.54
16.417	99.64	10.51	7.079	O I						9.30
16.500	67.00	10.51	7.581	O I						9.79
16.583	48.58	10.51	7.906	O I						10.11
16.667	38.35	10.51	8.133	O I						10.34
16.750	33.37	10.51	8.308	O I						10.51
16.833	31.28	10.51	8.458	O I						10.65

16.917	28.96	10.51	8.593	0	I	10.78
17.000	26.14	10.51	8.711	0	I	10.89
17.083	24.72	10.51	8.813	0	I	10.98
17.167	23.58	10.51	8.907	0	I	11.07
17.250	22.59	10.51	8.994	0	I	11.15
17.333	21.69	10.51	9.074	0	I	11.23
17.417	20.90	10.51	9.148	0	I	11.30
17.500	20.21	10.51	9.217	0	I	11.37
17.583	19.58	10.51	9.282	0	I	11.43
17.667	19.03	10.51	9.343	0	I	11.48
17.750	18.52	10.51	9.399	0	I	11.54
17.833	18.05	10.51	9.453	0	I	11.58
17.917	17.62	10.51	9.503	0	I	11.63
18.000	17.22	10.51	9.551	0	I	11.67
18.083	16.82	10.51	9.596	0	I	11.71
18.167	16.27	10.51	9.637	0	I	11.75
18.250	15.57	10.51	9.675	0	I	11.79
18.333	14.78	10.51	9.707	0	I	11.82
18.417	14.19	10.51	9.734	0	I	11.84
18.500	13.76	10.51	9.758	0	I	11.86
18.583	13.43	10.51	9.779	0	I	11.88
18.667	13.15	10.51	9.798	0	I	11.90
18.750	12.91	10.51	9.816	0	I	11.91
18.833	12.69	10.51	9.831	0	I	11.93
18.917	12.47	10.51	9.846	0	I	11.94
19.000	12.27	10.51	9.859	0	I	11.95
19.083	12.09	10.51	9.870	0	I	11.96
19.167	11.91	10.51	9.880	0	I	11.97
19.250	11.74	10.51	9.889	0	I	11.98
19.333	11.57	10.51	9.897	0	I	11.99
19.417	11.41	10.51	9.904	0	I	11.99
19.500	11.26	10.51	9.910	0	I	12.00
19.583	11.12	10.51	9.914	0	I	12.00
19.667	10.98	10.51	9.918	0	I	12.01
19.750	10.84	10.51	9.921	0	I	12.01
19.833	10.71	10.51	9.922	0	I	12.01
19.917	10.59	10.51	9.923	0	I	12.01
20.000	10.46	10.51	9.923	0	I	12.01
20.083	10.35	10.51	9.923	0	I	12.01
20.167	10.23	10.51	9.921	0	I	12.01
20.250	10.12	10.51	9.919	0	I	12.01
20.333	10.02	10.51	9.916	0	I	12.01
20.417	9.92	10.51	9.912	0	I	12.00
20.500	9.82	10.51	9.908	0	I	12.00
20.583	9.72	10.51	9.903	0	I	11.99
20.667	9.62	10.51	9.897	0	I	11.99
20.750	9.53	10.51	9.890	0	I	11.98
20.833	9.44	10.51	9.883	0	I	11.98
20.917	9.36	10.51	9.876	0	I	11.97
21.000	9.27	10.51	9.867	0	I	11.96
21.083	9.19	10.51	9.859	0	I	11.95
21.167	9.11	10.51	9.849	0	I	11.94
21.250	9.04	10.51	9.839	0	I	11.94
21.333	8.96	10.51	9.829	0	I	11.93
21.417	8.89	10.51	9.818	0	I	11.92
21.500	8.81	10.51	9.807	0	I	11.91
21.583	8.74	10.51	9.795	0	I	11.90
21.667	8.67	10.51	9.782	0	I	11.88
21.750	8.61	10.51	9.769	0	I	11.87
21.833	8.54	10.51	9.756	0	I	11.86
21.917	8.48	10.51	9.742	0	I	11.85
22.000	8.42	10.51	9.728	0	I	11.83
22.083	8.35	10.51	9.713	0	I	11.82
22.167	8.29	10.51	9.698	0	I	11.81
22.250	8.24	10.51	9.683	0	I	11.79
22.333	8.18	10.51	9.667	0	I	11.78
22.417	8.12	10.51	9.651	0	I	11.76
22.500	8.07	10.51	9.634	0	I	11.75
22.583	8.01	10.51	9.617	0	I	11.73

22.667	7.96	10.51	9.600	IO	11.72
22.750	7.91	10.51	9.582	IO	11.70
22.833	7.86	10.51	9.564	IO	11.69
22.917	7.81	10.51	9.545	IO	11.67
23.000	7.76	10.51	9.527	IO	11.65
23.083	7.71	10.51	9.507	IO	11.63
23.167	7.66	10.51	9.488	IO	11.62
23.250	7.62	10.51	9.468	IO	11.60
23.333	7.57	10.51	9.448	IO	11.58
23.417	7.53	10.51	9.428	IO	11.56
23.500	7.48	10.51	9.407	IO	11.54
23.583	7.44	10.51	9.386	IO	11.52
23.667	7.40	10.51	9.365	IO	11.50
23.750	7.36	10.51	9.343	IO	11.48
23.833	7.31	10.51	9.321	IO	11.46
23.917	7.27	10.51	9.299	IO	11.44
24.000	7.23	10.51	9.277	IO	11.42
24.083	7.03	10.51	9.253	IO	11.40
24.167	6.17	10.51	9.227	IO	11.37
24.250	4.57	10.51	9.191	IO	11.34
24.333	2.53	10.51	9.143	I 0	11.30
24.417	1.22	10.51	9.084	I 0	11.24
24.500	0.56	10.51	9.018	I 0	11.18
24.583	0.24	10.51	8.948	I 0	11.11
24.667	0.12	10.51	8.877	I 0	11.04
24.750	0.08	10.51	8.805	I 0	10.98
24.833	0.03	10.51	8.733	I 0	10.91
24.917	0.00	10.51	8.661	I 0	10.84
25.000	0.00	10.51	8.588	I 0	10.77
25.083	0.00	10.51	8.516	I 0	10.70
25.167	0.00	10.51	8.444	I 0	10.64
25.250	0.00	10.51	8.371	I 0	10.57
25.333	0.00	10.51	8.299	I 0	10.50
25.417	0.00	10.51	8.226	I 0	10.43
25.500	0.00	10.51	8.154	I 0	10.36
25.583	0.00	10.51	8.082	I 0	10.29
25.667	0.00	10.51	8.009	I 0	10.22
25.750	0.00	10.51	7.937	I 0	10.14
25.833	0.00	10.51	7.865	I 0	10.07
25.917	0.00	10.51	7.792	I 0	10.00
26.000	0.00	10.51	7.720	I 0	9.93
26.083	0.00	10.51	7.647	I 0	9.86
26.167	0.00	10.51	7.575	I 0	9.79
26.250	0.00	10.51	7.503	I 0	9.72
26.333	0.00	10.51	7.430	I 0	9.65
26.417	0.00	10.51	7.358	I 0	9.58
26.500	0.00	10.51	7.286	I 0	9.51
26.583	0.00	10.51	7.213	I 0	9.43
26.667	0.00	10.51	7.141	I 0	9.36
26.750	0.00	10.51	7.068	I 0	9.28
26.833	0.00	10.51	6.996	I 0	9.21
26.917	0.00	10.51	6.924	I 0	9.14
27.000	0.00	10.51	6.851	I 0	9.06
27.083	0.00	10.51	6.779	I 0	8.99
27.167	0.00	10.51	6.707	I 0	8.91
27.250	0.00	10.51	6.634	I 0	8.84
27.333	0.00	10.51	6.562	I 0	8.77
27.417	0.00	10.51	6.489	I 0	8.69
27.500	0.00	10.51	6.417	I 0	8.62
27.583	0.00	10.51	6.345	I 0	8.55
27.667	0.00	10.51	6.272	I 0	8.47
27.750	0.00	10.51	6.200	I 0	8.39
27.833	0.00	10.51	6.128	I 0	8.32
27.917	0.00	10.51	6.055	I 0	8.24
28.000	0.00	10.51	5.983	I 0	8.16
28.083	0.00	10.51	5.911	I 0	8.09
28.167	0.00	10.51	5.838	I 0	8.01
28.250	0.00	10.51	5.766	I 0	7.93
28.333	0.00	10.51	5.693	I 0	7.85

28.417	0.00	10.51	5.621	I 0		7.78
28.500	0.00	10.51	5.549	I 0		7.70
28.583	0.00	10.51	5.476	I 0		7.62
28.667	0.00	10.51	5.404	I 0		7.55
28.750	0.00	10.51	5.332	I 0		7.47
28.833	0.00	10.51	5.259	I 0		7.39
28.917	0.00	10.51	5.187	I 0		7.31
29.000	0.00	10.51	5.115	I 0		7.23
29.083	0.00	10.51	5.042	I 0		7.15
29.167	0.00	10.51	4.970	I 0		7.07
29.250	0.00	10.51	4.897	I 0		6.99
29.333	0.00	10.51	4.825	I 0		6.91
29.417	0.00	10.51	4.753	I 0		6.83
29.500	0.00	10.51	4.680	I 0		6.74
29.583	0.00	10.51	4.608	I 0		6.66
29.667	0.00	10.51	4.536	I 0		6.58
29.750	0.00	10.51	4.463	I 0		6.50
29.833	0.00	10.51	4.391	I 0		6.42
29.917	0.00	10.51	4.319	I 0		6.34
30.000	0.00	10.51	4.246	I 0		6.25
30.083	0.00	10.51	4.174	I 0		6.17
30.167	0.00	10.51	4.102	I 0		6.09
30.250	0.00	10.51	4.029	I 0		6.00
30.333	0.00	10.51	3.957	I 0		5.92
30.417	0.00	10.51	3.884	I 0		5.84
30.500	0.00	10.51	3.812	I 0		5.76
30.583	0.00	10.51	3.740	I 0		5.67
30.667	0.00	10.51	3.667	I 0		5.59
30.750	0.00	10.51	3.595	I 0		5.51
30.833	0.00	10.50	3.523	I 0		5.42
30.917	0.00	10.50	3.450	I 0		5.33
31.000	0.00	10.50	3.378	I 0		5.24
31.083	0.00	10.50	3.306	I 0		5.15
31.167	0.00	10.50	3.233	I 0		5.07
31.250	0.00	10.50	3.161	I 0		4.98
31.333	0.00	10.50	3.089	I 0		4.89
31.417	0.00	10.50	3.016	I 0		4.80
31.500	0.00	10.50	2.944	I 0		4.71
31.583	0.00	10.50	2.872	I 0		4.62
31.667	0.00	10.50	2.799	I 0		4.54
31.750	0.00	10.50	2.727	I 0		4.45
31.833	0.00	10.50	2.655	I 0		4.35
31.917	0.00	10.50	2.582	I 0		4.26
32.000	0.00	10.50	2.510	I 0		4.17
32.083	0.00	10.50	2.438	I 0		4.08
32.167	0.00	10.50	2.365	I 0		3.99
32.250	0.00	10.50	2.293	I 0		3.90
32.333	0.00	10.50	2.221	I 0		3.80
32.417	0.00	10.50	2.148	I 0		3.71
32.500	0.00	10.50	2.076	I 0		3.62
32.583	0.00	10.50	2.004	I 0		3.53
32.667	0.00	10.50	1.931	I 0		3.44
32.750	0.00	10.50	1.859	I 0		3.34
32.833	0.00	10.50	1.787	I 0		3.25
32.917	0.00	10.50	1.714	I 0		3.15
33.000	0.00	10.50	1.642	I 0		3.06
33.083	0.00	10.50	1.570	I 0		2.96
33.167	0.00	10.50	1.497	I 0		2.86
33.250	0.00	10.50	1.425	I 0		2.77
33.333	0.00	10.50	1.353	I 0		2.67
33.417	0.00	10.50	1.280	I 0		2.58
33.500	0.00	10.50	1.208	I 0		2.48
33.583	0.00	10.50	1.136	I 0		2.38
33.667	0.00	10.50	1.063	I 0		2.28
33.750	0.00	10.50	0.991	I 0		2.18
33.833	0.00	10.50	0.919	I 0		2.08
33.917	0.00	10.50	0.846	I 0		1.98
34.000	0.00	10.50	0.774	I 0		1.88
34.083	0.00	10.50	0.702	I 0		1.78

						vf01						
34.167	0.00	10.50	0.629	I	0							1.68
34.250	0.00	10.50	0.557	I	0							1.58
34.333	0.00	10.50	0.485	I	0							1.47
34.417	0.00	10.50	0.412	I	0							1.31
34.500	0.00	10.50	0.340	I	0							1.14
34.583	0.00	10.50	0.268	I	0							0.98
34.667	0.00	10.50	0.195	I	0							0.82
34.750	0.00	10.50	0.123	I	0							0.66
34.833	0.00	10.50	0.051	I	0							0.50
34.917	0.00	1.78	0.008	O								0.08
35.000	0.00	0.29	0.001	O								0.01
35.083	0.00	0.05	0.000	O								0.00

```

*****HYDROGRAPH DATA*****
      Number of intervals = 421
      Time interval = 5.0 (Min.)
      Maximum/Peak flow rate = 10.512 (CFS)
      Total volume = 28.500 (Ac.Ft)
      Status of hydrographs being held in storage
      Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
      Peak (CFS) 0.000 0.000 0.000 0.000 0.000
      Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000
*****

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SECTION 2.4

Unit Hydrograph: Developed Condition (100 Year-Storm)

VF100

Unit Hydrograph Analysis

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Study date 12/21/18

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

VAN FLEIT: TTM 20161 ('A' MAP); 20169, 20170, 20171, 20172, 20173
100-YEAR STORM
FILE:VF100

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
67.75	1	0.75

67.75	6	1.20
-------	---	------

67.75	24	2.00
-------	----	------

67.75	1	1.10
-------	---	------

67.75	6	3.00
-------	---	------

67.75	24	6.00
-------	----	------

***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
56.0	75.8	12.96	0.191	0.440	0.200	0.088
56.0	75.8	30.33	0.448	0.440	0.350	0.154
56.0	75.8	9.03	0.133	0.440	0.100	0.044
56.0	75.8	11.39	0.168	0.440	0.400	0.176
56.0	75.8	4.04	0.060	0.440	0.850	0.374

VF100

Area-averaged adjusted loss rate Fm (In/Hr) = 0.144

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
2.59	0.038	56.0	75.8	3.19	0.560
10.37	0.153	98.0	98.0	0.20	0.960
10.62	0.157	56.0	75.8	3.19	0.560
19.71	0.291	98.0	98.0	0.20	0.960
0.90	0.013	56.0	75.8	3.19	0.560
8.13	0.120	98.0	98.0	0.20	0.960
4.56	0.067	56.0	75.8	3.19	0.560
6.83	0.101	98.0	98.0	0.20	0.960
3.43	0.051	56.0	75.8	3.19	0.560
0.61	0.009	98.0	98.0	0.20	0.960

Area-averaged catchment yield fraction, Y = 0.830

Area-averaged low loss fraction, Yb = 0.170

User entry of time of concentration = 0.310 (hours)

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Watershed area = 67.75(Ac.)

Catchment Lag time = 0.248 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 33.6022

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.144(In/Hr)

Average low loss rate fraction (Yb) = 0.170 (decimal)

VALLEY DEVELOPED S-Graph Selected

Computed peak 5-minute rainfall = 0.407(In)

Computed peak 30-minute rainfall = 0.834(In)

Specified peak 1-hour rainfall = 1.100(In)

Computed peak 3-hour rainfall = 2.035(In)

Specified peak 6-hour rainfall = 3.000(In)

Specified peak 24-hour rainfall = 6.000(In)

Rainfall depth area reduction factors:

Using a total area of 67.75(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997 Adjusted rainfall = 0.406(In)

30-minute factor = 0.997 Adjusted rainfall = 0.831(In)

1-hour factor = 0.997 Adjusted rainfall = 1.097(In)

3-hour factor = 1.000 Adjusted rainfall = 2.034(In)

6-hour factor = 1.000 Adjusted rainfall = 2.999(In)

24-hour factor = 1.000 Adjusted rainfall = 5.999(In)

Unit Hydrograph

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Interval 'S' Graph Unit Hydrograph
Number Mean values ((CFS))

(K = 819.35 (CFS))

1	2.299	18.833
2	13.934	95.333
3	36.131	181.872
4	64.543	232.797
5	82.874	150.195
6	92.118	75.743
7	96.619	36.874
8	98.327	13.999
9	98.941	5.030

VF100
 10 99.546 4.955
 11 100.000 3.721

 Total soil rain loss = 0.95(In)
 Total effective rainfall = 5.05(In)
 Peak flow rate in flood hydrograph = 135.44(CFS)

+++++
 24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	50.0	100.0	150.0	200.0
0+ 5	0.0011	0.16	Q				
0+10	0.0079	0.99	Q				
0+15	0.0256	2.56	Q				
0+20	0.0571	4.58	Q				
0+25	0.0977	5.89	VQ				
0+30	0.1430	6.56	VQ				
0+35	0.1905	6.90	VQ				
0+40	0.2390	7.04	VQ				
0+45	0.2879	7.10	VQ				
0+50	0.3372	7.16	VQ				
0+55	0.3869	7.22	VQ				
1+ 0	0.4367	7.24	VQ				
1+ 5	0.4867	7.26	VQ				
1+10	0.5368	7.28	VQ				
1+15	0.5871	7.30	VQ				
1+20	0.6374	7.32	VQ				
1+25	0.6880	7.34	VQ				
1+30	0.7386	7.36	Q				
1+35	0.7894	7.38	Q				
1+40	0.8404	7.40	Q				
1+45	0.8915	7.42	Q				
1+50	0.9427	7.44	Q				
1+55	0.9941	7.46	Q				
2+ 0	1.0457	7.48	Q				
2+ 5	1.0973	7.51	Q				
2+10	1.1492	7.53	Q				
2+15	1.2012	7.55	Q				
2+20	1.2533	7.57	Q				
2+25	1.3056	7.59	Q				
2+30	1.3581	7.62	Q				
2+35	1.4107	7.64	Q				
2+40	1.4635	7.66	QV				
2+45	1.5165	7.69	QV				
2+50	1.5696	7.71	QV				
2+55	1.6228	7.73	QV				
3+ 0	1.6763	7.76	QV				
3+ 5	1.7299	7.78	QV				
3+10	1.7836	7.81	QV				
3+15	1.8376	7.83	QV				
3+20	1.8917	7.86	QV				
3+25	1.9460	7.88	QV				
3+30	2.0005	7.91	QV				
3+35	2.0551	7.93	QV				
3+40	2.1100	7.96	QV				
3+45	2.1650	7.99	Q V				
3+50	2.2201	8.01	Q V				
3+55	2.2755	8.04	Q V				
4+ 0	2.3311	8.07	Q V				
4+ 5	2.3868	8.09	Q V				
4+10	2.4428	8.12	Q V				
4+15	2.4989	8.15	Q V				

4+20	2.5552	8.18	Q V
4+25	2.6118	8.21	Q V
4+30	2.6685	8.24	Q V
4+35	2.7254	8.27	Q V
4+40	2.7825	8.30	Q V
4+45	2.8399	8.32	Q V
4+50	2.8974	8.36	Q V
4+55	2.9552	8.39	Q V
5+ 0	3.0131	8.42	Q V
5+ 5	3.0713	8.45	Q V
5+10	3.1297	8.48	Q V
5+15	3.1883	8.51	Q V
5+20	3.2471	8.54	Q V
5+25	3.3062	8.58	Q V
5+30	3.3655	8.61	Q V
5+35	3.4250	8.64	Q V
5+40	3.4848	8.68	Q V
5+45	3.5447	8.71	Q V
5+50	3.6050	8.74	Q V
5+55	3.6654	8.78	Q V
6+ 0	3.7261	8.81	Q V
6+ 5	3.7871	8.85	Q V
6+10	3.8483	8.89	Q V
6+15	3.9097	8.92	Q V
6+20	3.9714	8.96	Q V
6+25	4.0334	9.00	Q V
6+30	4.0956	9.04	Q V
6+35	4.1581	9.07	Q V
6+40	4.2209	9.11	Q V
6+45	4.2839	9.15	Q V
6+50	4.3472	9.19	Q V
6+55	4.4108	9.23	Q V
7+ 0	4.4747	9.27	Q V
7+ 5	4.5388	9.32	Q V
7+10	4.6033	9.36	Q V
7+15	4.6680	9.40	Q V
7+20	4.7331	9.44	Q V
7+25	4.7984	9.49	Q V
7+30	4.8641	9.53	Q V
7+35	4.9301	9.58	Q V
7+40	4.9963	9.62	Q V
7+45	5.0629	9.67	Q V
7+50	5.1299	9.72	Q V
7+55	5.1971	9.77	Q V
8+ 0	5.2647	9.82	Q V
8+ 5	5.3327	9.86	Q V
8+10	5.4010	9.92	Q V
8+15	5.4696	9.97	Q V
8+20	5.5386	10.02	Q V
8+25	5.6079	10.07	Q V
8+30	5.6777	10.12	Q V
8+35	5.7478	10.18	Q V
8+40	5.8182	10.23	Q V
8+45	5.8891	10.29	Q V
8+50	5.9604	10.35	Q V
8+55	6.0320	10.40	Q V
9+ 0	6.1041	10.46	Q V
9+ 5	6.1766	10.52	Q V
9+10	6.2495	10.58	Q V
9+15	6.3228	10.65	Q V
9+20	6.3965	10.71	Q V
9+25	6.4707	10.77	Q V
9+30	6.5454	10.84	Q V
9+35	6.6205	10.91	Q V
9+40	6.6961	10.97	Q V
9+45	6.7721	11.04	Q V
9+50	6.8487	11.11	Q V
9+55	6.9257	11.19	Q V
10+ 0	7.0033	11.26	Q V

10+ 5	7.0813	11.33	Q	V			
10+10	7.1599	11.41	Q	V			
10+15	7.2390	11.49	Q	V			
10+20	7.3187	11.57	Q	V			
10+25	7.3990	11.65	Q	V			
10+30	7.4798	11.73	Q	V			
10+35	7.5611	11.82	Q	V			
10+40	7.6431	11.90	Q	V			
10+45	7.7257	11.99	Q	V			
10+50	7.8090	12.08	Q	V			
10+55	7.8928	12.18	Q	V			
11+ 0	7.9773	12.27	Q	V			
11+ 5	8.0625	12.37	Q	V			
11+10	8.1484	12.47	Q	V			
11+15	8.2349	12.57	Q	V			
11+20	8.3222	12.67	Q	V			
11+25	8.4102	12.78	Q	V			
11+30	8.4990	12.89	Q	V			
11+35	8.5886	13.00	Q	V			
11+40	8.6789	13.12	Q	V			
11+45	8.7701	13.24	Q	V			
11+50	8.8621	13.36	Q	V			
11+55	8.9550	13.49	Q	V			
12+ 0	9.0488	13.62	Q	V			
12+ 5	9.1437	13.79	Q	V			
12+10	9.2410	14.12	Q	V			
12+15	9.3418	14.64	Q	V			
12+20	9.4470	15.27	Q	V			
12+25	9.5553	15.73	Q	V			
12+30	9.6658	16.04	Q	V			
12+35	9.7779	16.27	Q	V			
12+40	9.8913	16.47	Q	V			
12+45	10.0060	16.64	Q	V			
12+50	10.1219	16.83	Q	V			
12+55	10.2391	17.02	Q	V			
13+ 0	10.3576	17.21	Q	V			
13+ 5	10.4774	17.40	Q	V			
13+10	10.5986	17.60	Q	V			
13+15	10.7212	17.80	Q	V			
13+20	10.8453	18.02	Q	V			
13+25	10.9710	18.25	Q	V			
13+30	11.0983	18.48	Q	V			
13+35	11.2273	18.73	Q	V			
13+40	11.3580	18.99	Q	V			
13+45	11.4906	19.25	Q	V			
13+50	11.6251	19.54	Q	V			
13+55	11.7617	19.83	Q	V			
14+ 0	11.9004	20.14	Q	V			
14+ 5	12.0413	20.47	Q	V			
14+10	12.1848	20.82	Q	V			
14+15	12.3308	21.20	Q	V			
14+20	12.4797	21.62	Q	V			
14+25	12.6315	22.04	Q	V			
14+30	12.7864	22.49	Q	V			
14+35	12.9444	22.96	Q	V			
14+40	13.1060	23.46	Q	V			
14+45	13.2713	24.00	Q	V			
14+50	13.4406	24.58	Q	V			
14+55	13.6142	25.21	Q	V			
15+ 0	13.7926	25.90	Q	V			
15+ 5	13.9762	26.65	Q	V			
15+10	14.1655	27.49	Q	V			
15+15	14.3611	28.41	Q	V			
15+20	14.5640	29.46	Q	V			
15+25	14.7733	30.39	Q	V			
15+30	14.9840	30.58	Q	V			
15+35	15.1899	29.90	Q	V			
15+40	15.3892	28.93	Q	V			
15+45	15.5915	29.38	Q	V			

				VF100		
15+50	15.8084	31.49			V	
15+55	16.0513	35.28	Q		V	
16+ 0	16.3431	42.36	Q		V	
16+ 5	16.7496	59.03	Q		V	
16+10	17.3950	93.71		Q	V	
16+15	18.2585	125.37			Q	
16+20	19.1913	135.44			V	
16+25	19.8775	99.64		Q	V	
16+30	20.3390	67.00			V	
16+35	20.6736	48.58	Q		V	
16+40	20.9377	38.35	Q		V	
16+45	21.1675	33.37	Q		V	
16+50	21.3829	31.28	Q		V	
16+55	21.5823	28.96	Q		V	
17+ 0	21.7624	26.14	Q		V	
17+ 5	21.9326	24.72	Q		V	
17+10	22.0950	23.58	Q		V	
17+15	22.2506	22.59	Q		V	
17+20	22.4000	21.69	Q		V	
17+25	22.5439	20.90	Q		V	
17+30	22.6830	20.21	Q		V	
17+35	22.8179	19.58	Q		V	
17+40	22.9490	19.03	Q		V	
17+45	23.0765	18.52	Q		V	
17+50	23.2008	18.05	Q		V	
17+55	23.3221	17.62	Q		V	
18+ 0	23.4408	17.22	Q		V	
18+ 5	23.5566	16.82	Q		V	
18+10	23.6686	16.27	Q		V	
18+15	23.7759	15.57	Q		V	
18+20	23.8777	14.78	Q		V	
18+25	23.9754	14.19	Q		V	
18+30	24.0702	13.76	Q		V	
18+35	24.1626	13.43	Q		V	
18+40	24.2532	13.15	Q		V	
18+45	24.3422	12.91	Q		V	
18+50	24.4295	12.69	Q		V	
18+55	24.5154	12.47	Q		V	
19+ 0	24.6000	12.27	Q		V	
19+ 5	24.6832	12.09	Q		V	
19+10	24.7652	11.91	Q		V	
19+15	24.8460	11.74	Q		V	
19+20	24.9257	11.57	Q		V	
19+25	25.0043	11.41	Q		V	
19+30	25.0819	11.26	Q		V	
19+35	25.1584	11.12	Q		V	
19+40	25.2340	10.98	Q		V	
19+45	25.3087	10.84	Q		V	
19+50	25.3825	10.71	Q		V	
19+55	25.4554	10.59	Q		V	
20+ 0	25.5274	10.46	Q		V	
20+ 5	25.5987	10.35	Q		V	
20+10	25.6692	10.23	Q		V	
20+15	25.7389	10.12	Q		V	
20+20	25.8079	10.02	Q		V	
20+25	25.8762	9.92	Q		V	
20+30	25.9438	9.82	Q		V	
20+35	26.0107	9.72	Q		V	
20+40	26.0770	9.62	Q		V	
20+45	26.1426	9.53	Q		V	
20+50	26.2077	9.44	Q		V	
20+55	26.2721	9.36	Q		V	
21+ 0	26.3360	9.27	Q		V	
21+ 5	26.3993	9.19	Q		V	
21+10	26.4621	9.11	Q		V	
21+15	26.5243	9.04	Q		V	
21+20	26.5860	8.96	Q		V	
21+25	26.6472	8.89	Q		V	
21+30	26.7079	8.81	Q		V	

VF100

21+35	26.7681	8.74	Q			V
21+40	26.8279	8.67	Q			V
21+45	26.8872	8.61	Q			V
21+50	26.9460	8.54	Q			V
21+55	27.0044	8.48	Q			V
22+ 0	27.0623	8.42	Q			V
22+ 5	27.1199	8.35	Q			V
22+10	27.1770	8.29	Q			V
22+15	27.2337	8.24	Q			V
22+20	27.2900	8.18	Q			V
22+25	27.3460	8.12	Q			V
22+30	27.4015	8.07	Q			V
22+35	27.4567	8.01	Q			V
22+40	27.5116	7.96	Q			V
22+45	27.5660	7.91	Q			V
22+50	27.6201	7.86	Q			V
22+55	27.6739	7.81	Q			V
23+ 0	27.7273	7.76	Q			V
23+ 5	27.7804	7.71	Q			V
23+10	27.8332	7.66	Q			V
23+15	27.8857	7.62	Q			V
23+20	27.9378	7.57	Q			V
23+25	27.9897	7.53	Q			V
23+30	28.0412	7.48	Q			V
23+35	28.0924	7.44	Q			V
23+40	28.1434	7.40	Q			V
23+45	28.1940	7.36	Q			V
23+50	28.2444	7.31	Q			V
23+55	28.2945	7.27	Q			V
24+ 0	28.3444	7.23	Q			V
24+ 5	28.3928	7.03	Q			V
24+10	28.4353	6.17	Q			V
24+15	28.4668	4.57	Q			V
24+20	28.4842	2.53	Q			V
24+25	28.4927	1.22	Q			V
24+30	28.4965	0.56	Q			V
24+35	28.4982	0.24	Q			V
24+40	28.4990	0.12	Q			V
24+45	28.4995	0.08	Q			V
24+50	28.4998	0.03	Q			V

SECTION 2.5

Street Capacity Calculation

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Analysis prepared by:

LD King
10390 Commerce Center Drive
Rancho Cucamonga CA 91730

TIME/DATE OF STUDY: 07:43 02/07/2018
=====

Problem Descriptions:
Street Capacity @ S=0.005
Tilted Alleys

>>>>STREETFLOW MODEL INPUT INFORMATION<<<<

CONSTANT STREET GRADE (FEET/FEET) = 0.005000
CONSTANT STREET FLOW DEPTH (FEET) = 0.33
AVERAGE STREETFLOW FRICTION FACTOR (MANNING) = 0.015000
CONSTANT SYMMETRICAL STREET HALF-WIDTH (FEET) = 20.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
INTERIOR STREET CROSSFALL (DECIMAL) = 0.020000
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020000
CONSTANT SYMMETRICAL CURB HEIGHT (FEET) = 0.33
CONSTANT SYMMETRICAL GUTTER-WIDTH (FEET) = 1.75
CONSTANT SYMMETRICAL GUTTER-LIP (FEET) = 0.01000
CONSTANT SYMMETRICAL GUTTER-HIKE (FEET) = 0.08000
FLOW ASSUMED TO FILL STREET ON ONE SIDE.

STREET FLOW MODEL RESULTS:

STREET FLOW DEPTH (FEET) = 0.33
HALFSTREET FLOOD WIDTH (FEET) = 13.75
HALFSTREET FLOW (CFS) = 3.61
AVERAGE FLOW VELOCITY (FEET/SEC.) = 1.85
PRODUCT OF DEPTH&VELOCITY = 0.61
=====

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Analysis prepared by:

LD King
10390 Commerce Center Drive
Rancho Cucamonga CA 91730

TIME/DATE OF STUDY: 07:38 02/07/2018
=====

Problem Descriptions:
Street Capaciy @ S=0.006
Tilted Alleys

>>>>STREETFLOW MODEL INPUT INFORMATION<<<<

CONSTANT STREET GRADE (FEET/FEET) = 0.006000
CONSTANT STREET FLOW DEPTH (FEET) = 0.33
AVERAGE STREETFLOW FRICTION FACTOR (MANNING) = 0.015000
CONSTANT SYMMETRICAL STREET HALF-WIDTH (FEET) = 20.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
INTERIOR STREET CROSSFALL (DECIMAL) = 0.020000
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020000
CONSTANT SYMMETRICAL CURB HEIGHT (FEET) = 0.33
CONSTANT SYMMETRICAL GUTTER-WIDTH (FEET) = 1.75
CONSTANT SYMMETRICAL GUTTER-LIP (FEET) = 0.01000
CONSTANT SYMMETRICAL GUTTER-HIKE (FEET) = 0.08000
FLOW ASSUMED TO FILL STREET ON ONE SIDE.
=====

STREET FLOW MODEL RESULTS:

STREET FLOW DEPTH (FEET) = 0.33
HALFSTREET FLOOD WIDTH (FEET) = 13.75
HALFSTREET FLOW (CFS) = 3.95
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.03
PRODUCT OF DEPTH&VELOCITY = 0.67
=====

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Analysis prepared by:

LD King
10390 Commerce Center Drive
Rancho Cucamonga CA 91730

TIME/DATE OF STUDY: 07:46 02/07/2018
=====

Problem Descriptions:

Street Capacity To Top of Curb @ S=0.006
Street W=36' (curb to curb) 60' (R/W to R/W)

>>>>STREETFLOW MODEL INPUT INFORMATION<<<<

CONSTANT STREET GRADE (FEET/FEET) = 0.006000
CONSTANT STREET FLOW DEPTH (FEET) = 0.50
AVERAGE STREETFLOW FRICTION FACTOR (MANNING) = 0.015000
CONSTANT SYMMETRICAL STREET HALF-WIDTH (FEET) = 18.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
INTERIOR STREET CROSSFALL (DECIMAL) = 0.020000
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020000
CONSTANT SYMMETRICAL CURB HEIGHT (FEET) = 0.50
CONSTANT SYMMETRICAL GUTTER-WIDTH (FEET) = 2.00
CONSTANT SYMMETRICAL GUTTER-LIP (FEET) = 0.03125
CONSTANT SYMMETRICAL GUTTER-HIKE (FEET) = 0.16700
FLOW ASSUMED TO FILL STREET ON ONE SIDE.
=====

STREET FLOW MODEL RESULTS:

STREET FLOW DEPTH (FEET) = 0.50
HALFSTREET FLOOD WIDTH (FEET) = 17.09
HALFSTREET FLOW (CFS) = 7.42
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.39
PRODUCT OF DEPTH&VELOCITY = 1.19
=====

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Analysis prepared by:

LD King
10390 Commerce Center Drive
Rancho Cucamonga CA 91730

TIME/DATE OF STUDY: 07:51 02/07/2018
=====

Problem Descriptions:

Street Capacity to R/W @ S=0.006
W=36' (curb to curb) 60' (R/W to R/W)

>>>STREETFLOW MODEL INPUT INFORMATION<<<<

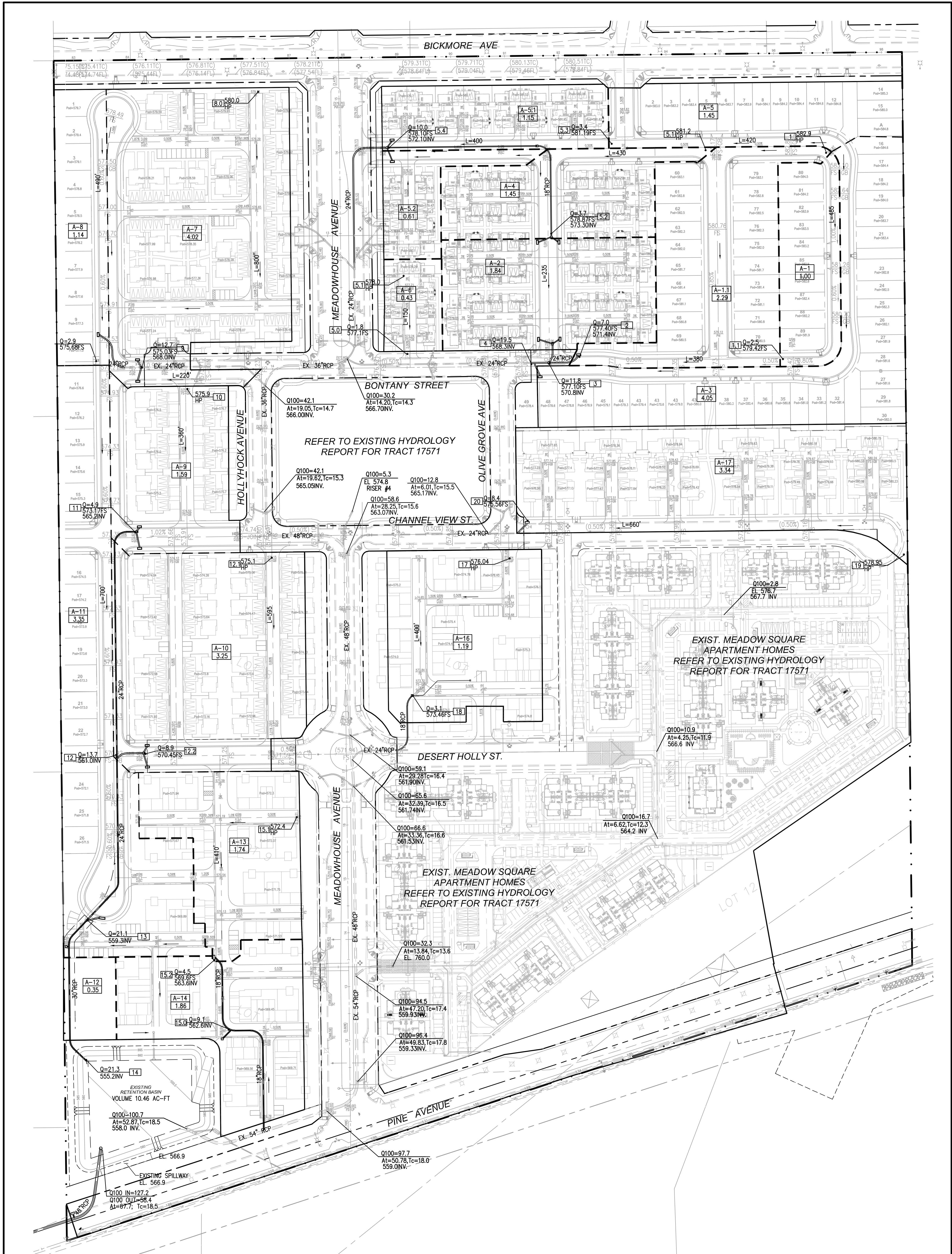
CONSTANT STREET GRADE (FEET/FEET) = 0.006000
CONSTANT STREET FLOW DEPTH (FEET) = 0.74
AVERAGE STREETFLOW FRICTION FACTOR (MANNING) = 0.015000
CONSTANT SYMMETRICAL STREET HALF-WIDTH (FEET) = 18.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 12.00
INTERIOR STREET CROSSFALL (DECIMAL) = 0.020000
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020000
CONSTANT SYMMETRICAL CURB HEIGHT (FEET) = 0.50
CONSTANT SYMMETRICAL GUTTER-WIDTH (FEET) = 2.00
CONSTANT SYMMETRICAL GUTTER-LIP (FEET) = 0.03125
CONSTANT SYMMETRICAL GUTTER-HIKE (FEET) = 0.16700
FLOW ASSUMED TO FILL STREET ON ONE SIDE.
=====

STREET FLOW MODEL RESULTS:

WARNING: STREET FLOW SPLITS OVER STREET-CROWN.
NOTE: STREET FLOW EXCEEDS TOP OF CURB.
THE FOLLOWING STREET FLOW RESULTS ARE BASED ON THE ASSUMPTION
THAT NEGLIBLE FLOW OCCURS OUTSIDE OF THE STREET CHANNEL.
THAT IS, ALL FLOW ALONG THE PARKWAY, ETC., IS NEGLECTED.
STREET FLOW DEPTH (FEET) = 0.74
HALFSTREET FLOOD WIDTH (FEET) = 18.00
HALFSTREET FLOW (CFS) = 31.45
AVERAGE FLOW VELOCITY (FEET/SEC.) = 4.23
PRODUCT OF DEPTH&VELOCITY = 3.13
=====

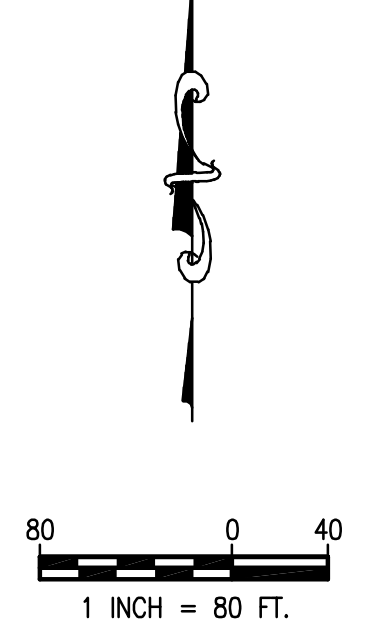
SECTION 3: HYDROLOGY MAPS

- 3.1 Hydrology Map: Developed Condition
- 3.2 Hydrology Map: Interim Condition
- 3.3 Hydrology Map: Existing Condition



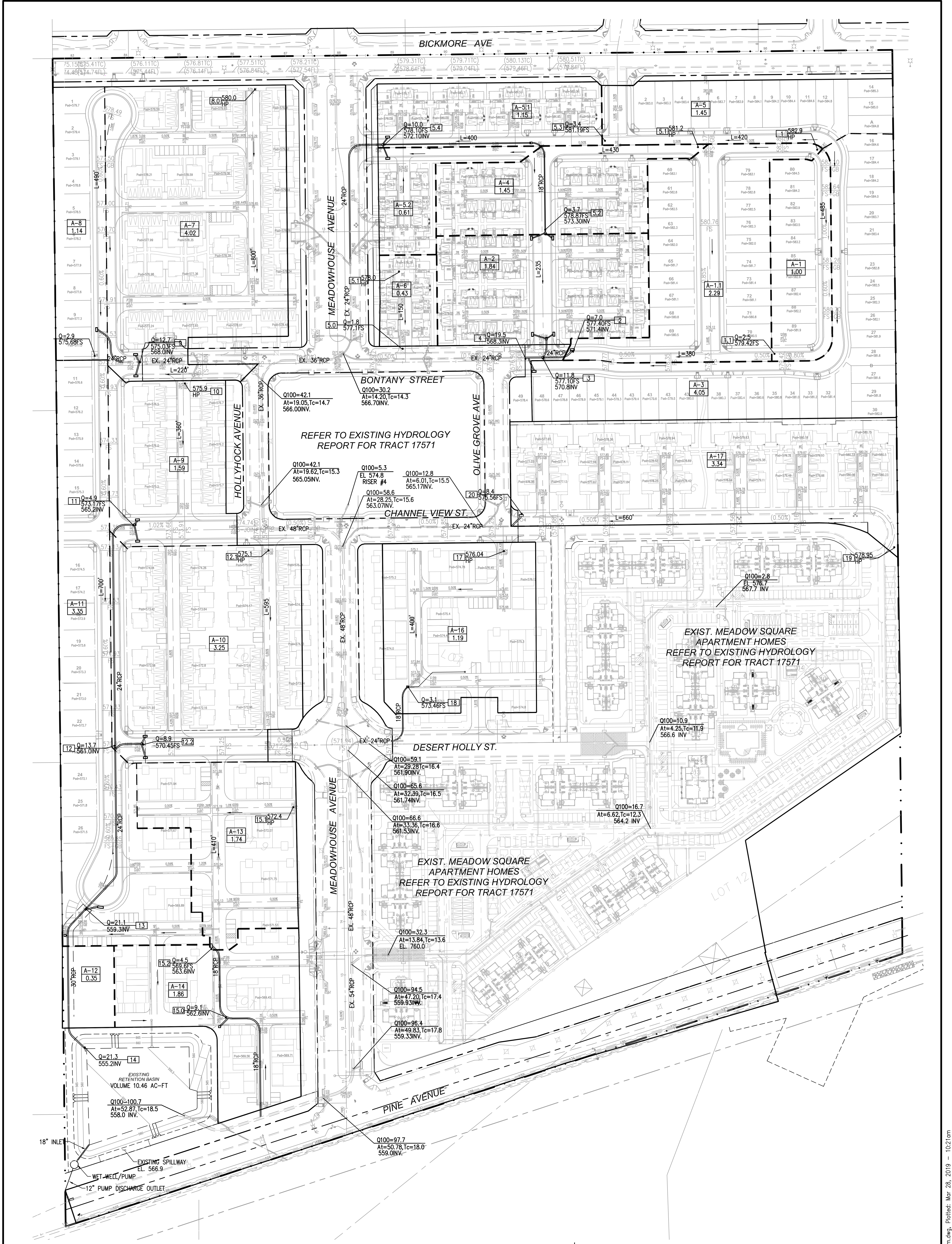
LEGEND/ABBREVIATIONS

1	NODE NUMBER
Q=12.0 cfs	Q100 PEAK DISCHARGE IN CFS
Tc=10.2 MIN.	TIME OF CONCENTRATION IN MINUTES
L=554'	LENGTH OF A DRAINAGE COURSE
HP	HIGH POINT
FS	FINISH SURFACE ELEVATION
INV	PIPE INVERT ELEVATION
→	DIRECTIONAL FLOW ARROW
A-1 1.65	DRAINAGE SUBAREA DESIGNATION DRAINAGE SUBAREA IN ACREAGE
---	DRAINAGE AREA BOUNDARY
- - -	SUB-DRAINAGE AREA BOUNDARY



HYDROLOGY MAP
VAN VLIET SITE ULTIMATE CONDITION
T. M 20161 ('A' Map), 20169, 20170, 20171, 20172,
20173, 20270 & 20271

975 N. Haven Avenue, Suite 200
 Ontario, California 91764
 (909) 945-0526 Fax: (909) 945-0629

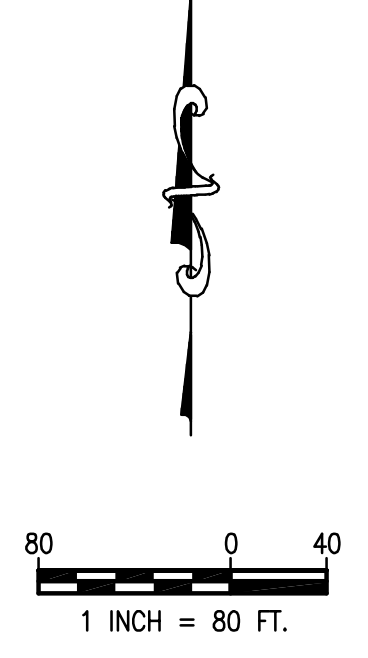


REFER TO EXISTING HYDROLOGY REPORT FOR TRACT 17571

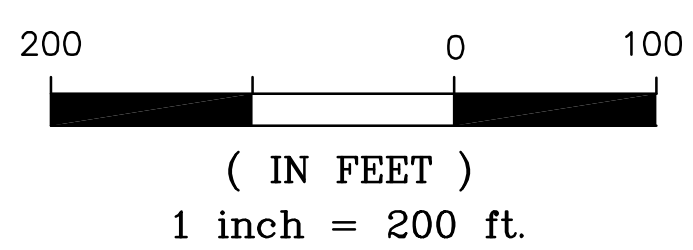
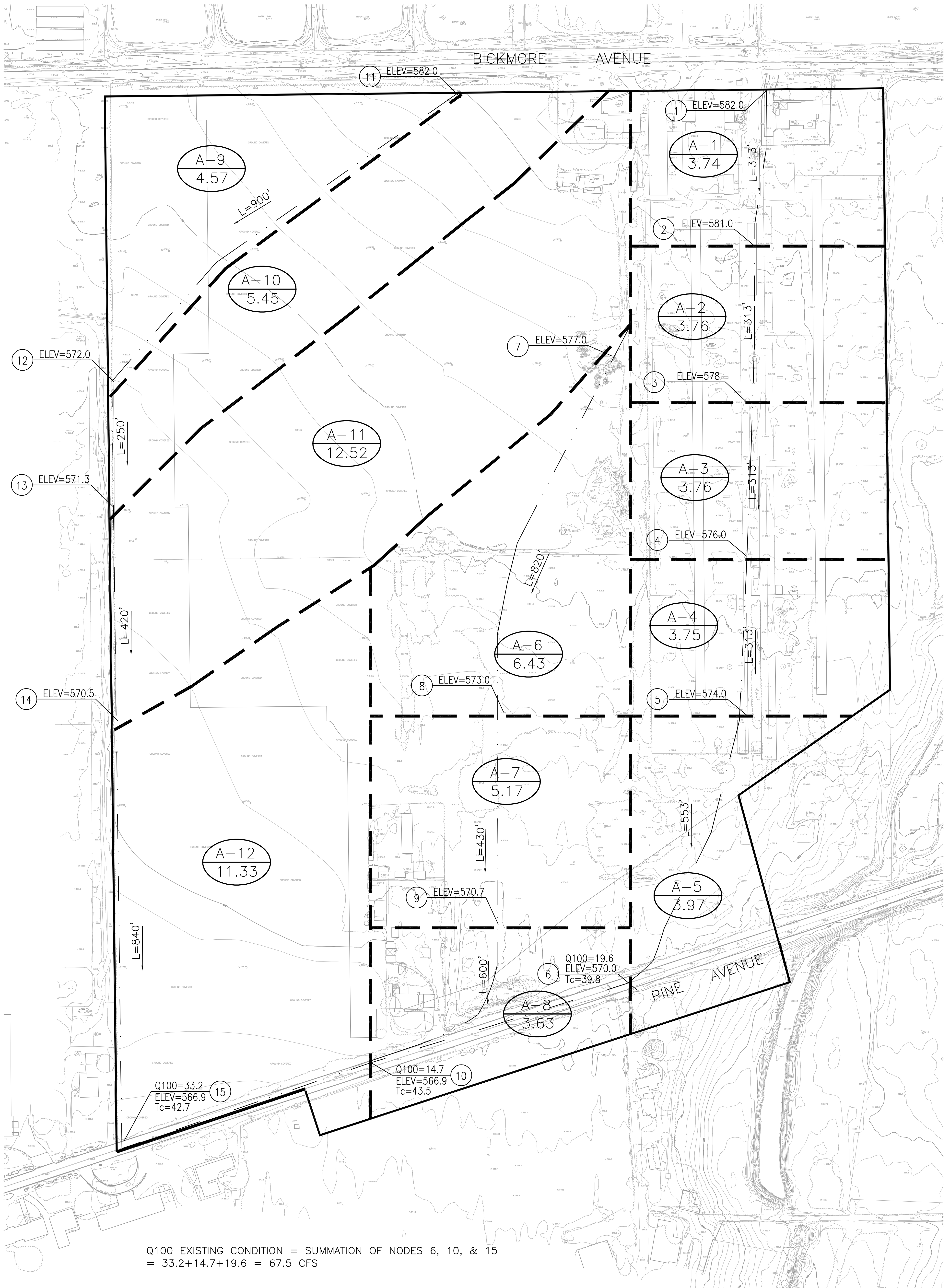
EXIST. MEADOW SQUARE APARTMENT HOMES REFER TO EXISTING HYDROLOGY REPORT FOR TRACT 17571

EXIST. MEADOW SQUARE APARTMENT HOMES REFER TO EXISTING HYDROLOGY REPORT FOR TRACT 17571

- LEGEND/ABBREVIATIONS**
- 1 NODE NUMBER
 - Q=12.0 cfs Q100 PEAK DISCHARGE IN CFS
 - Tc=10.2 MIN. TIME OF CONCENTRATION IN MINUTES
 - L=554' LENGTH OF A DRAINAGE COURSE
 - HP HIGH POINT
 - FS FINISH SURFACE ELEVATION
 - INV PIPE INVERT ELEVATION
 - ← DIRECTIONAL FLOW ARROW
 - A-1 DRAINAGE SUBAREA DESIGNATION
 - 1.65 DRAINAGE SUBAREA IN ACRES
 - DRAINAGE AREA BOUNDARY
 - - - SUB-DRAINAGE AREA BOUNDARY



HYDROLOGY MAP
VAN VLIET SITE INTERIM CONDITION
T. M 20161 ('A' Map), 20169, 20170, 20171, 20172,
20173, 20270 & 20271



HYDROLOGY MAP - EXISTING CONDITION
VAN VLIET SITE
Tract Map No. 20161 ('A' Map)
Tract Maps 20169, 20170, 20171, 20172, & 20173