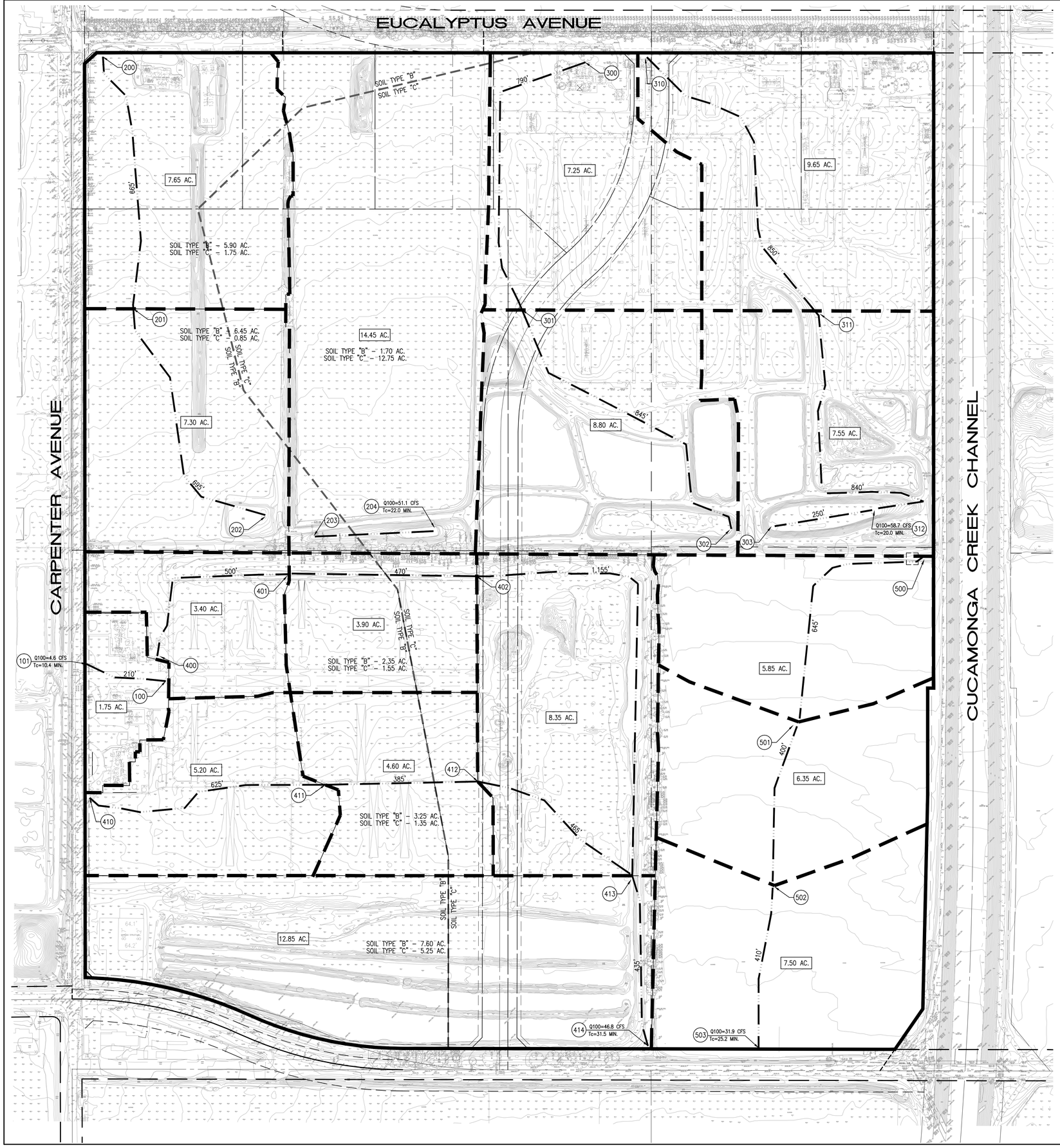

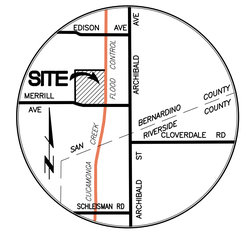

VICINITY MAP

N.T.S.

LEGEND

	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
	SOIL TYPE BOUNDARY
1.00 AC.	SUBAREA AREA
100	NODE NUMBER

0 50 100 200 300

SCALE:1"=100'

Last Update: 10/4/17
O:\3200-3299\3290\3290HYD-EX.dwg

CITY OF ONTARIO

PUBLIC WORKS DEPARTMENT

EXISTING HYDROLOGY MAP

WEST ONTARIO COMMERCE CENTER
MERRILL AVENUE, CARPENTER AVENUE, AND EUCALYPTUS AVENUE

PREPARED FOR:

ONTARIO LAND VENTURES, LLC
4100 MACARTHUR BOULEVARD, SUITE 120
NEWPORT BEACH, CA 92660
PHONE: (949) 954-3087
FAX: (213) 627-2138

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by
Date
Checked by
Date
Designed by
Date
Checked by
Date

Approved by Date

Public Works Director R.C.E. XXXXX

Sheet 1 of 1 Sheets

3290/1 OF 1 SHEET

PRELIMINARY HYDROLOGY CALCULATIONS

FOR

WEST ONTARIO COMMERCE CENTER
MERRILL AVENUE, CARPERNTER AVENUE AND EUCALYPTUS AVENUE
ONTARIO, CALIFORNIA

PREPARED FOR

ONTARIO LAND VENTRUES, LLC
4100 MACARTHUR BOULEVARD, SUITE 120
NEWPORT BEACH, CALIFORNIA 92660
P. (949) 954-3087
FAX. (213) 627-2138

JANUARY 6, 2017
REVISED AUGUST 22, 2017
REVISED OCTOBER 4, 2017

JOB NO. 3290

PREPARED BY

THIENES ENGINEERING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
(714) 521-4811

PRELIMINARY HYDROLOGY CALCULATIONS

FOR

WEST ONTARIO COMMERCE CENTER

PREPARED UNDER
THE SUPERVISION OF:

REINHARD STENZEL DATE:
R.C.E. 56155
EXP. 12/31/18

INTRODUCTION

A: PROJECT LOCATION

The project site is located at the northeast corner of Merrill Avenue and Carpenter Avenue, west of the Cucamonga Creek Channel, and south of Eucalyptus Avenue in the City of Ontario. Please see next page for vicinity map.

B: STUDY PURPOSE

The purpose of this study is to determine the 100-year peak flow rate from the project site that ultimately drains to the Cucamonga Creek Channel via proposed public storm drains in Merrill Avenue and in proposed Hellman Avenue.

C: PROJECT STAFF:

Thienes Engineering staff involved in this study include:

Reinhard Stenzel
Brian Weil
Ricky Hwa

SHEET 1 OF 1

Last Update: 11/22/16
O:\3200-3299\3290\3290-HYDROLOGY EXHIBIT.dwg

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
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VICINITY MAP

FOR

WEST ONTARIO COMMERCE CENTER

DISCUSSION

The project site encompasses approximately 124.7 acres. Proposed improvements consist of two large commercial/warehouse type buildings of approximately 1,072,180 (Building 2) and 1,227,950 (Building 1) square feet. The buildings will be separated by the future development of Hellman Avenue. There will be truck yards on the east and west sides of each building and vehicle parking lots on the north and south sides of each building.

Four smaller buildings (Buildings 3-6) are proposed in the Business Park zone area located on the southerly side of Eucalyptus Avenue, north of Buildings 1 and 2. The respective size of these buildings are 140,640 square feet, 69,260 square feet, 55,900 square feet and 105,520 square feet. Each of these buildings have a truck yard on the southerly side of the building. There are water quality basins on the easterly side of Buildings 5 and 6. The remainder of the site will be reserved for landscaping.

Master Plan Drainage

Per the City of Ontario Master Plan of Drainage dated March 2012 by Hunsaker & Associates, this project site (including the future build out north of proposed Buildings 1 & 2) are tabled to the Cucamonga Creek Channel via a proposed public storm drain in Merrill Avenue (MERL-XI-1). From the Master Plan of Drainage, the project site is comprised of areas J7.5, J19.5 and J82.4 and zoned as industrial development. The proposed Merrill Avenue storm drain and Cucamonga Creek Channel are designed for 100-year storm events.

A revision to the Master Plan of Drainage, by David Evans and Associates, was approved by the City of Ontario in June 2017. This study basically combines Master Plan storm drain facilities WLKR-XII-1X and MERL-XI-1. This will increase the size of the proposed storm drain in Merrill Avenue adjacent to the project site. The proposed facility is a double 12' wide by 10' high reinforced concrete box (RCB). The original WLKR-XII-1X facility drained south below Merrill Avenue at a location between Grove Avenue and Carpenter Avenue and ultimately connected to Cucamonga Creek Channel approximately 2400' south of Merrill Avenue.

Hydrology calculations from the David Evans and Associates report show that the project site is included in the area tributary to the proposed RCB in Merrill Avenue at a location approximately 800' upstream of the connection to Cucamonga Creek (at node 1738 on Exhibit "A", Proposed Drainage Map).

See Appendix "A" for portions of the City of Ontario Master Plan of Drainage, as-built channel plans for Cucamonga Creek and pertinent reference materials from David Evans and Associates hydrology report for the Master Plan Revision.

Existing Condition

The project site is currently a mixture of cattle ranches, single family homes, and dirt lots. Flow generally surface drains from north to south. The northerly portion of the project site (nodes 200-312 on existing condition hydrology map) drains to several depressed basin that store runoff. There appears to be pipes connecting several of the basins, but it does not appear that there is any discharge locations from the basins either to the adjacent channel or areas to the south. Aerial topography suggests that runoff would eventually continue in a southerly direction once all of the basins are full. The existing condition 100-year peak flow rate for these areas is approximately 109.8 cfs (direct sum of the two individual drainage areas).

Runoff from the southerly half of the project site also drains from north to south. Here, the westerly 2/3 of the site (nodes 400-414) drains to depressed basins located adjacent to Merrill Avenue. These basins do not appear to have a discharge location. Once the basins are full, storm water will ultimately spill into Merrill Avenue. The 100-year peak flow rate for this area under existing condition is approximately 46.8 cfs.

The easterly 1/3 of the southerly half of the site (nodes 500-503) tends to sheet flow to Merrill Avenue. Flow to Merrill Avenue is intercepted in an existing 24-inch corrugated metal pipe. This pipe appears to drain easterly and connect to the two 66-inch reinforced concrete pipes, which outlets to the Cucamonga Creek Channel. The 100-year existing condition peak flow rate for this area is approximately 31.9 cfs.

A small residential area (nodes 100-101) sheet flows to Carpenter Avenue. The 100-year peak flow rate for this area is approximately 4.6 cfs.

Proposed Condition

Proposed condition drainage patterns for the project site are consistent with both the City of Ontario's Master Plan of Drainage and the revision to the Master Plan of Drainage prepared by David Evans and Associates. Runoff from all of the proposed buildings will ultimately drain to the proposed double 12' wide by 10' high RCB in Merrill Avenue. Drainage for these areas are described as follows:

Building 2 (Westerly building)

The westerly parking area north of the building (Nodes 100-101, 1.35 acres) drains westerly to a catch basin near the northwest corner of the building. Runoff is then conveyed southerly via the proposed onsite storm drain, Line "A". The west half of building and the westerly truck yard (Nodes 102-113, 21.0 acres) drain to catch basins in the truck yard. Runoff is then conveyed southerly and then easterly around the building via Line "A". The parking area south of Building 2 (Node 120-132, 4.55 acres) will drain to a catch basins in the parking lot and connect to Line "A".

The northerly parking area north of the building (Nodes 140-142, 1.75 acres) drains easterly to a catch basins near the northeast corner of the building. Runoff is then conveyed southerly via the proposed onsite storm drain, Line "A-1". The east half of the building and the easterly truck yard (Nodes 150-161, 18.45 acres) drain to catch basins in the truck yard. Runoff is then conveyed southerly via Line "A-1" and confluences with Line A (at node 162). Flows are then conveyed to the proposed Hellman Avenue public storm drain. The 100-year peak flow rate for the above mentioned areas is approximately 112.5 cfs.

Building 1 (Easterly building)

The west half of the building, its westerly truck yard, the west half of the northerly parking lot and the parking lot southwest of the building (Nodes 200-211, 23.90 acres) drain to catch basins in the truck yard and the parking lot. Runoff is then conveyed southerly through the truck yard and then westerly via the proposed onsite storm drain, Line "B". Line "B" connects to the proposed Hellman Avenue public storm drain. The 100-year peak flow rate for this area is approximately 55.6 cfs.

The east half of the building, its easterly truck yard and the east half of the northerly parking lot (Nodes 300-344, 25.45 acres) drain to catch basins in the truck yard, northerly parking lot and southerly parking lot. Runoff is then conveyed southerly via the proposed onsite storm drain, Line C, to the proposed double RCB in Merrill Avenue and ultimately to Cucamonga Creek Channel. The 100-year peak flow rate for this area is approximately 66.3 cfs.

Future Business Park (Buildings 3-6)

Runoff from Buildings 3-5 (nodes 400-453, 13.80 acres) will be collected in catch basins throughout the parking and truck yard areas. A storm drain system will convey runoff easterly to the proposed storm drain system in Hellman Avenue. The 100-year peak flow rate for these buildings is approximately 41.9 cfs.

Flow from Building 6 (nodes 500-515, 6.15 acres) will drain to catch basins in the parking areas and truck yard. A storm drain system conveys runoff westerly to the proposed storm drain system in Hellman Avenue. The 100-year peak flow rate for this building is approximately 15.6 cfs.

Offsite Drainage

In general, areas north of the project site are existing dairies and open space that drain from north to south. The offsite areas to the north have low spots and berms that prevent storm water runoff from entering the project site. There is an existing storm drain connection to Cucamonga creek at this location for runoff north of Eucalyptus Avenue. These areas are tabled to Cucamonga Creek Channel at Eucalyptus Avenue and are not considered in the proposed condition hydrology.

Areas west of Carpenter Avenue between Eucalyptus Avenue and Merrill Avenue also drain from north to south. Based on street plans and available topography for Merrill Avenue, areas west of Carpenter Street continue to drain westerly, and are not tributary to the frontage of the project site. This drainage area is also supported by the original Master Plan of Drainage, which shows the storm drain traversing southerly between Grove Avenue and Carpenter Avenue, not easterly in Merrill Avenue. Recent aerial topography suggests that Carpenter Avenue drains easterly in Merrill Avenue at the intersection.

There is a small area tributary to Carpenter Avenue between Eucalyptus Avenue and Merrill Avenue will be considered to drain to Merrill Avenue adjacent to the project site. Several areas west of Carpenter Avenue are self-detained. Other areas are considered draining to Carpenter Avenue. The 100-year peak flow rate in Carpenter Avenue at the intersection of Merrill Avenue is approximately 12.9 cfs. This flow continues easterly in Merrill Avenue.

Proposed Storm Drains

The hydrology study by David Evans and Associates provides peak flow rates and hydraulic calculations for the proposed double 12'w by 10' high RCB in Merrill Avenue. The David Evans and Associates study includes the project site as commercial development. The double RCB is located on the southerly side of Merrill Avenue (within the street right-of-way) and connects to Cucamonga Creek Channel. Construction of the double RCB in Merrill Avenue from Cucamonga Creek Channel to Carpenter Avenue will be required with the proposed development. Overall length of the double RCB is approximately 2300 linear feet.

Also required with the project development will be the construction of the Master Plan of Drainage facility in Eucalyptus Avenue, even though the project site will not drain to this system. From the Master Plan of Drainage, the downstream portion of the proposed storm drain in Eucalyptus Avenue is 114" diameter reinforced concrete pipe (RCP), while the upstream portion is 60" RCP. A 96" RCP from the north ultimately confluences with the proposed Eucalyptus Avenue storm drain (where the pipe changes from 114" to 60"). A junction structure and stub will be provided. The 114" RCP will ultimately connect to Cucamonga Creek Channel and continue westerly approximately 800 linear feet. The proposed 60" RCP will continue westerly approximately 650 linear feet.

This study provides preliminary 100-year peak flow rates from the project site and Hellman Avenue that are tributary to the proposed Hellman Avenue storm drain. This storm drain continues southerly in Hellman Avenue to the proposed double RCB. Preliminary hydraulic calculations show that a 66" diameter storm drain can convey runoff tributary to the downstream portion of the Hellman Avenue storm drain (at node 616). Upstream of this location, the estimated storm drain is primarily 48" in diameter with the upstream portion of 36" diameter.

See Appendix "B" for proposed condition hydrology calculations and Appendix "D" for proposed condition hydrology map.

Interim Condition

Offsite runoff in Merrill Avenue continues easterly to the intersection of proposed Hellman Avenue. Here, a catch basin will intercept this flow along with runoff from a portion of the northerly half of Merrill Avenue. A storm drain will convey this flow to the double RCB. Runoff from the project site is also conveyed to the double RCB at two locations, at Hellman Avenue and at the easterly side of Building 1.

A hydrologic model was established to consider all runoff from the offsite area, the project site and northerly portion of Merrill Avenue. This is the total flow tributary to the double RCB drain in Merrill Avenue in the interim condition. The total 100-year peak flow rate for the interim storm drain system is approximately 292.4 cfs.

As previously mentioned, there are two existing 66" storm drains (side by side) that currently connect to Cucamonga Creek Channel south of Merrill Avenue. Until all necessary permits are obtained for the connection of the double RCB to Cucamonga Creek Channel, the existing storm drain connection can be utilized. Here, the downstream portion of the double RCB can be transitioned to a 78" RCP that then transitions to the two existing 66" storm drains. A hydraulic model was established for the existing 66" storm drains and a portion of 78" storm drain. This model shows that the 100-year peak flow rate in the interim condition can be adequately conveyed to the channel.

The same permitting process to connect to Cucamonga Creek Channel will be required for the proposed Eucalyptus Avenue storm drain. Once again, the existing connections to the channel at Eucalyptus Avenue can be used until all necessary permits are issued.

Note that the ultimate peak flow rate to the double RCB at Carpenter Avenue is not included since the upstream portion of the RCB is not constructed at this time. Overall peak flow rates for the double RCB were calculated in the update to the City's Master Plan of Drainage by David Evans and Associates. Once the entire Merrill Avenue storm drain is complete upstream of Carpenter Avenue, the ultimate connection to the channel will be necessary. The interim storm drain solution will not adequately convey all Master Plan of Drainage runoff.

Methodology

Hydrology calculations were computed using San Bernardino County's Rational Method Program (by AES Software). The soil type is "B" for the westerly portion of the project site and "C" for the remainder of the site, per the San Bernardino County Hydrology Manual. See Appendix "A" for reference materials. WSPG was used for hydraulic calculations.

Conclusion

The proposed project site is considered as commercial development and tabled to the proposed Master Plan Storm Drain in Merrill Avenue as shown in the hydrology report for the Master Plan of Drainage Revision. The proposed facility has a 100-year design frequency and discharges into Cucamonga Creek just east of the project site. Cucamonga Creek also has a 100-year design frequency. Therefore, the proposed project site will not have any adverse effect on downstream facilities.

Hydraulic calculations from David Evans and Associates indicate that the hydraulic grade line is approximately 2' above the soffit of the double 12' wide by 10' high RCB adjacent to the project site. This is at least 6' below the proposed finished surface of Merrill Avenue. In addition, the elevations of the project site are considerably higher than Merrill Avenue, so this water surface elevation will not be a concern for the project site.

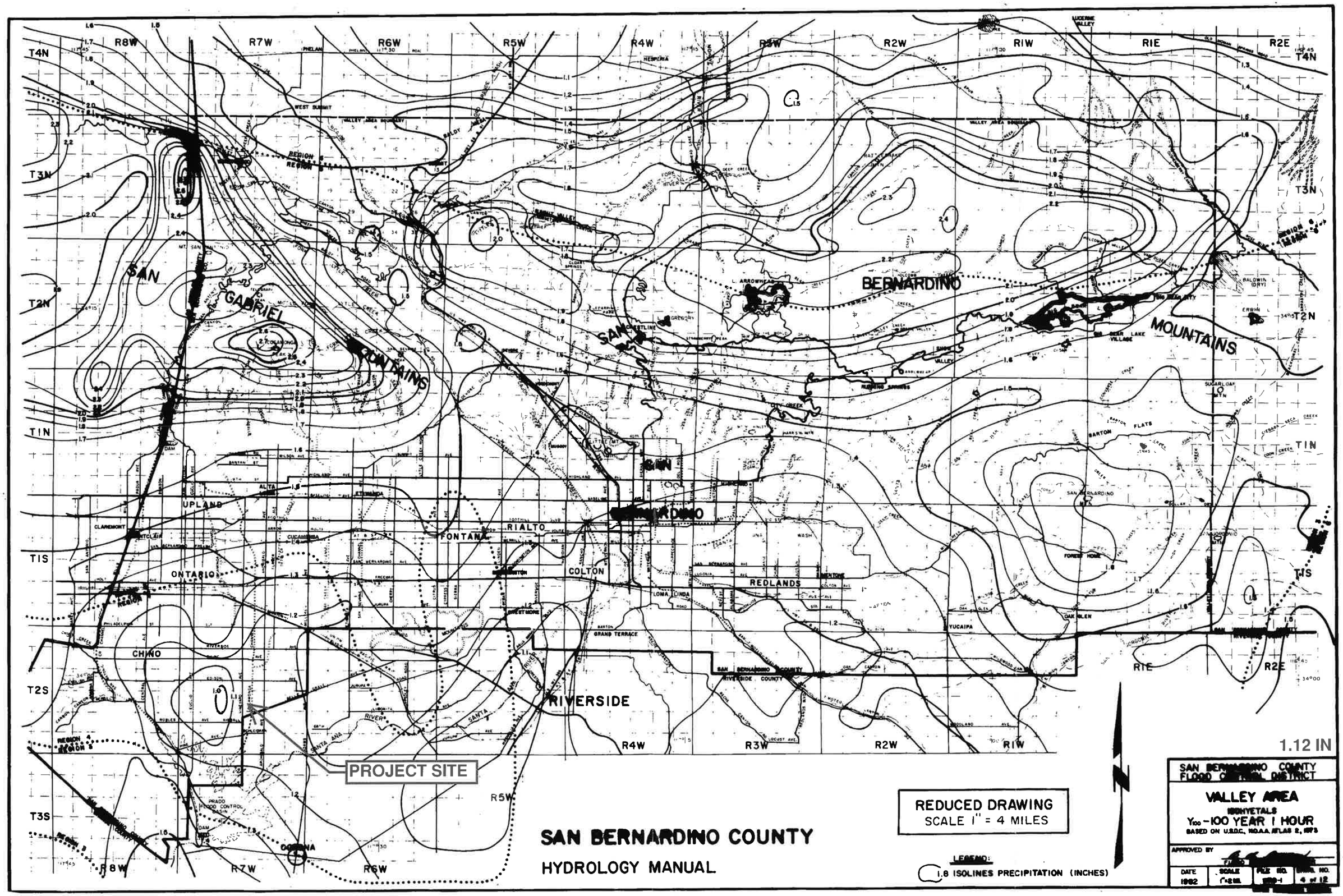
The 100-year peak flow rate tributary to the double RCB and interim storm drain is from the proposed improvements is approximately 292.4 cfs.

Until the ultimate double RCB connection to the channel is permitted, an interim storm drain can be constructed to convey runoff from the project site and adjacent tributary areas. The interim storm drain will utilize an existing connection to the channel, and therefore does not adversely affect downstream facilities. The double RCB will replace the interim storm drain and existing double 66" storm drain connection.

APPENDIX	DESCRIPTION
A	REFERENCE MATERIAL • San Bernardino County Hydrology Manual • City of Ontario Master Plan of Drainage • Cucamonga Creek Storm Drain Plans • Master Plan of Drainage Revision by David Evans and Associates • Merrill Avenue Street Plans • Conceptual Site Plan
B	HYDROLOGY CALCULATIONS • Existing Condition • Proposed Condition
C	HYDRAULIC CALCULATIONS
D	HYDROLOGY MAPS

APPENDIX A

REFERENCE MATERIALS


SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
1.8 ISOLINES PRECIPITATION (INCHES)
PROJECT SITE
SAN GABRIEL MOUNTAINS
SAN BERNARDINO MOUNTAINS
SAN BERNARDINO
RIVERSIDE
UPLAND
ONTARIO
CHINO
FONTANA
RIALTO
COLTON
REDLANDS
YUCAIPA
CORONA
T4N
T3N
T2N
T1N
T1S
T2S
T3S
R8W
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E
1.12 IN
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
Y100 - 100 YEAR 1 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973
APPROVED BY
DATE 1982
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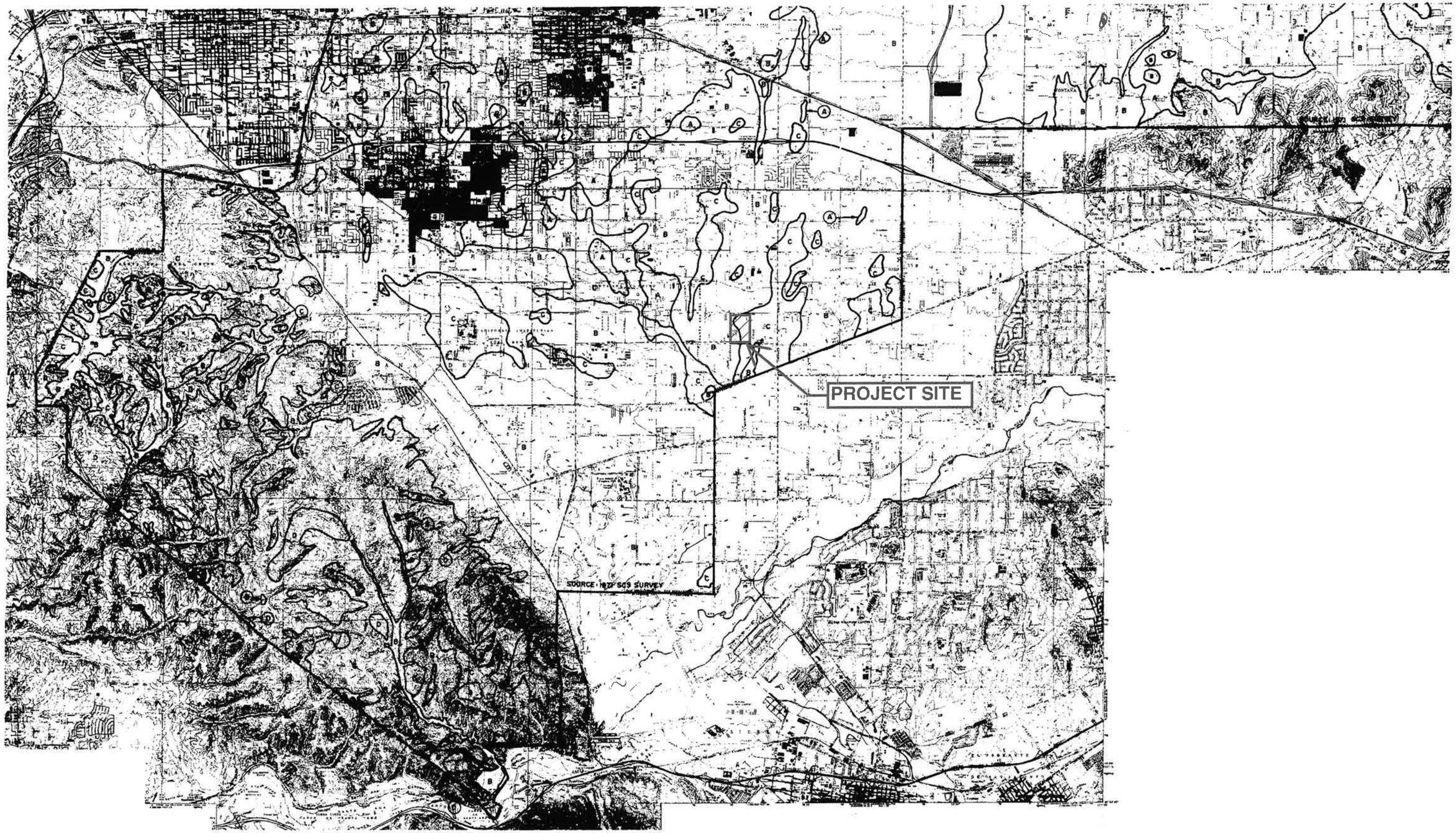
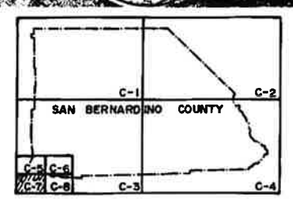
FILE NO.
DWG. NO. 4 of 12

FIGURE B-4





INDEX MAP

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000

SCALE REDUCED BY 1/2

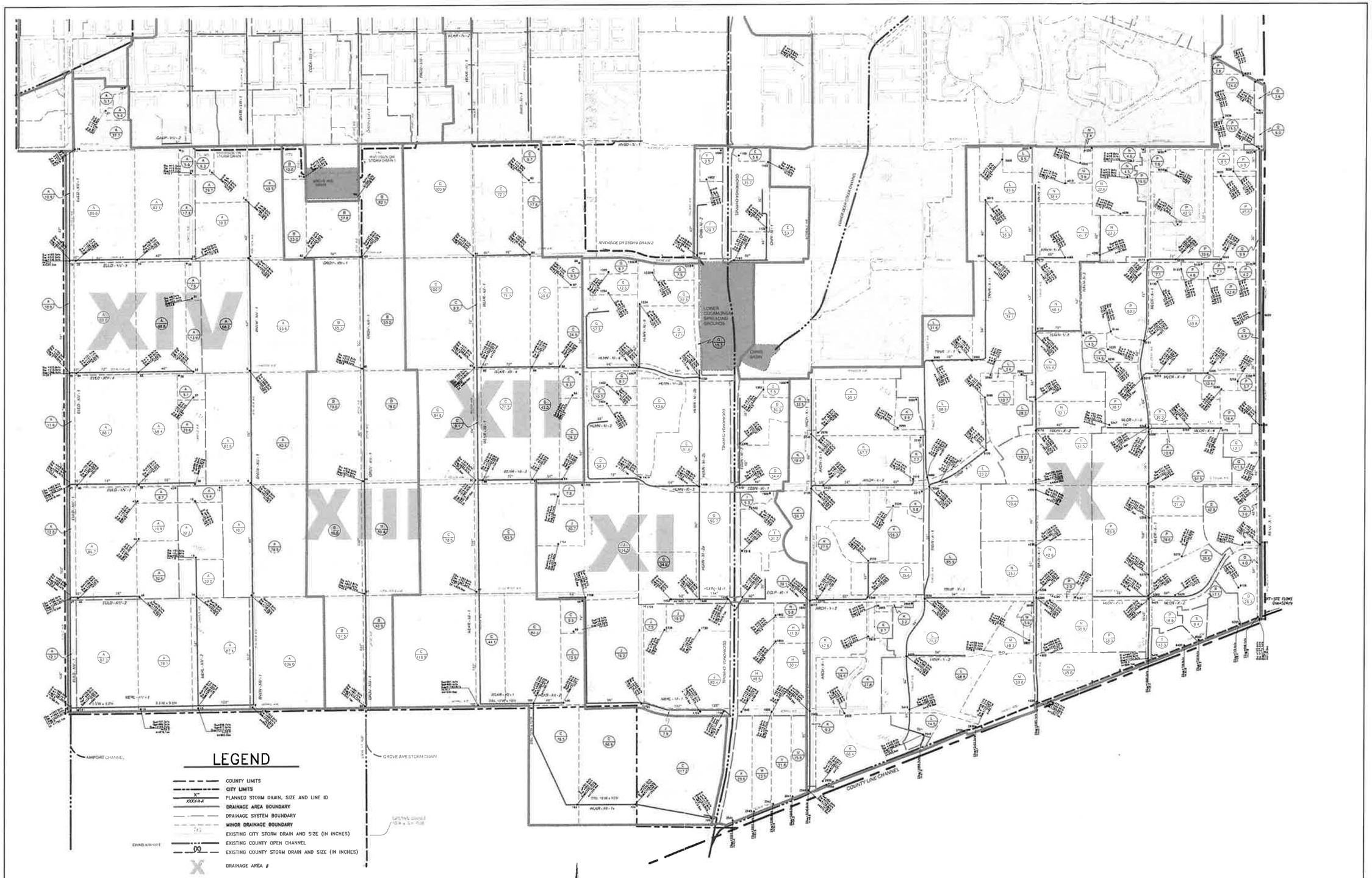
SOIL TYPES B & C

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-C AREA

FIGURE C-15



MARCH 2012

REVISIONS

HUNSAKER & ASSOCIATES IRVINE, INC.
PLANNING • ENGINEERING • SURVEYING
Three Hughes • Irvine, CA 92618 • PH: (949) 583-1010 • FX: (949) 583-0759

CITY OF ONTARIO

MASTER PLAN OF DRAINAGE

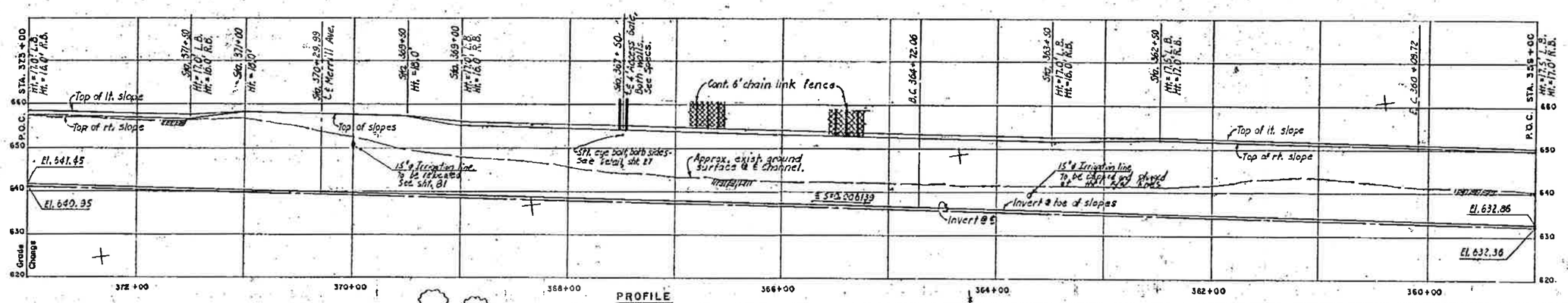
HYDROLOGY MAP

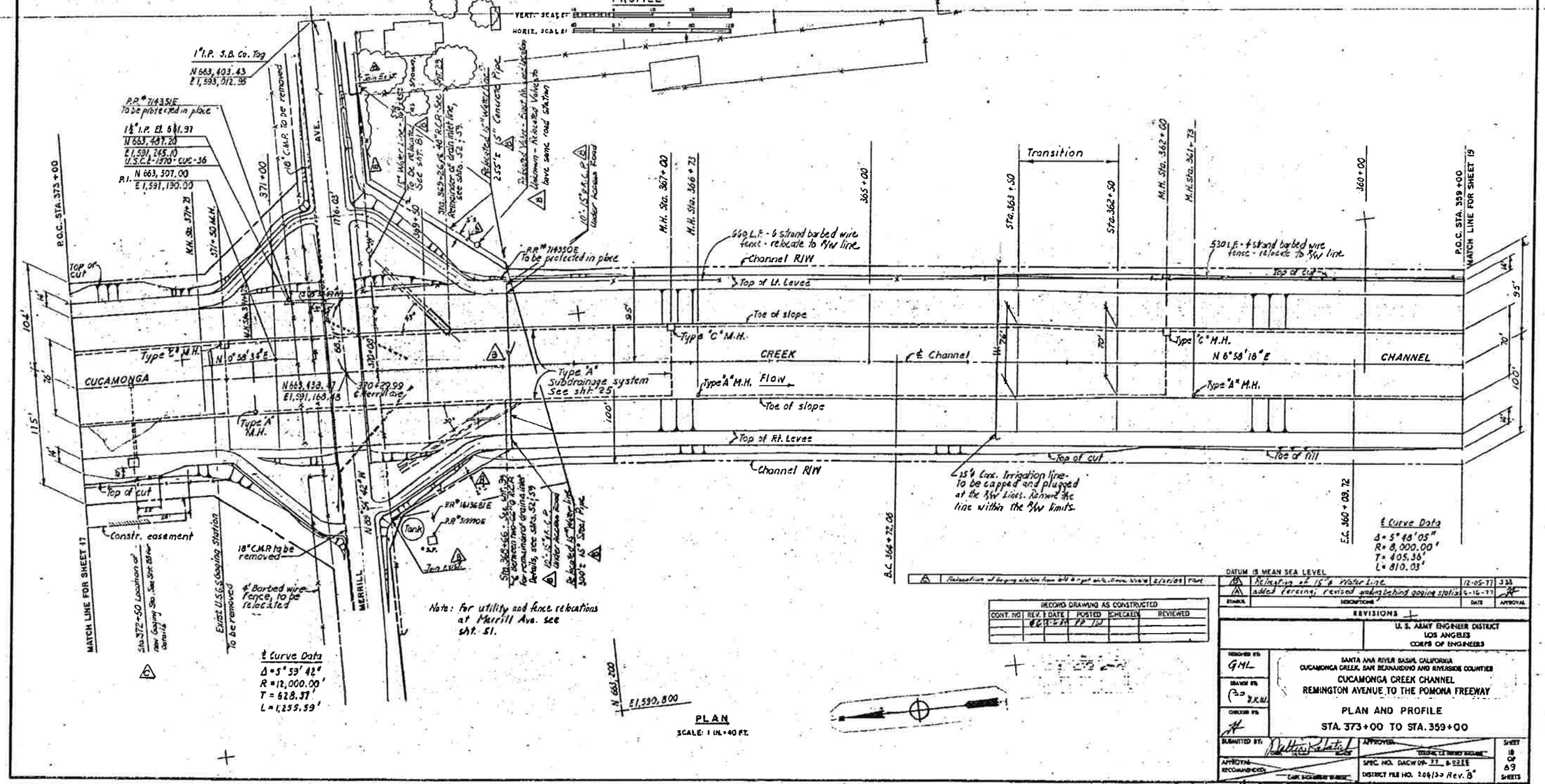
NEW MODEL COLONY

PLOTTED 3/15/2012 10:26 AM F:\0841\Engineering\SY_SD Master Plan\Rpt_SD Master Plan\HYDROLOGY MAPS\HYDROLOGY MAP-NMC-ALL-X-XIV.dwg

U.S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS





DATUM IS MEAN SEA LEVEL

5	Relocation of 15"ø Water Line.	12-05-77	JJS
4	Added fencing, revised grading behind gaging station	6-16-77	
STANDARD	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

RECORD DRAWING AS CONSTRUCTED

CONT. NO	REV. 1 DATE	POSTED	CHECKED	REVIEWED
	12-5-84	FP	JJ	

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: GML

DRAWN BY: B.K.M.

CHECKED BY:

SANTA ANA RIVER BASIN, CALIFORNIA
CUCAMONGA CREEK, SAN BERNARDINO AND RIVERSIDE COUNTIES

CUCAMONGA CREEK CHANNEL
REMINGTON AVENUE TO THE POMONA FREEWAY

PLAN AND PROFILE

STA. 373+00 TO STA. 359+00

SUBMITTED BY: Walter Roberts

APPROVED: COLONEL, C.E. DISTRICT ENGINEER

APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION

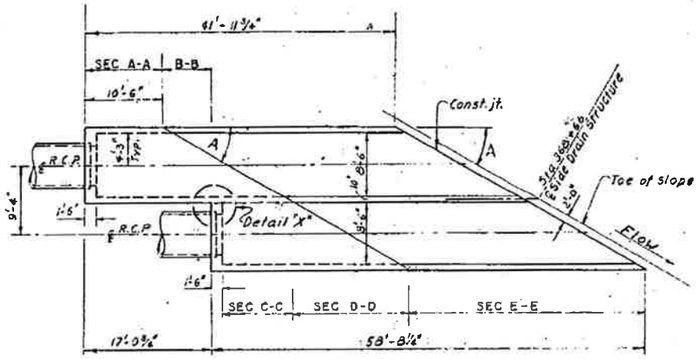
SPEC. NO. DACW09-77-B-0215

DISTRICT FILE NO. 206133 Rev. "B"

SHEET 18 OF 89 SHEETS

#1-301-23

OC-6



Note: For Const. jt. details see Sec C-C sheet 29.

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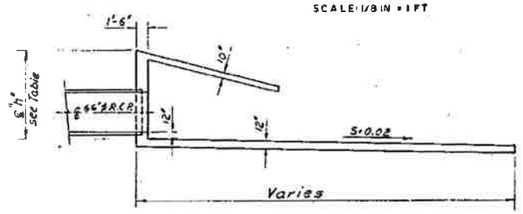

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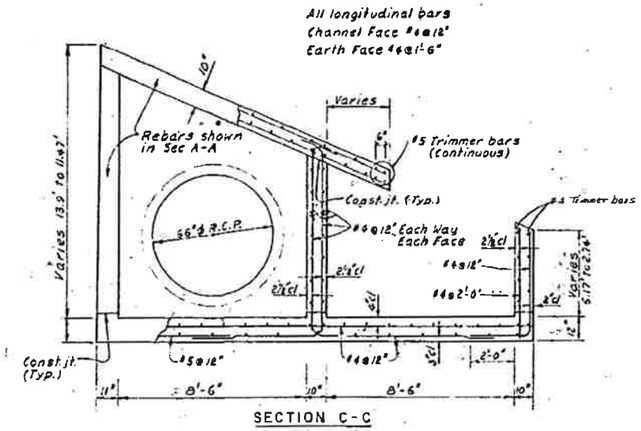

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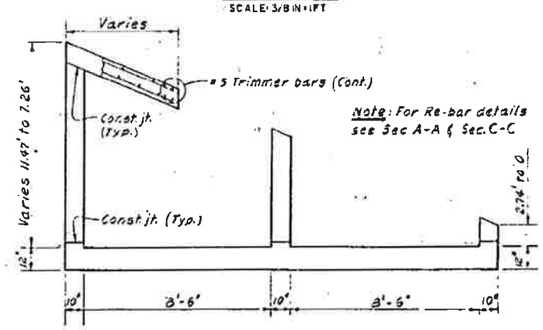

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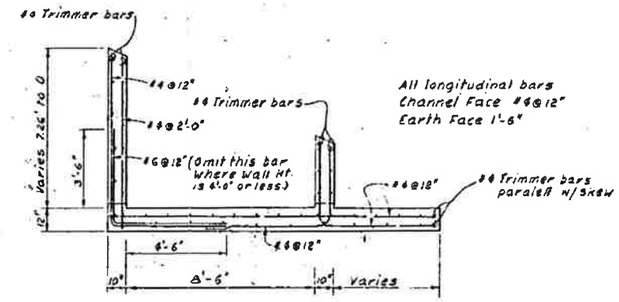

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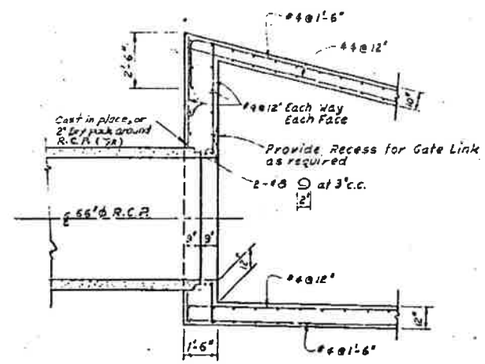

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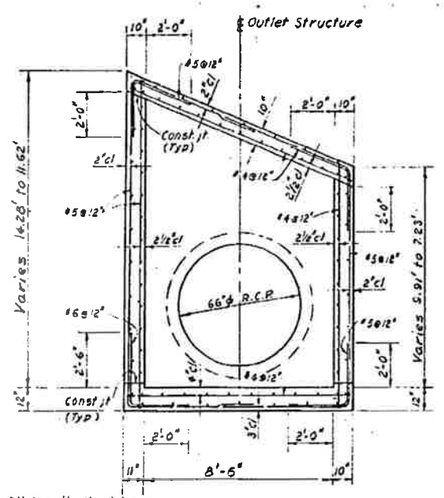

All longitudinal bars
Channel face #4@12".
Earth face #4@1'-6"

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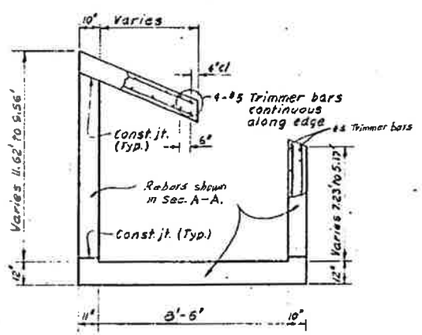

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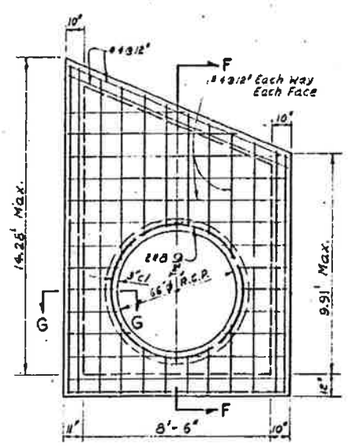

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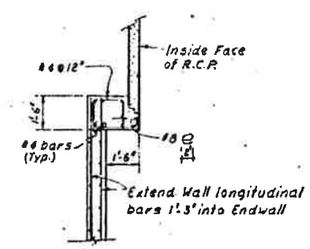
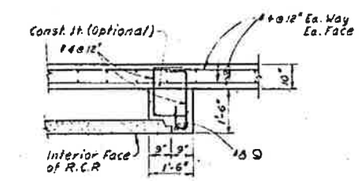


SECTION G-G
SCALE: 3/8 IN = 1 FT



DETAIL "X"
SCALE: 1/2 IN = 1 FT

STRUCTURE OUTLET						ELEVATIONS **				
U/S "h"*	℄ "h"	D/S "h"	U/S "L"	D/S "L"	∠A	TOE OF SLOPE	"X"	"Y"	"Z"	"W"
9.91'	12.09'	14.28'	41.97'	58.70'	30°	638.85	640.64	641.84	642.22	639.85
						638.73	640.20	641.70	642.22	639.73

* "h" Dimensions are given for 1-66"ø pipe. These dimensions apply to both pipes.

** Elevations are at ℄ projection of each outlet.

Note: For location of "X", "Y", "Z" and "W" elevations see Sheet 29.

RECORD DRAWING AS CONSTRUCTED

CONT. NO.	REV.	DATE	POSTED	CHECKED	REVIEWED
	NC	1-28-94	PP	(J)	

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

SANTA ANA RIVER BASIN, CALIFORNIA
CUCAMONGA CREEK, SAN BERNARDINO AND RIVERSIDE COUNTIES

CUCAMONGA CREEK CHANNEL
REMINGTON AVENUE TO THE POMONA FREEWAY

SIDE DRAIN OUTLETS – STA. 368+66 R.B.

DESIGNED BY:
DRAWN BY: RO
CHECKED BY:
SUBMITTED BY:
APPROVAL RECOMMENDED:
APPROVED:

SPEC. NO. DACW09-77-B-0045
DISTRICT FILE NO. 206/91
SCALE: MAY 1978

SHEET 38 OF 89 SHEETS

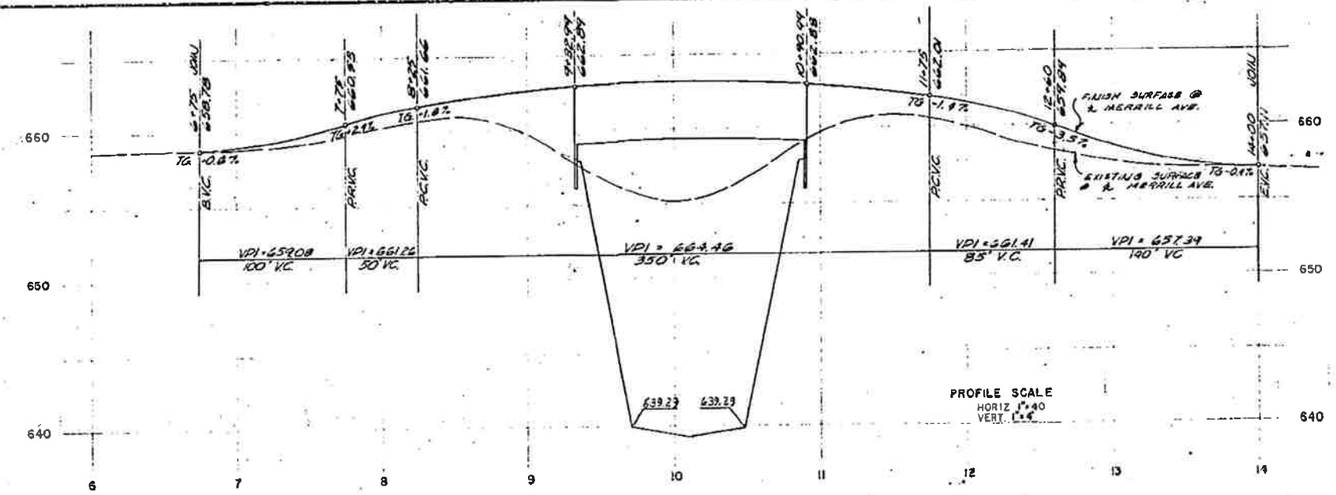
#1-301-23

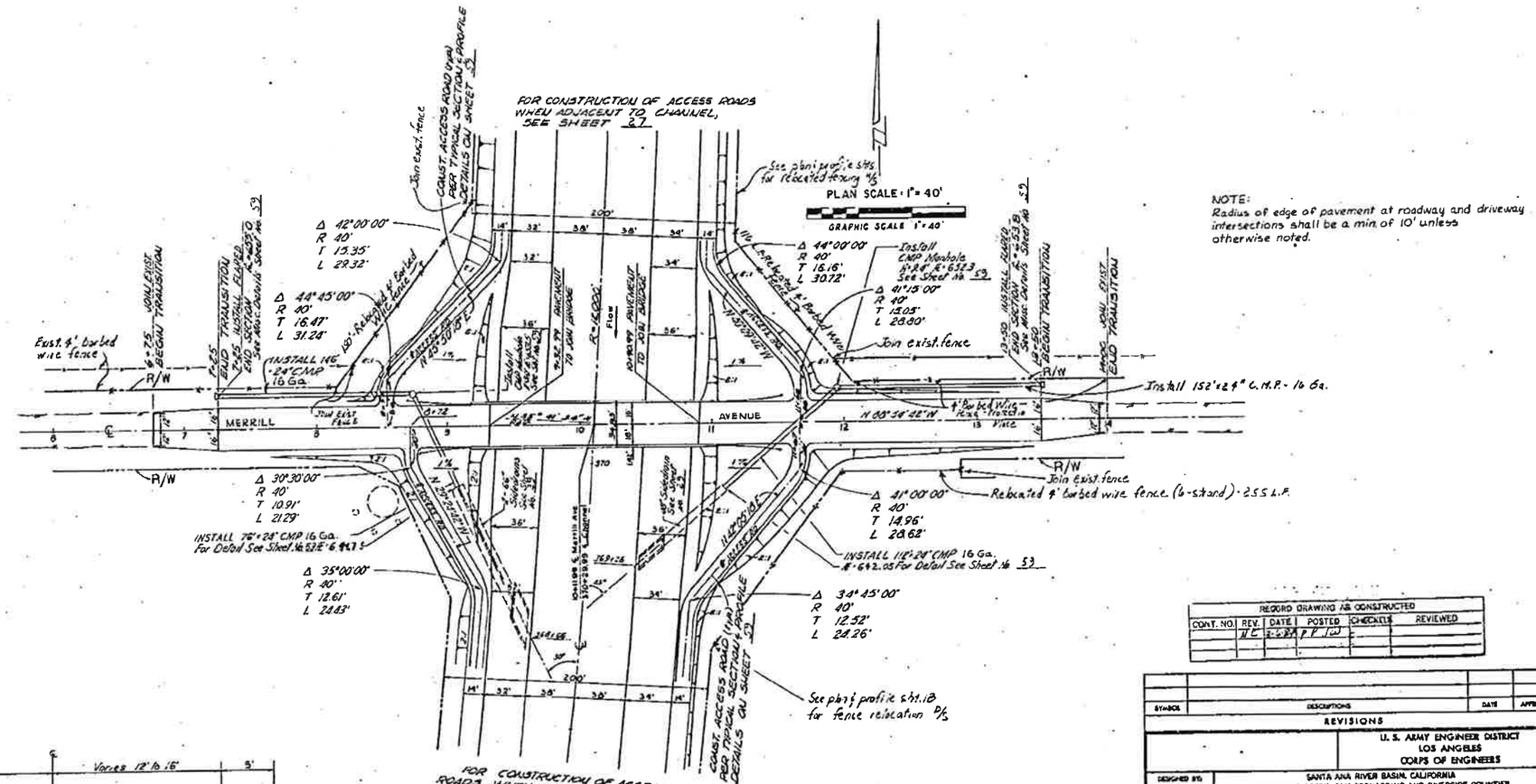
U.S. ARMY ENGINEER DISTRICT

BENCH MARK

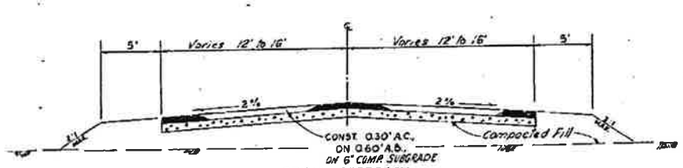
AT THE MERRILL AVE. CROSSING AT CUCAMONGA CREEK, 0.4 MI. WEST OF ARCHIBALD AVE. AND 50' ± NORTH OF ℄ MERRILL AVE., 3' WEST OF A FENCE CORNER. SET A 1½" IP 0.4' ABOVE GROUND AND STAMPED "USCE, 1970, CUC-5B, LA DIST."

ELEV. 661.970





NOTE:
Radius of edge of pavement at roadway and driveway intersections shall be a min. of 10' unless otherwise noted.



BRIDGE APPROACH
TYPICAL SECTION
NOT TO SCALE

REVISIONS			
SYMBOL	DESCRIPTIONS	DATE	APPROVAL

RECORD DRAWING AS CONSTRUCTED					
CONT. NO.	REV.	DATE	POSTED	CHECKED	REVIEWED

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

SANTA ANA RIVER BASIN, CALIFORNIA
CUCAMONGA CREEK, SAN BERNARDINO AND RIVERSIDE COUNTIES
CUCAMONGA CREEK CHANNEL
REMINGTON AVENUE TO THE POMONA FREEWAY

MERRILL AVENUE BRIDGE
PLAN AND PROFILE

DESIGNED BY:
DRAWN BY:
CHECKED BY:

L. D. KING ENGINEERING CO., INC.
ENGINEER — REG. # 15268

SAN BERNARDINO COUNTY TRAN. DEPT.
APPROVED 3-14 1977
COUNTY ENGINEER

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
APPROVED 3-14 1977
FLOOD CONTROL ENGINEER

SUBMITTED BY: CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION
APPROVED: COLONEL, CE, DISTRICT ENGINEER

SPEC. NO. DACW09-77-B-0223
DISTRICT FILE NO. 206/66

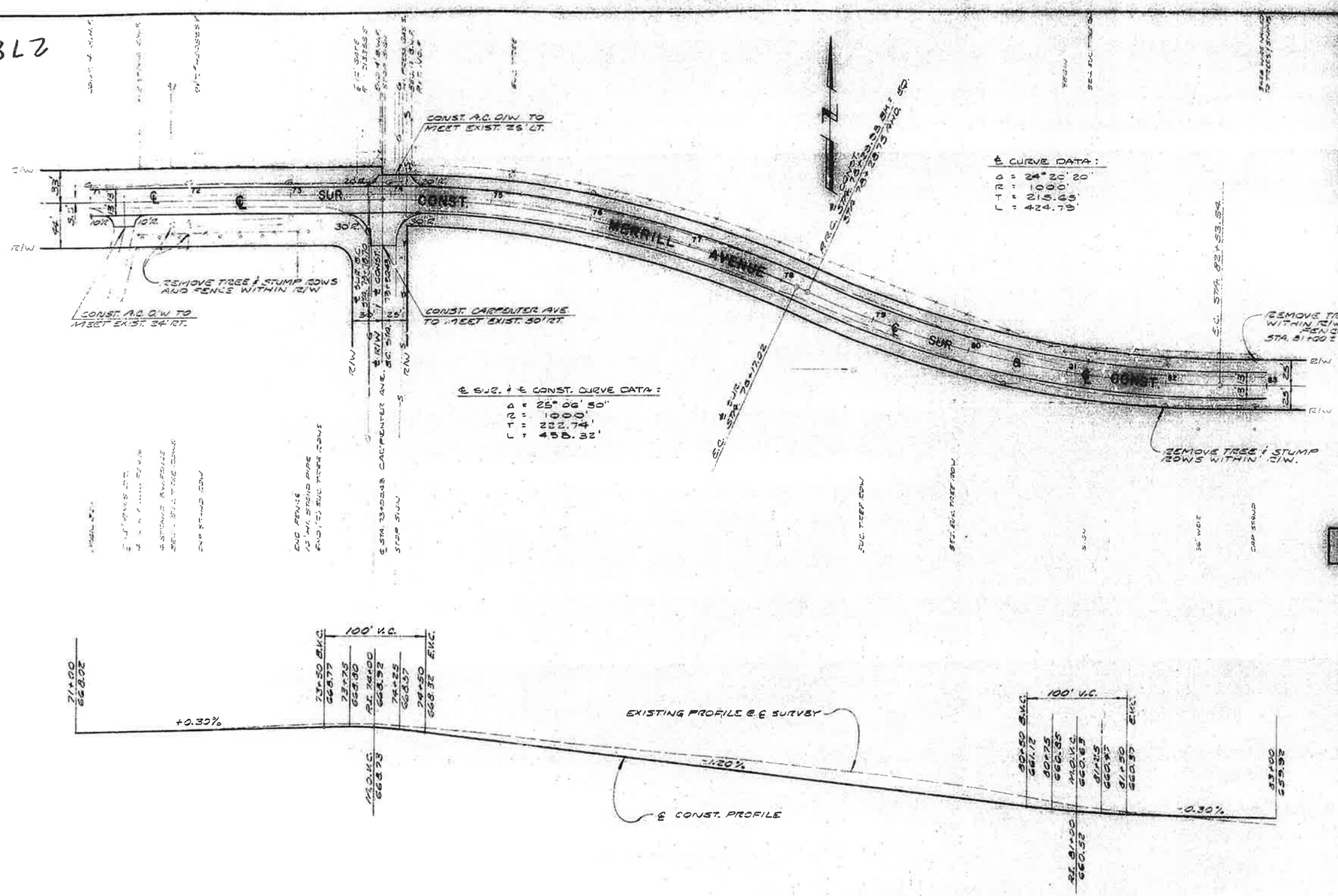
SHEET 52 OF 57 SHEETS

#1-301-23

0BL2

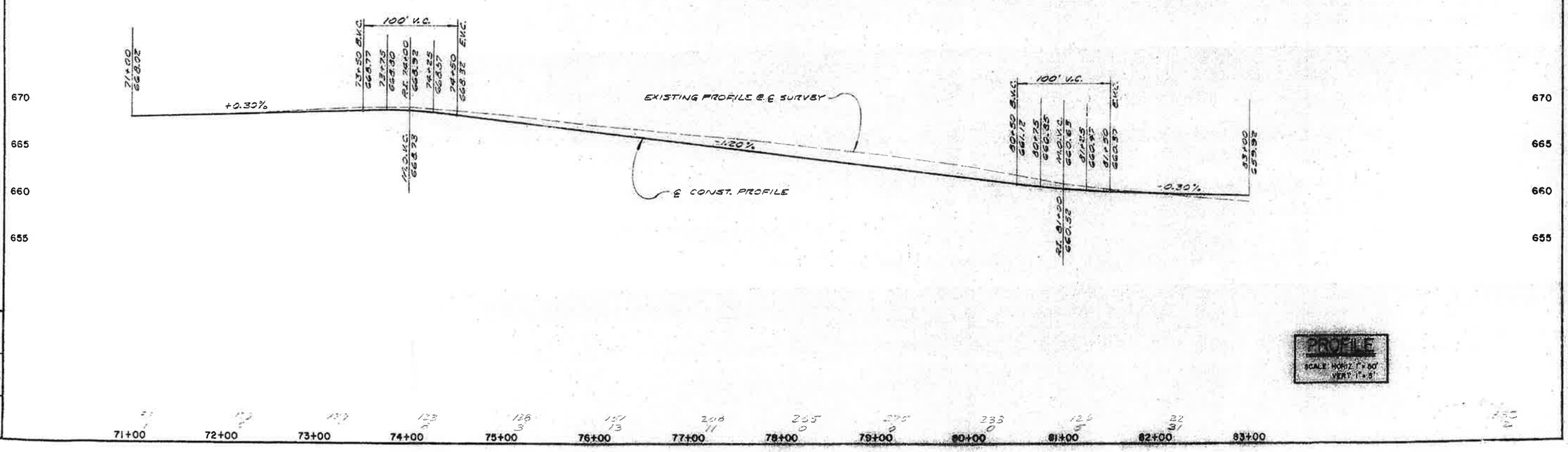
COUNTY OF SAN BERNARDINO
TRANSPORTATION DEPARTMENT
MERRILL AVENUE
FROM WALKER AVE TO CUCAMONGA CH.
CHINO AREA

W.O. NO. H06508 | FIELD BOOK REF. 4006/98-19,71/737,882-879
SUBMITTED BY: Bob Taylor 6-9-79 PROJECT ENGINEER DATE
RECOMMENDED/APPROVED BY: D.W. Mirsch 6/9/79 CHIEF ROAD ZONE ADMINISTRATOR DATE
6-9-79 CHIEF ROAD ENGINEER DATE



NO CORRECTIONS
AS BUILT
RESIDENT ENGINEER DATE

FILE NO. 6-35000 AC



0812

TRANSPORTATION DEPARTMENT

MERRILL AVENUE

FROM WALKER AVE. TO CUCAMONGA CH

CHINO AREA

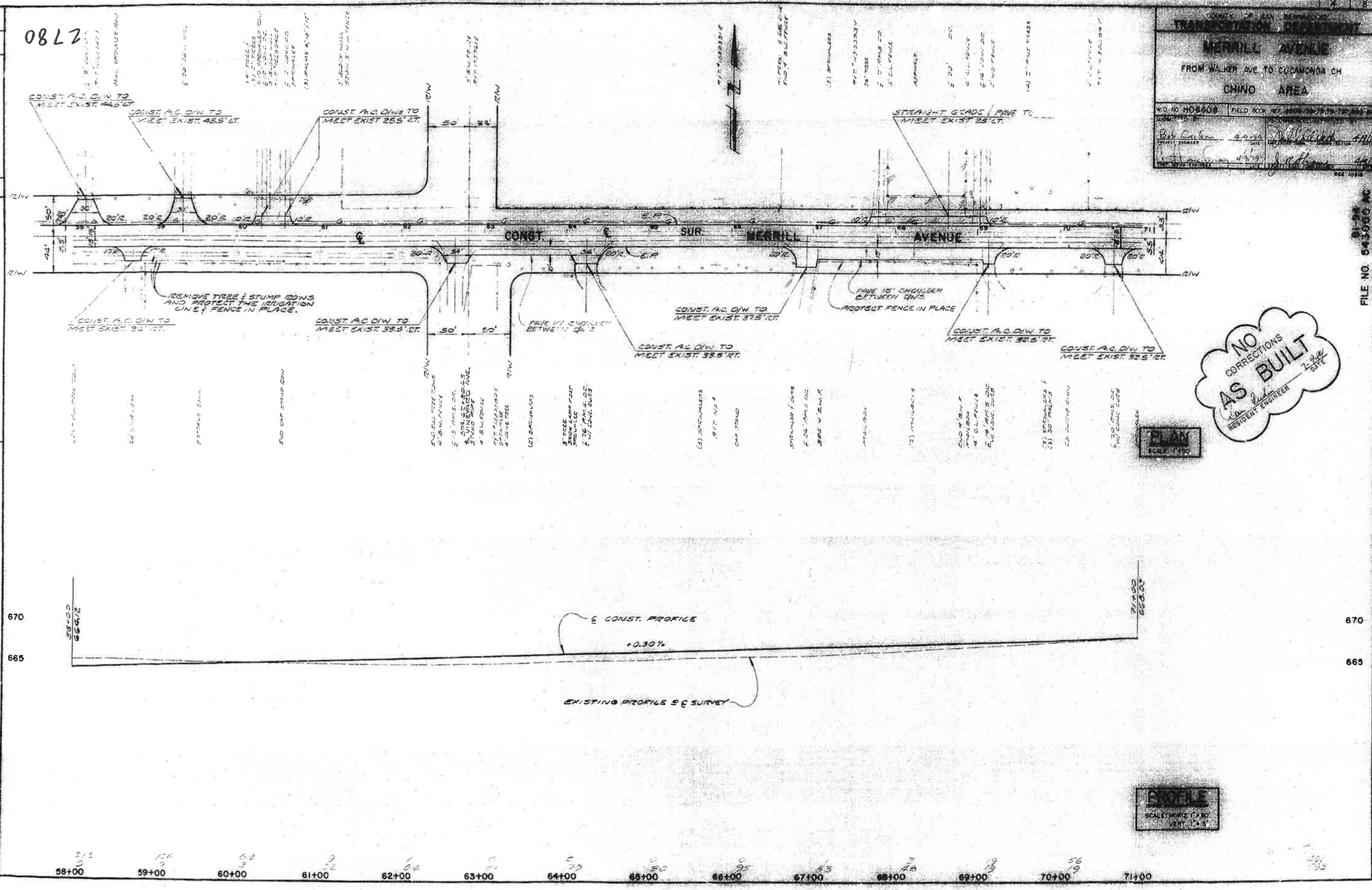
W.O. NO. H08608 | FIELD BOOK REF.

SUBMITTED BY: Bob Carter 4-9-79 PROJECT ENGINEER DATE

RECOMMENDED BY: 4-11-79 DATE

RECOMMENDED BY: 4-11-79 DATE

RECOMMENDED BY: 4-11-79 DATE



NO CORRECTIONS
AS BUILT
RESIDENT ENGINEER
DATE

FILE NO. 543000

DAVID EVANS
AND ASSOCIATES INC

17782 17th Street, Suite 200, Tustin, California 92780
Telephone: (714) 665-4500 • FAX: (714) 665-4501 • website: www.deainc.com

MASTER PLAN OF DRAINAGE REVISION WLKR-XII-1 REALIGNMENT

Ontario, CA

Prepared for:
CapRock Partners
2050 Main Street, Suite 240
Irvine, CA 92614

Project Number: PSP15-001

Prepared under the Supervision of:

Glenn M. Chung

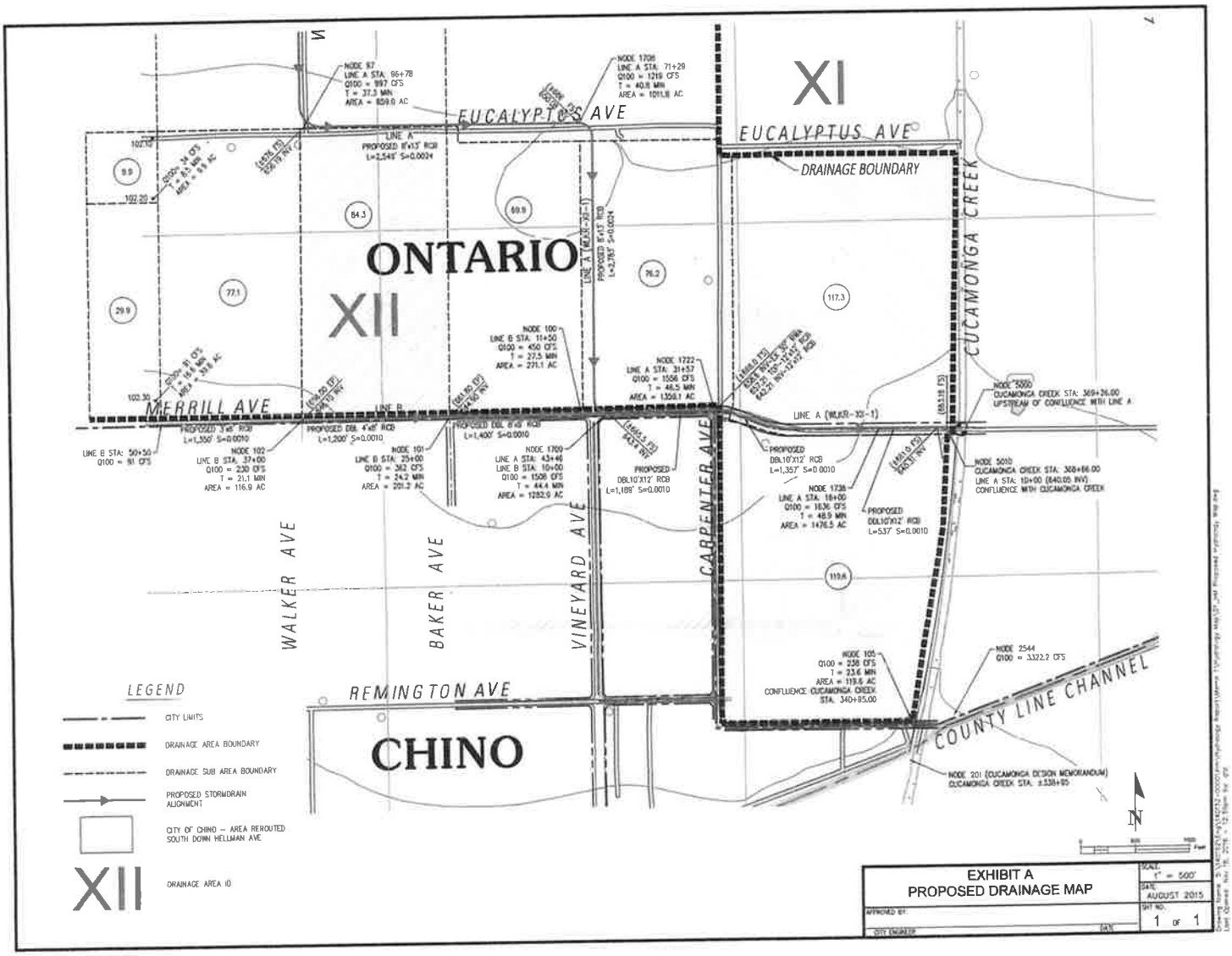
REGISTERED PROFESSIONAL ENGINEER
GLENN MATTHEW CHUNG
No. 62794
Exp. 06/30/18
CIVIL
STATE OF CALIFORNIA

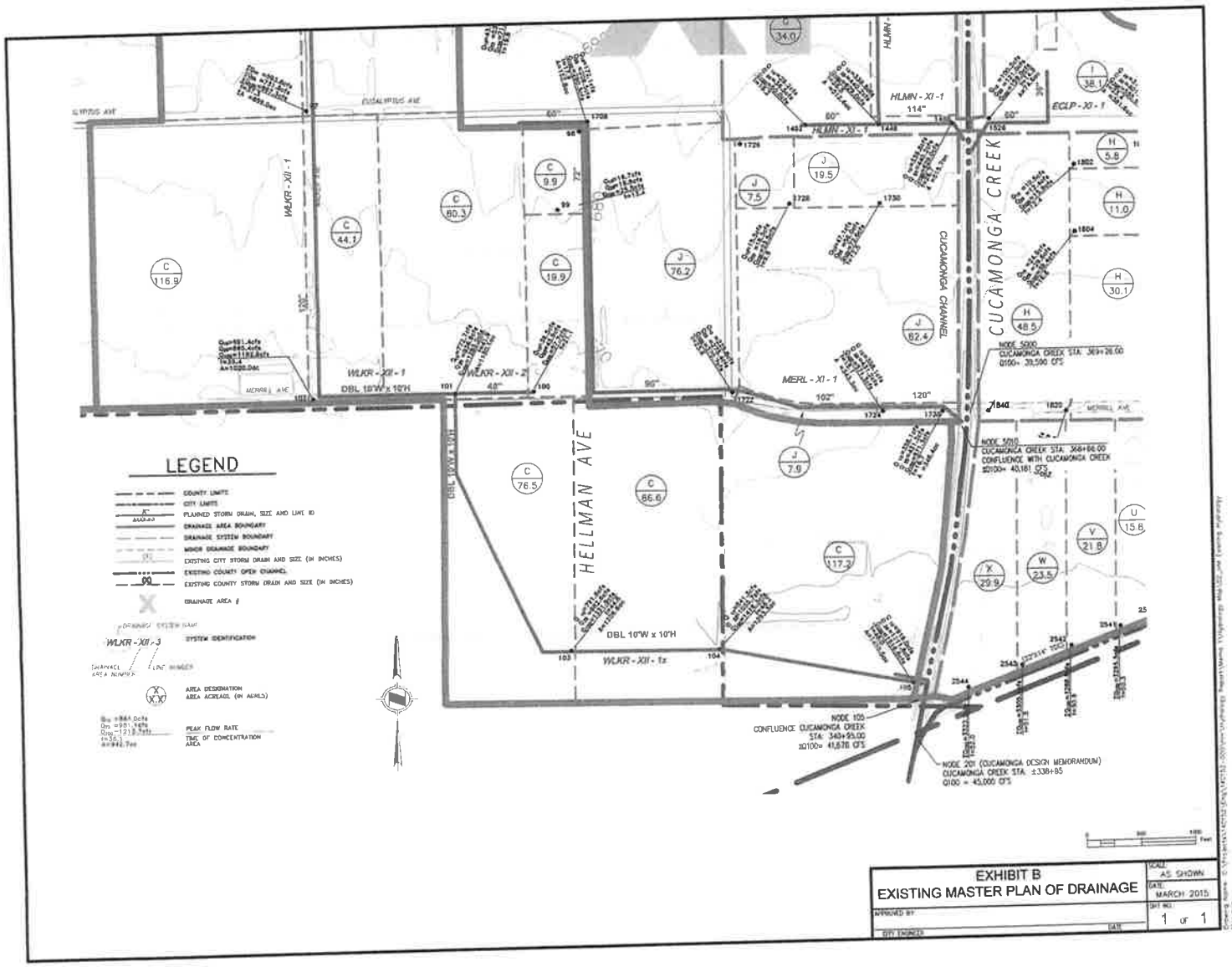
Glenn Chung, P.E.

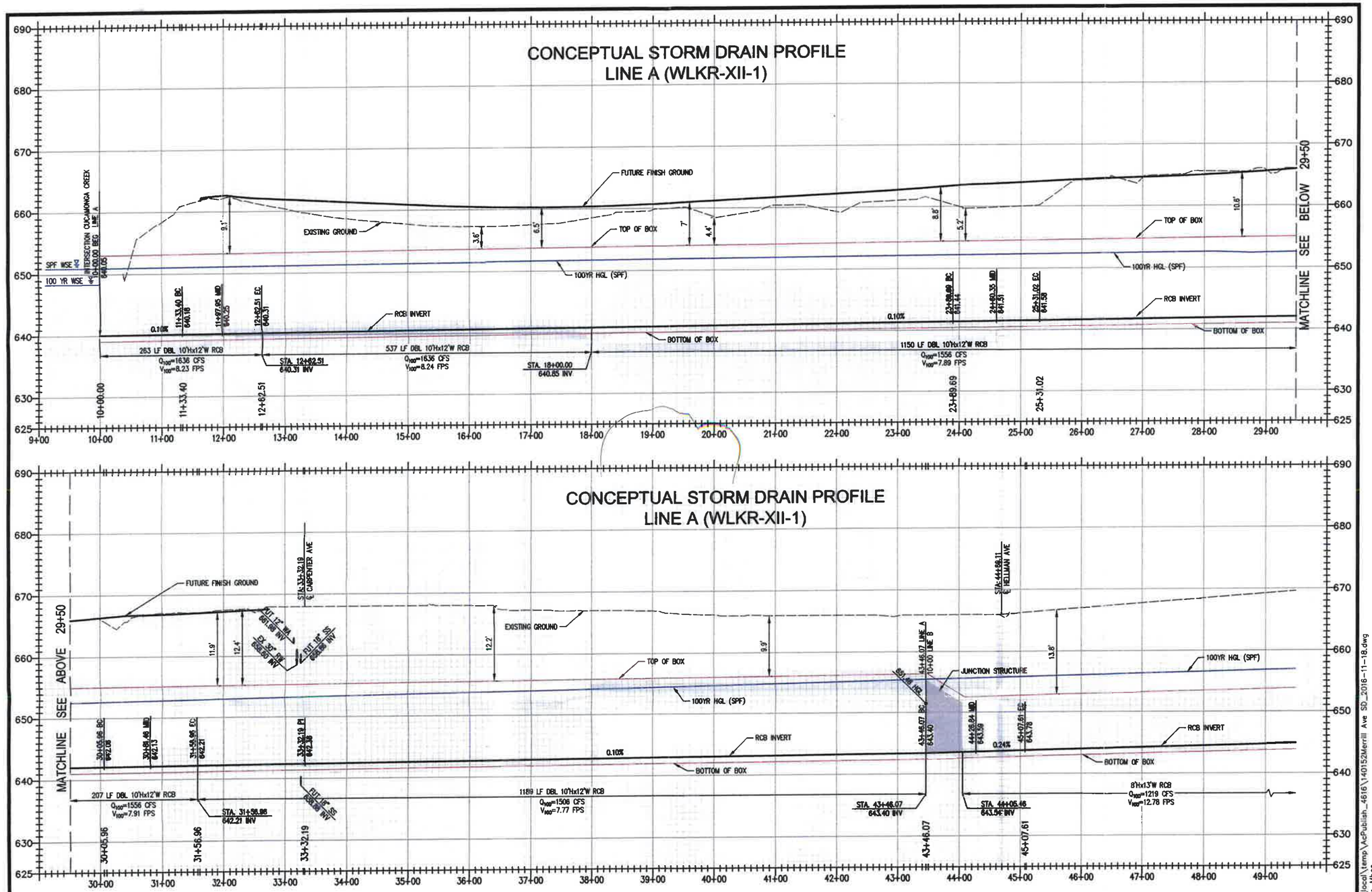
December, 2016

DEA Job No. CPRK000000020

XI
EUCALYPTUS AVE
VINEYARD AVE
WALKER AVE
ARCHIBALD AVE
TURNER AVE
MERRILL AVE
COUNTY LINE CHANNEL
CUCAMONGA CHANNEL
HLMN - XI - 1
HLMN - XI - 2a
ECLP - XI - 1
ARCH - X - 2
ARCH - X - 1
MERL - XI - 1
WLKR - XII - 1
WLKR - XII - 2
DBL 10'W x 10'H
DBL 10'W x 10'H


ONTARIO
CHINO
XI
XII
EUCALYPTUS AVE
MERRILL AVE
REMINGTON AVE
WALKER AVE
BAKER AVE
VINEYARD AVE
CARPENTER AVE
CUCAMONGA CREEK
COUNTY LINE CHANNEL
DRAINAGE BOUNDARY
LEGEND
CITY LIMITS
DRAINAGE AREA BOUNDARY
DRAINAGE SUB AREA BOUNDARY
PROPOSED STORMDRAIN ALIGNMENT
CITY OF CHINO – AREA REROUTED SOUTH DOWN HELLMAN AVE
DRAINAGE AREA ID
EXHIBIT A
PROPOSED DRAINAGE MAP
SCALE 1" = 500'
DATE AUGUST 2015
SHT NO. 1 OF 1
APPROVED BY
CITY ENGINEER
DATE


LEGEND
COUNTY LIMITS
CITY LIMITS
PLANNED STORM DRAIN, SIZE AND LINE ID
DRAINAGE AREA BOUNDARY
DRAINAGE SYSTEM BOUNDARY
MINOR DRAINAGE BOUNDARY
EXISTING CITY STORM DRAIN AND SIZE (IN INCHES)
EXISTING COUNTY OPEN CHANNEL
EXISTING COUNTY STORM DRAIN AND SIZE (IN INCHES)
DRAINAGE AREA #
WLKR - XII - 3
SYSTEM IDENTIFICATION
AREA DESIGNATION
AREA ACREAGE (IN ACRES)
PEAK FLOW RATE
TIME OF CONCENTRATION
AREA
HELLMAN AVE
CUCAMONGA CREEK
CUCAMONGA CHANNEL
WLKR - XII - 1
DBL 10'W x 10'H
WLKR - XII - 2
MERL - XI - 1
HLMN - XI - 1
ECLP - XI - 1
NODE 5000
CUCAMONGA CREEK STA: 363+28.00
Q100= 39,590 CFS
NODE 5010
CUCAMONGA CREEK STA: 364+86.00
CONFLUENCE WITH CUCAMONGA CREEK
Q100= 40,181 CFS
NODE 100
CONFLUENCE CUCAMONGA CREEK
STA: 340+95.00
Q100= 41,670 CFS
NODE 201 (CUCAMONGA DESIGN MEMORANDUM)
CUCAMONGA CREEK STA: ±338+85
Q100 = 45,000 CFS
EXHIBIT B
EXISTING MASTER PLAN OF DRAINAGE
SCALE: AS SHOWN
DATE: MARCH 2015
SHT NO.: 1 OF 1
APPROVED BY
CITY ENGINEER
DATE



HORIZONTAL 0 100 200 Feet

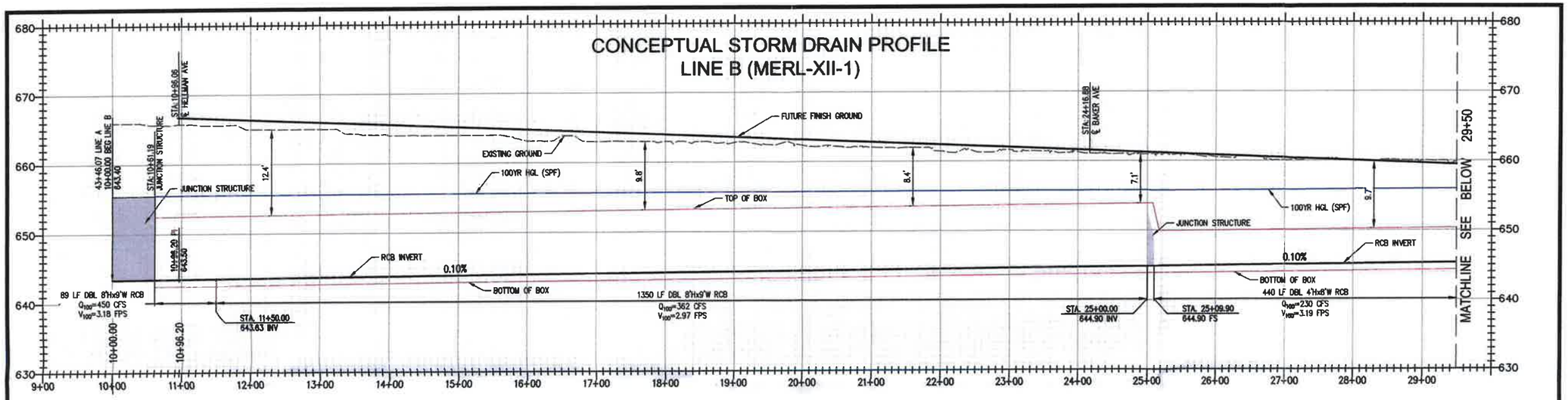
VERTICAL 0 100 200 Feet

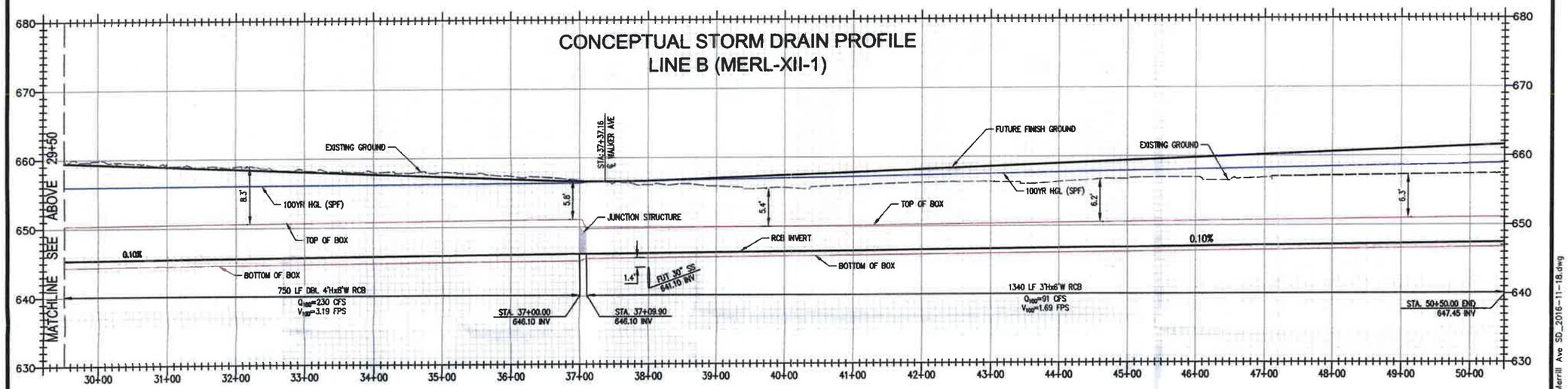
NOTE: THE PROFILE SHOWN IS FOR INFORMATION ONLY AND NOT FOR CONSTRUCTION. THE CONTINUATION OF THE PROFILE PAST STATION 49+50 IS NOT SHOWN BECAUSE THE EXISTING GROUND SLOPES ENOUGH TO PROVIDE ADEQUATE COVER (APPROXIMATELY 10' - 26') WITH ROOM FOR UTILITY CROSSINGS.

NOTE: HGL CONTROL IS BASED ON THE STANDARD PROJECT FLOOD (SPF) PEAK FLOW AND CORRESPONDING HGL WITHIN THE CUCAMONGA CHANNEL.

LINE A (WLKR-XII-1) CONCEPTUAL STORMDRAIN PROFILE	SCALE: AS SHOWN
	DATE: NOV. 2016
APPROVED BY:	SHT NO.: 1 OF 1
CITY ENGINEER DATE	

Drawing Name: C:\Users\mbec\appdata\local\temp\AcPublish_4616\140152Merrill Ave SD_2016-11-18.dwg
Last Opened: Nov 21, 2016 - 5:13pm by: Mbec





NOTE: HGL CONTROL IS BASED ON THE STANDARD PROJECT FLOOD (SPF) PEAK FLOW AND CORRESPONDING HGL WITHIN THE CUCAMONGA CHANNEL.

NOTE: THE PROFILE SHOWN IS FOR INFORMATION ONLY AND NOT FOR CONSTRUCTION.

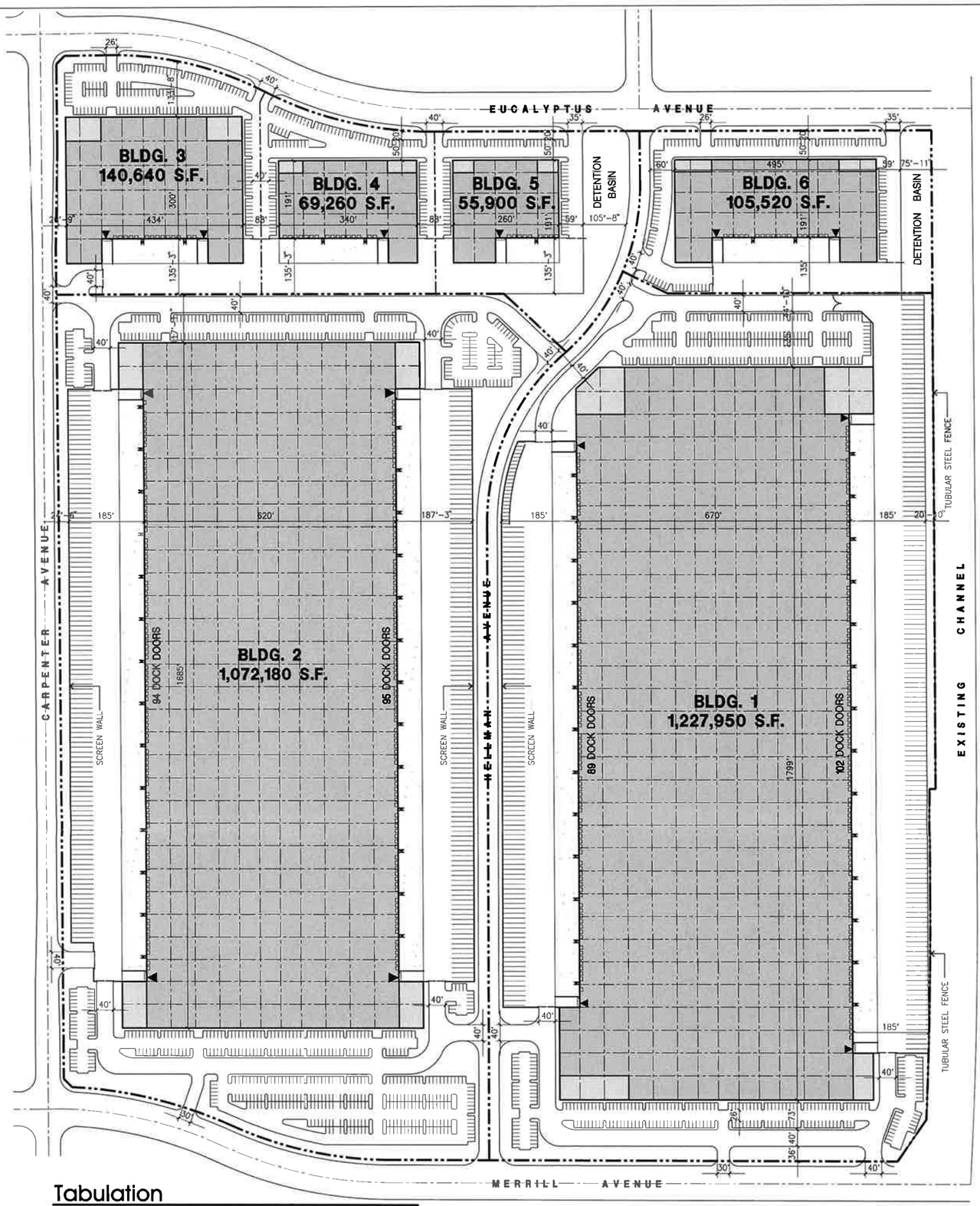
HORIZONTAL 0 100 200 Feet

VERTICAL 0 100 200 Feet

LINE B (MERL-XII-1) CONCEPTUAL STORMDRAIN PROFILE	SCALE: AS SHOWN
	DATE: AUGUST 2015
APPROVED BY:	SHT NO.: 1 OF 1
CITY ENGINEER DATE	

Drawing Name: C:\Users\mbec\appdata\local\temp\AcPublish_4616\140152Merrill Ave SD_2016-11-18.dwg
Last Opened: Nov 21, 2016 - 5:17pm by: Mbec

CAUTION: IF THIS SHEET IS NOT 30"X42", IT IS A REDUCED PRINT



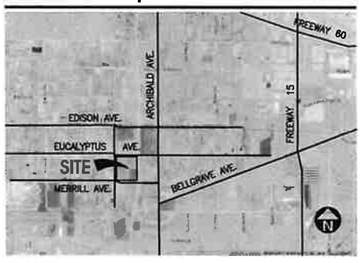
Tabulation

	BLDG. 1	BLDG. 2	BLDG. 3	BLDG. 4	BLDG. 5	BLDG. 6	TOTAL
SITE AREA							
in s.f.	2,255,845	2,201,866	283,924	183,986	213,265	285,632	5,424,518 s.f.
in acres	51.8	50.5	6.5	4.2	4.9	6.6	124.5 ac
BUILDING AREA							
Office	20,000	20,000	10,000	5,000	5,000	5,000	65,000 s.f.
warehouse	1,207,950	1,052,180	130,640	64,260	50,900	100,520	2,606,450 s.f.
TOTAL	1,227,950	1,072,180	140,640	69,260	55,900	105,520	2,671,450 s.f.
COVERAGE	54.4%	48.7%	49.5%	37.6%	26.2%	36.9%	49.2%
AUTO PARKING REQUIRED							
Office: 1/250 s.f.	80	80	40	20	20	20	260 stalls
Whse: 1st 20K @ 1/1,000 s.f.	20	20	20	20	20	20	120 stalls
over 20K @ 1/2,000 s.f.	594	517	58	23	16	41	1,247 stalls
TOTAL	694	617	116	63	56	81	1,627 stalls
PARKING PROVIDED							
Standard (9' x 18')	442	646	145	92	68	116	1,509 stalls
Trailer (12' x 55')	252	234	0	0	0	0	486 stalls
TOTAL	694	880	145	92	68	116	1,995 stalls
MAXIMUM FLOOR AREA RATIO							
FAR - .55							

SETBACKS

Building	Landscape
front/street side - 25'	Hellman Ave. - 18'
side - 25'	Merril Ave. - 23'
rear - 15'	Carpenter Ave. - 15'
ZONING ORDINANCE FOR CITY	Eucalyptus Ave. - 20'
New specific plan to be determined	side - 10', rear - 0'

Aerial Map



Note: This is a conceptual plan. It is based on preliminary information which is not fully verified and may be incomplete. It is meant as a comparative aid in examining alternate development strategies and any quantities indicated are subject to revision as more reliable information becomes available.

Legend

- POTENTIAL OFFICE
- WAREHOUSE
- ▼ DRIVE THRU DOOR

north

1" = 100'

0 100 200 300

HPA architecture

Conceptual Site Plan

West Ontario Commerce Center

REDA REAL ESTATE DEVELOPMENT ASSOCIATES

18831 Bardeen Ave. - Ste. #100
Irvine, CA 92612
(949) 863-1770
www.hparchs.com

Ontario, CA

March 24, 2017 / Job #13390

Scheme 23

APPENDIX B

HYDROLOGY CALCULATIONS

EXISTING CONDITION

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                         Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3290                                                          *
* EXISTING CONDITION (NODES 100-101)                                       *
* 100-YEAR STORM EVENT                                                     *
 ****************************************************************************

  FILE NAME: W:\3290\EX100A.DAT
  TIME/DATE OF STUDY: 10:58 10/04/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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)
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   210.00
  ELEVATION DATA: UPSTREAM(FEET) =    674.04  DOWNSTREAM(FEET) =    672.79

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.362
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.213
  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.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"          B        1.75      0.42      0.700    76   10.36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA RUNOFF(CFS) =      4.59
  TOTAL AREA(ACRES) =      1.75   PEAK FLOW RATE(CFS) =      4.59
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        1.8  TC(MIN.) =     10.36
  EFFECTIVE AREA(ACRES) =       1.75  AREA-AVERAGED Fm(INCH/HR)=  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.700
  PEAK FLOW RATE(CFS)    =       4.59
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                         Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3290                                                          *
* EXISTING CONDITION (NODES 200-204)                                       *
* 100-YEAR STORM EVENT                                                     *
 ****************************************************************************

  FILE NAME: W:\3290\EX100B.DAT
  TIME/DATE OF STUDY: 14:29 10/04/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   665.00
  ELEVATION DATA: UPSTREAM(FEET) =    684.86  DOWNSTREAM(FEET) =    677.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.250
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.366
  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.)
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"    B        5.90      0.15      1.000    95   17.25
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"    C        1.75      0.09      1.000    98   17.25
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.14
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      15.35
  TOTAL AREA(ACRES) =       7.65   PEAK FLOW RATE(CFS) =     15.35

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    677.18  DOWNSTREAM(FEET) =    665.16
  CHANNEL LENGTH THRU SUBAREA(FEET) =   695.00   CHANNEL SLOPE =  0.0173
  CHANNEL FLOW THRU SUBAREA(CFS) =      15.35
```

```
FLOW VELOCITY(FEET/SEC) =   3.67 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   3.15   Tc(MIN.) =   20.40
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1360.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   20.40
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.139
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   B        6.45      0.15      1.000    95
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   C        0.85      0.09      1.000    98
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.14
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA AREA(ACRES) =    7.30      SUBAREA RUNOFF(CFS) =   13.11
EFFECTIVE AREA(ACRES) =     14.95   AREA-AVERAGED Fm(INCH/HR) =  0.14
AREA-AVERAGED Fp(INCH/HR) =  0.14  AREA-AVERAGED Ap =  1.00
TOTAL AREA(ACRES) =       14.9       PEAK FLOW RATE(CFS) =      26.90

****************************************************************************
FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   669.43  DOWNSTREAM(FEET) =   668.80
FLOW LENGTH(FEET) =   125.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.06
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       26.90
PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =   20.70
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1485.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  52
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    668.80  DOWNSTREAM(FEET) =    664.23
CHANNEL LENGTH THRU SUBAREA(FEET) =   300.00   CHANNEL SLOPE =  0.0152
CHANNEL FLOW THRU SUBAREA(CFS) =      26.90
FLOW VELOCITY(FEET/SEC) =   4.01 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   1.25   Tc(MIN.) =   21.95
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    1785.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   21.95
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.048
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   B        1.70      0.15      1.000    95
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   C       12.75      0.09      1.000    98
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.10
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA AREA(ACRES) =   14.45      SUBAREA RUNOFF(CFS) =   25.39
EFFECTIVE AREA(ACRES) =     29.40   AREA-AVERAGED Fm(INCH/HR) =  0.12
AREA-AVERAGED Fp(INCH/HR) =  0.12  AREA-AVERAGED Ap =  1.00
TOTAL AREA(ACRES) =       29.4       PEAK FLOW RATE(CFS) =      51.06
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       29.4  TC(MIN.) =     21.95
EFFECTIVE AREA(ACRES) =     29.40  AREA-AVERAGED Fm(INCH/HR)=  0.12
AREA-AVERAGED Fp(INCH/HR) =  0.12  AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE(CFS)    =      51.06
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
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                        Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3290                                                          *
* EXISTING CONDITINO (NODES 300-312)                                       *
* 100-YEAR STORM EVENT                                                     *
 ****************************************************************************

  FILE NAME: W:\3290\EX100C.DAT
  TIME/DATE OF STUDY: 11:26 10/04/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ==================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE     300.00 TO NODE     301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   790.00
  ELEVATION DATA: UPSTREAM(FEET) =    682.91  DOWNSTREAM(FEET) =    674.96

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.848
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.490
  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.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"          C        1.75      0.27     0.700    86   15.85
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"    C        5.50      0.09     1.000    98   19.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.12
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.928
  SUBAREA RUNOFF(CFS) =      15.51
  TOTAL AREA(ACRES) =       7.25   PEAK FLOW RATE(CFS) =     15.51

****************************************************************************
  FLOW PROCESS FROM NODE     301.00 TO NODE     302.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    674.96  DOWNSTREAM(FEET) =    668.83
  CHANNEL LENGTH THRU SUBAREA(FEET) =   845.00   CHANNEL SLOPE =  0.0073
  CHANNEL FLOW THRU SUBAREA(CFS) =      15.51
```

```
  FLOW VELOCITY(FEET/SEC) =   2.38 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.91   Tc(MIN.) =   21.75
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1635.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   21.75
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.059
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   C        8.80      0.09      1.000    98
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.09
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    8.80      SUBAREA RUNOFF(CFS) =   15.61
  EFFECTIVE AREA(ACRES) =     16.05   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.10  AREA-AVERAGED Ap =  0.97
  TOTAL AREA(ACRES) =       16.0       PEAK FLOW RATE(CFS) =      28.31

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   663.70  DOWNSTREAM(FEET) =   663.20
  FLOW LENGTH(FEET) =   100.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.08
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      28.31
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =   21.99
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1735.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    312.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    663.20  DOWNSTREAM(FEET) =    661.25
  CHANNEL LENGTH THRU SUBAREA(FEET) =   250.00   CHANNEL SLOPE =  0.0078
  CHANNEL FLOW THRU SUBAREA(CFS) =      28.31
  FLOW VELOCITY(FEET/SEC) =   2.91 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.43   Tc(MIN.) =   23.42
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    312.00 =    1985.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    312.00 TO NODE    312.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   23.42
  RAINFALL INTENSITY(INCH/HR) =   1.97
  AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.10
  AREA-AVERAGED Ap =  0.97
  EFFECTIVE STREAM AREA(ACRES) =      16.05
  TOTAL STREAM AREA(ACRES) =      16.05
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      28.31

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    311.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   850.00
  ELEVATION DATA: UPSTREAM(FEET) =    683.40  DOWNSTREAM(FEET) =    674.87

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.328
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.445
  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.)
  RESIDENTIAL
```

```
"2 DWELLINGS/ACRE"          C        2.20      0.27     0.700    86   16.33
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"    C        7.45      0.09     1.000    98   19.57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.12
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.932
SUBAREA RUNOFF(CFS) =      20.27
TOTAL AREA(ACRES) =       9.65   PEAK FLOW RATE(CFS) =      20.27

****************************************************************************
FLOW PROCESS FROM NODE     311.00 TO NODE     312.00 IS CODE =  52
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =     674.87  DOWNSTREAM(FEET) =     661.25
CHANNEL LENGTH THRU SUBAREA(FEET) =   840.00   CHANNEL SLOPE =  0.0162
CHANNEL FLOW THRU SUBAREA(CFS) =       20.27
FLOW VELOCITY(FEET/SEC) =   3.83 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   3.66   Tc(MIN.) =   19.98
LONGEST FLOWPATH FROM NODE     310.00 TO NODE     312.00 =    1690.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     312.00 TO NODE     312.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   19.98
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.166
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"    C        7.55      0.09     1.000    98
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.09
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA AREA(ACRES) =     7.55      SUBAREA RUNOFF(CFS) =   14.12
EFFECTIVE AREA(ACRES) =      17.20   AREA-AVERAGED Fm(INCH/HR) =  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.11  AREA-AVERAGED Ap =  0.96
TOTAL AREA(ACRES) =        17.2       PEAK FLOW RATE(CFS) =      31.97

****************************************************************************
FLOW PROCESS FROM NODE     312.00 TO NODE     312.00 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.) =   19.98
RAINFALL INTENSITY(INCH/HR) =   2.17
AREA-AVERAGED Fm(INCH/HR) =  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.11
AREA-AVERAGED Ap =  0.96
EFFECTIVE STREAM AREA(ACRES) =       17.20
TOTAL STREAM AREA(ACRES) =       17.20
PEAK FLOW RATE(CFS) AT CONFLUENCE =       31.97

** CONFLUENCE DATA **
 STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
    1       28.31   23.42    1.969  0.10( 0.10) 0.97       16.0      300.00
    2       31.97   19.98    2.166  0.11( 0.10) 0.96       17.2      310.00

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

** PEAK FLOW RATE TABLE **
 STREAM       Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
    1       58.66   19.98    2.166  0.10( 0.10) 0.96       30.9      310.00
    2       57.23   23.42    1.969  0.10( 0.10) 0.96       33.2      300.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       58.66    Tc(MIN.) =     19.98
EFFECTIVE AREA(ACRES) =       30.89   AREA-AVERAGED Fm(INCH/HR) =  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.10  AREA-AVERAGED Ap =  0.96
TOTAL AREA(ACRES) =        33.2
LONGEST FLOWPATH FROM NODE     300.00 TO NODE     312.00 =    1985.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       33.2  TC(MIN.) =      19.98
EFFECTIVE AREA(ACRES) =      30.89  AREA-AVERAGED Fm(INCH/HR)=  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.10  AREA-AVERAGED Ap = 0.964
```

PEAK FLOW RATE(CFS) = 58.66

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	58.66	19.98	2.166	0.10(0.10)	0.96	30.9	310.00
2	57.23	23.42	1.969	0.10(0.10)	0.96	33.2	300.00

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

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****************************************************************************
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                        Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3290                                                          *
* EXISTING CONDITION (NODE 400-414)                                        *
* 100-YEAR STORM EVENT                                                     *
 ****************************************************************************

  FILE NAME: W:\3290\EX100D.DAT
  TIME/DATE OF STUDY: 14:00 10/04/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====  ====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   500.00
  ELEVATION DATA: UPSTREAM(FEET) =    673.50  DOWNSTREAM(FEET) =    666.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.685
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.606
  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.)
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   B        3.40      0.15     1.000    95   14.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.15
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      7.51
  TOTAL AREA(ACRES) =      3.40   PEAK FLOW RATE(CFS) =      7.51

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    666.20  DOWNSTREAM(FEET) =    665.08
  CHANNEL LENGTH THRU SUBAREA(FEET) =   470.00   CHANNEL SLOPE =  0.0024
  CHANNEL FLOW THRU SUBAREA(CFS) =       7.51
```

```
  FLOW VELOCITY(FEET/SEC) =   1.14 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.90   Tc(MIN.) =   21.58
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     970.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   21.58
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.069
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   B        2.35      0.15      1.000    95
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   C        1.55      0.09      1.000    98
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.13
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    3.90      SUBAREA RUNOFF(CFS) =    6.82
  EFFECTIVE AREA(ACRES) =      7.30   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.14  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        7.3       PEAK FLOW RATE(CFS) =      12.69

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    413.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    665.08  DOWNSTREAM(FEET) =    661.24
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1155.00   CHANNEL SLOPE =  0.0033
  CHANNEL FLOW THRU SUBAREA(CFS) =      12.69
  FLOW VELOCITY(FEET/SEC) =   1.53 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =  12.57   Tc(MIN.) =   34.15
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    413.00 =    2125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    413.00 TO NODE    413.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   34.15
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.571
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   C        8.35      0.09      1.000    98
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.09
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    8.35      SUBAREA RUNOFF(CFS) =   11.14
  EFFECTIVE AREA(ACRES) =     15.65   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.11  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =       15.7       PEAK FLOW RATE(CFS) =      20.56

****************************************************************************
  FLOW PROCESS FROM NODE    413.00 TO NODE    413.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   34.15
  RAINFALL INTENSITY(INCH/HR) =   1.57
  AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.11
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =      15.65
  TOTAL STREAM AREA(ACRES) =      15.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      20.56

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    411.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   625.00
  ELEVATION DATA: UPSTREAM(FEET) =    671.84  DOWNSTREAM(FEET) =    665.17

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
```

```
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.095
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.379
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.)
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   B        5.20      0.15      1.000    95   17.09
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.15
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA RUNOFF(CFS) =      10.43
TOTAL AREA(ACRES) =       5.20   PEAK FLOW RATE(CFS) =     10.43

****************************************************************************
FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  52
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    665.17  DOWNSTREAM(FEET) =    663.73
CHANNEL LENGTH THRU SUBAREA(FEET) =   385.00   CHANNEL SLOPE =  0.0037
CHANNEL FLOW THRU SUBAREA(CFS) =      10.43
FLOW VELOCITY(FEET/SEC) =   1.54 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   4.15   Tc(MIN.) =   21.25
LONGEST FLOWPATH FROM NODE    410.00 TO NODE    412.00 =    1010.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    412.00 TO NODE    412.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   21.25
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.088
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   B        3.25      0.15      1.000    95
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   C        1.35      0.09      1.000    98
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.13
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA AREA(ACRES) =    4.60      SUBAREA RUNOFF(CFS) =     8.10
EFFECTIVE AREA(ACRES) =      9.80   AREA-AVERAGED Fm(INCH/HR) =  0.14
AREA-AVERAGED Fp(INCH/HR) =  0.14  AREA-AVERAGED Ap =  1.00
TOTAL AREA(ACRES) =        9.8       PEAK FLOW RATE(CFS) =      17.16

****************************************************************************
FLOW PROCESS FROM NODE    412.00 TO NODE    413.00 IS CODE =  52
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    663.73  DOWNSTREAM(FEET) =    661.24
CHANNEL LENGTH THRU SUBAREA(FEET) =   465.00   CHANNEL SLOPE =  0.0054
CHANNEL FLOW THRU SUBAREA(CFS) =      17.16
FLOW VELOCITY(FEET/SEC) =   2.10 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   3.68   Tc(MIN.) =   24.93
LONGEST FLOWPATH FROM NODE    410.00 TO NODE    413.00 =    1475.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    413.00 TO NODE    413.00 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.) =   24.93
RAINFALL INTENSITY(INCH/HR) =   1.90
AREA-AVERAGED Fm(INCH/HR) =  0.14
AREA-AVERAGED Fp(INCH/HR) =  0.14
AREA-AVERAGED Ap =  1.00
EFFECTIVE STREAM AREA(ACRES) =       9.80
TOTAL STREAM AREA(ACRES) =       9.80
PEAK FLOW RATE(CFS) AT CONFLUENCE =      17.16

** CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       20.56   34.15    1.571  0.11( 0.11) 1.00      15.7     400.00
    2       17.16   24.93    1.897  0.14( 0.14) 1.00       9.8     410.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
    1        35.52   24.93    1.897  0.13( 0.13) 1.00       21.2      410.00
    2        34.53   34.15    1.571  0.12( 0.12) 1.00       25.5      400.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      35.52    Tc(MIN.) =    24.93
EFFECTIVE AREA(ACRES) =      21.23   AREA-AVERAGED Fm(INCH/HR) =  0.13
AREA-AVERAGED Fp(INCH/HR) =  0.13  AREA-AVERAGED Ap =  1.00
TOTAL AREA(ACRES) =       25.5
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    413.00 =    2125.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    413.00 TO NODE    414.00 IS CODE =  52
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    661.24  DOWNSTREAM(FEET) =    661.08
CHANNEL LENGTH THRU SUBAREA(FEET) =   435.00   CHANNEL SLOPE =  0.0004
NOTE: CHANNEL SLOPE OF .001 WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) =      35.52
FLOW VELOCITY(FEET/SEC) =   1.11 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   6.53   Tc(MIN.) =   31.46
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    414.00 =    2560.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    414.00 TO NODE    414.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =   31.46
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.650
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   B        7.60      0.15      1.000    95
AGRICULTURAL POOR COVER
"ROW CROPS,STRAIGHT ROW"   C        5.25      0.09      1.000    98
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.13
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA AREA(ACRES) =   12.85      SUBAREA RUNOFF(CFS) =   17.63
EFFECTIVE AREA(ACRES) =     34.08   AREA-AVERAGED Fm(INCH/HR) =  0.13
AREA-AVERAGED Fp(INCH/HR) =  0.13  AREA-AVERAGED Ap =  1.00
TOTAL AREA(ACRES) =       38.3       PEAK FLOW RATE(CFS) =      46.75
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       38.3  TC(MIN.) =     31.46
EFFECTIVE AREA(ACRES) =     34.08  AREA-AVERAGED Fm(INCH/HR)=  0.13
AREA-AVERAGED Fp(INCH/HR) =  0.13  AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE(CFS)    =      46.75

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
    1        46.75   31.46    1.650  0.13( 0.13) 1.00       34.1      410.00
    2        44.44   40.73    1.413  0.12( 0.12) 1.00       38.3      400.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

♀

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****************************************************************************
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1435

                        Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3290                                                          *
* EXISTING CONDITION (NODES 500-503)                                       *
* 100-YEAR STORM EVENT                                                     *
 ****************************************************************************

  FILE NAME: W:\3290\EX100E.DAT
  TIME/DATE OF STUDY: 13:32 10/04/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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)
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   645.00
  ELEVATION DATA: UPSTREAM(FEET) =    669.24  DOWNSTREAM(FEET) =    665.57

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.632
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.189
  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.)
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   C        5.85      0.09      1.000    98   19.63
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.09
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     11.06
  TOTAL AREA(ACRES) =      5.85   PEAK FLOW RATE(CFS) =     11.06

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    665.57  DOWNSTREAM(FEET) =    663.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00   CHANNEL SLOPE =  0.0057
  CHANNEL FLOW THRU SUBAREA(CFS) =      11.06
  FLOW VELOCITY(FEET/SEC) =   1.93 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.45   Tc(MIN.) =   23.08
```

```
  LONGEST FLOWPATH FROM NODE     500.00 TO NODE     502.00 =     1045.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     502.00 TO NODE     502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    23.08
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.987
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   C         6.35      0.09      1.000    98
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.09
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =     6.35      SUBAREA RUNOFF(CFS) =    10.85
  EFFECTIVE AREA(ACRES) =      12.20   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.09  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        12.2       PEAK FLOW RATE(CFS) =       20.85

****************************************************************************
  FLOW PROCESS FROM NODE     502.00 TO NODE     503.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     663.30  DOWNSTREAM(FEET) =     658.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00   CHANNEL SLOPE =  0.0112
  CHANNEL FLOW THRU SUBAREA(CFS) =       20.85
  FLOW VELOCITY(FEET/SEC) =    3.21 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =    2.13   Tc(MIN.) =    25.21
  LONGEST FLOWPATH FROM NODE     500.00 TO NODE     503.00 =     1455.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     503.00 TO NODE     503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    25.21
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.884
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL POOR COVER
  "ROW CROPS,STRAIGHT ROW"   C         7.50      0.09      1.000    98
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.09
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =     7.50      SUBAREA RUNOFF(CFS) =    12.12
  EFFECTIVE AREA(ACRES) =      19.70   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.09  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        19.7       PEAK FLOW RATE(CFS) =       31.85
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        19.7  TC(MIN.) =      25.21
  EFFECTIVE AREA(ACRES) =      19.70  AREA-AVERAGED Fm(INCH/HR)=  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.09  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)    =      31.85
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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PROPOSED CONDITION

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****************************************************************************
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                        Analysis prepared by:

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                          LA MIRADA CA 90638
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 ************************** DESCRIPTION OF STUDY **************************
* JOB #3290 WEST ONTARIO COMMERCE CENTER, MERRILL & CARPENTER              *
* PROPOSED CONDITION 100-YEAR                                              *
* BUILDING 2, NODE 100-162                                                 *
 ***************************************************************************

  FILE NAME: C:\XDRIVE\3290\100PR1.DAT
  TIME/DATE OF STUDY: 17:13 08/21/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   385.00
  ELEVATION DATA: UPSTREAM(FEET) =    672.80  DOWNSTREAM(FEET) =    669.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.743
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.557
  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        0.25      0.45       0.10    76    8.74
  COMMERCIAL                  C        0.40      0.27       0.10    86    8.74
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.34
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =       2.06
  TOTAL AREA(ACRES) =       0.65   PEAK FLOW RATE(CFS) =       2.06

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    101.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =    8.74
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) -  3.557
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.45      0.45       0.10    76
  COMMERCIAL                  C        0.25      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.39
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.70      SUBAREA RUNOFF(CFS) =     2.22
  EFFECTIVE AREA(ACRES) =     1.35   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.37  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      1.35      PEAK FLOW RATE(CFS) =       4.28

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   666.97  DOWNSTREAM(FEET) =   666.54
  FLOW LENGTH(FEET) =   155.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.61
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.28
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =   9.46
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =   540.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
MAINLINE Tc(MIN) =   9.46
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.393
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        0.40       0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.40       SUBAREA RUNOFF(CFS) =     1.21
EFFECTIVE AREA(ACRES) =      1.75    AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.39    AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      1.75        PEAK FLOW RATE(CFS) =        5.28

****************************************************************************
FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   666.54  DOWNSTREAM(FEET) =   666.09
FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.93
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       5.28
PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =  10.07
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =   685.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  10.07
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.267
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        2.10       0.45       0.10    76
COMMERCIAL                  C        1.25       0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.38
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     3.35       SUBAREA RUNOFF(CFS) =     9.73
EFFECTIVE AREA(ACRES) =      5.10    AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.38    AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      5.10        PEAK FLOW RATE(CFS) =       14.82

****************************************************************************
FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   666.09  DOWNSTREAM(FEET) =   665.66
FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.08
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      14.82
PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =  10.53
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =   825.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  10.53
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.181
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.55       0.45       0.10    76
COMMERCIAL                  C        0.45       0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.41
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     2.00       SUBAREA RUNOFF(CFS) =     5.65
EFFECTIVE AREA(ACRES) =      7.10    AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.39    AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      7.10        PEAK FLOW RATE(CFS) =       20.08

****************************************************************************
FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   665.66  DOWNSTREAM(FEET) =   665.22
FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.45
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      20.08
PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =  10.98
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =   970.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
MAINLINE Tc(MIN) =  10.98
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.103
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B        1.40      0.45       0.10    76
COMMERCIAL                 C        0.05      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     1.45      SUBAREA RUNOFF(CFS) =     3.99
EFFECTIVE AREA(ACRES) =      8.55   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.40   AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      8.55       PEAK FLOW RATE(CFS) =      23.57

******************************************************************************
FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   665.22  DOWNSTREAM(FEET) =   664.78
FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  30.0 INCH PIPE IS  24.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.54
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     23.57
PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =  11.41
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =  1115.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
------------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
MAINLINE Tc(MIN) =  11.41
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.032
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B        2.05      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     2.05      SUBAREA RUNOFF(CFS) =     5.51
EFFECTIVE AREA(ACRES) =     10.60   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.41   AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     10.60       PEAK FLOW RATE(CFS) =      28.53

******************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   664.78  DOWNSTREAM(FEET) =   664.33
FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.94
ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     28.53
PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =  11.82
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =  1260.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
------------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
MAINLINE Tc(MIN) =  11.82
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.969
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B        1.70      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     1.70      SUBAREA RUNOFF(CFS) =     4.47
EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.42   AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     12.30       PEAK FLOW RATE(CFS) =      32.40

******************************************************************************
FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   664.33  DOWNSTREAM(FEET) =   663.89
FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.14
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     32.40
PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  12.21
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =  1405.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.21
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.911
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.85      0.45       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.85      SUBAREA RUNOFF(CFS) =     4.77
  EFFECTIVE AREA(ACRES) =    14.15    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    14.15        PEAK FLOW RATE(CFS) =       36.53

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   663.89  DOWNSTREAM(FEET) =   663.45
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.24
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     36.53
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  12.60
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =  1550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    109.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.60
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.857
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.55      0.45       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.55      SUBAREA RUNOFF(CFS) =     3.92
  EFFECTIVE AREA(ACRES) =    15.70    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    15.70        PEAK FLOW RATE(CFS) =       39.77

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   663.45  DOWNSTREAM(FEET) =   663.01
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.47
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     39.77
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =  12.97
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =  1695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.97
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.807
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.95      0.45       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.95      SUBAREA RUNOFF(CFS) =     4.85
  EFFECTIVE AREA(ACRES) =    17.65    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.43   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    17.65        PEAK FLOW RATE(CFS) =       43.91

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   663.01  DOWNSTREAM(FEET) =   662.57
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.56
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     43.91
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =  13.34
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    111.00 =  1840.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.34
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.760
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.90      0.45       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.90       SUBAREA RUNOFF(CFS) =     4.64
  EFFECTIVE AREA(ACRES) =    19.55   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     19.55       PEAK FLOW RATE(CFS) =      47.81

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   662.57  DOWNSTREAM(FEET) =   662.12
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.67
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      47.81
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =  13.70
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =  1985.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.70
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.716
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        2.50      0.45       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.50       SUBAREA RUNOFF(CFS) =     6.01
  EFFECTIVE AREA(ACRES) =    22.05   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     22.05       PEAK FLOW RATE(CFS) =      53.05

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   662.12  DOWNSTREAM(FEET) =   661.90
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.05
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =  13.87
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =  2055.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.87
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.697
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        0.30      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =     0.72
  EFFECTIVE AREA(ACRES) =    22.35   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     22.35       PEAK FLOW RATE(CFS) =      53.38

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    114.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   661.90  DOWNSTREAM(FEET) =   661.02
  FLOW LENGTH(FEET) =   295.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.84
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.38
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =  14.59
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    114.00 =  2350.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  14.59
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.616
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.25      0.45       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.25       SUBAREA RUNOFF(CFS) =     0.58
  EFFECTIVE AREA(ACRES) =    22.60   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     22.60        PEAK FLOW RATE(CFS) =      53.38
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   661.02  DOWNSTREAM(FEET) =   660.39
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.86
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     53.38
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =  15.10
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =  2560.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  15.10
  RAINFALL INTENSITY(INCH/HR) =   2.56
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =   22.60
  TOTAL STREAM AREA(ACRES) =   22.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.38

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   460.00
  ELEVATION DATA: UPSTREAM(FEET) =    670.59  DOWNSTREAM(FEET) =    667.77

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.783
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.325
  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        1.90      0.45       0.10    76    9.78
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      5.61
  TOTAL AREA(ACRES) =      1.90   PEAK FLOW RATE(CFS) =      5.61

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   663.77  DOWNSTREAM(FEET) =   660.39
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.64
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      5.61
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   9.88
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =   525.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 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.) =   9.88
  RAINFALL INTENSITY(INCH/HR) =   3.31
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.45
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    1.90
  TOTAL STREAM AREA(ACRES) =    1.90
```

```
PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.61

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
    1      53.38  15.10     2.563   0.43( 0.04) 0.10    22.6     100.00
    2       5.61   9.88     3.306   0.45( 0.05) 0.10     1.9     120.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)    NODE
    1      57.71  15.10     2.563   0.43( 0.04) 0.10    24.5     100.00
    2      50.83   9.88     3.306   0.43( 0.04) 0.10    16.7     120.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      57.71    Tc(MIN.) =     15.10
EFFECTIVE AREA(ACRES) =     24.50   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      24.50
LONGEST FLOWPATH FROM NODE     100.00 TO NODE     122.00 =  2560.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     122.00 TO NODE     132.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   660.39  DOWNSTREAM(FEET) =   660.26
FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.06
ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      57.71
PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  15.28
LONGEST FLOWPATH FROM NODE     100.00 TO NODE     132.00 =  2625.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     132.00 TO NODE     132.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  15.28
RAINFALL INTENSITY(INCH/HR) =   2.54
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.43
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =   24.50
TOTAL STREAM AREA(ACRES) =   24.50
PEAK FLOW RATE(CFS) AT CONFLUENCE =      57.71

****************************************************************************
FLOW PROCESS FROM NODE     130.00 TO NODE     131.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   465.00
ELEVATION DATA: UPSTREAM(FEET) =    670.27  DOWNSTREAM(FEET) =    666.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     9.063
' 100 YEAR RAINFALL INTENSITY(INCH/HR) -  3.481
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        1.90      0.45       0.10    76    9.06
COMMERCIAL                  C        0.50      0.27       0.10    86    9.06
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.41
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =       7.43
TOTAL AREA(ACRES) =       2.40   PEAK FLOW RATE(CFS) =       7.43

****************************************************************************
FLOW PROCESS FROM NODE     131.00 TO NODE     132.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   662.01  DOWNSTREAM(FEET) =   660.26
FLOW LENGTH(FEET) =   255.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.79
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       7.43
PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =    9.80
LONGEST FLOWPATH FROM NODE     130.00 TO NODE     132.00 =   720.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     132.00 TO NODE     132.00 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.) =    9.80
RAINFALL INTENSITY(INCH/HR) =    3.32
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.41
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =     2.40
TOTAL STREAM AREA(ACRES) =     2.40
PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.43

** CONFLUENCE DATA **
 STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1      57.71  15.28     2.545  0.43( 0.04) 0.10     24.5      100.00
    1      50.83  10.06     3.270  0.43( 0.04) 0.10     16.7      120.00
    2       7.43   9.80     3.322  0.41( 0.04) 0.10      2.4      130.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1      58.14  10.06     3.270  0.43( 0.04) 0.10     19.1      120.00
    2      63.38  15.28     2.545  0.43( 0.04) 0.10     26.9      100.00
    3      57.73   9.80     3.322  0.43( 0.04) 0.10     18.6      130.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      63.38    Tc(MIN.) =     15.28
EFFECTIVE AREA(ACRES) =     26.90   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      26.90
LONGEST FLOWPATH FROM NODE     100.00 TO NODE     132.00 =  2625.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     132.00 TO NODE     162.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    660.26  DOWNSTREAM(FEET) =    659.96
FLOW LENGTH(FEET) =   230.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  51.0 INCH PIPE IS  41.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.17
ESTIMATED PIPE DIAMETER(INCH) =  51.00     NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      63.38
PIPE TRAVEL TIME(MIN.) =   0.74     Tc(MIN.) =  16.02
LONGEST FLOWPATH FROM NODE     100.00 TO NODE     162.00 =  2855.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     162.00 TO NODE     162.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
FLOW PROCESS FROM NODE     140.00 TO NODE     141.00 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) =    674.08  DOWNSTREAM(FEET) =    669.93

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.451
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.630
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                  C       0.90      0.27       0.10    86    8.45
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =      2.92
TOTAL AREA(ACRES) =      0.90   PEAK FLOW RATE(CFS) =      2.92

****************************************************************************
FLOW PROCESS FROM NODE     141.00 TO NODE     142.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   666.03  DOWNSTREAM(FEET) =   665.55
FLOW LENGTH(FEET) =   155.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  15.0 INCH PIPE IS   9.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.41
ESTIMATED PIPE DIAMETER(INCH) =  15.00     NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      2.92
PIPE TRAVEL TIME(MIN.) =   0.76     Tc(MIN.) =   9.21
LONGEST FLOWPATH FROM NODE     140.00 TO NODE     142.00 =   565.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     142.00 TO NODE     142.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =   9.21
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.448
SUBAREA LOSS RATE DATA(AMC III):
```

```
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C        0.85      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.85      SUBAREA RUNOFF(CFS) =     2.62
EFFECTIVE AREA(ACRES) =      1.75   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27   AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      1.75       PEAK FLOW RATE(CFS) =       5.39

****************************************************************************
FLOW PROCESS FROM NODE    142.00 TO NODE    152.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   665.55  DOWNSTREAM(FEET) =   665.24
FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.12
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       5.39
PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   9.57
LONGEST FLOWPATH FROM NODE    140.00 TO NODE    152.00 =   655.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    152.00 TO NODE    152.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   9.57
RAINFALL INTENSITY(INCH/HR) =   3.37
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    1.75
TOTAL STREAM AREA(ACRES) =    1.75
PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.39

****************************************************************************
FLOW PROCESS FROM NODE    150.00 TO NODE    151.00 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) =    672.74  DOWNSTREAM(FEET) =    667.26

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.877
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.787
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                  C        2.55      0.27       0.10    86    7.88
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =      8.63
TOTAL AREA(ACRES) =      2.55   PEAK FLOW RATE(CFS) =      8.63

****************************************************************************
FLOW PROCESS FROM NODE    151.00 TO NODE    152.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   665.34  DOWNSTREAM(FEET) =   665.24
FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.38
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       8.63
PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =   8.20
LONGEST FLOWPATH FROM NODE    150.00 TO NODE    152.00 =   465.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    152.00 TO NODE    152.00 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.) =   8.20
RAINFALL INTENSITY(INCH/HR) =   3.70
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    2.55
TOTAL STREAM AREA(ACRES) =    2.55
PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.63

** CONFLUENCE DATA **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1      5.39   9.57    3.369  0.27( 0.03) 0.10     1.8     140.00
    2      8.63   8.20    3.698  0.27( 0.03) 0.10     2.5     150.00
```

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

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1     13.24   9.57    3.369  0.27( 0.03) 0.10     4.3     140.00
      2     13.70   8.20    3.698  0.27( 0.03) 0.10     4.0     150.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     13.70    Tc(MIN.) =     8.20
  EFFECTIVE AREA(ACRES) =     4.05   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      4.30
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    152.00 =   655.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    152.00 TO NODE    153.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   665.24  DOWNSTREAM(FEET) =   664.74
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.17
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     13.70
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =   8.65
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    153.00 =   795.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    153.00 TO NODE    153.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   8.65
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.581
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.75      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) -     1.75      SUBAREA RUNOFF(CFS) =     5.60
  EFFECTIVE AREA(ACRES) =     5.80   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      6.05      PEAK FLOW RATE(CFS) =      18.54

****************************************************************************
  FLOW PROCESS FROM NODE    153.00 TO NODE    154.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   664.74  DOWNSTREAM(FEET) =   664.24
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.50
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     18.54
  PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =   9.09
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    154.00 =   940.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.09
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.476
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.35      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.35      SUBAREA RUNOFF(CFS) =     4.19
  EFFECTIVE AREA(ACRES) =     7.15   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      7.40      PEAK FLOW RATE(CFS) =      22.19

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    155.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   664.24  DOWNSTREAM(FEET) =   663.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.89
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     22.19
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   9.50
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    155.00 =  1085.00 FEET.

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

```
  FLOW PROCESS FROM NODE    155.00 TO NODE    155.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.385
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.20      0.45       0.10    76
  COMMERCIAL                  C        1.55      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.29
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.75      SUBAREA RUNOFF(CFS) =     5.29
  EFFECTIVE AREA(ACRES) =      8.90   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.28  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      9.15       PEAK FLOW RATE(CFS) =      26.89

****************************************************************************
  FLOW PROCESS FROM NODE    155.00 TO NODE    156.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   663.73  DOWNSTREAM(FEET) =   663.23
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.16
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     26.89
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =   9.89
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    156.00 =  1230.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.89
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.304
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.40      0.45       0.10    76
  COMMERCIAL                  C        0.95      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.33
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.35      SUBAREA RUNOFF(CFS) =     3.97
  EFFECTIVE AREA(ACRES) =     10.25   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.28  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     10.50       PEAK FLOW RATE(CFS) =      30.21

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    157.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   663.23  DOWNSTREAM(FEET) =   662.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.26
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     30.21
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  10.28
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    157.00 =  1375.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    157.00 TO NODE    157.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.28
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.229
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.95      0.45       0.10    76
  COMMERCIAL                  C        0.80      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.37
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.75      SUBAREA RUNOFF(CFS) =     5.03
  EFFECTIVE AREA(ACRES) =     12.00   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     12.25       PEAK FLOW RATE(CFS) =      34.55

****************************************************************************
  FLOW PROCESS FROM NODE    157.00 TO NODE    158.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   662.73  DOWNSTREAM(FEET) =   662.22
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.60
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     34.55
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =  10.64
```

```
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    158.00 =  1520.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.64
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.162
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.75      0.45       0.10    76
  COMMERCIAL                  C        0.60      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.37
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.35      SUBAREA RUNOFF(CFS) =     3.80
  EFFECTIVE AREA(ACRES) =    13.35   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    13.60       PEAK FLOW RATE(CFS) =       37.62

****************************************************************************
  FLOW PROCESS FROM NODE    158.00 TO NODE    159.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   662.22  DOWNSTREAM(FEET) =   661.72
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.63
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     37.62
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =  11.01
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    159.00 =  1665.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    159.00 TO NODE    159.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.01
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.098
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.20      0.45       0.10    76
  COMMERCIAL                  C        0.55      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.75      SUBAREA RUNOFF(CFS) =     4.82
  EFFECTIVE AREA(ACRES) =    15.10   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.31  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    15.35       PEAK FLOW RATE(CFS) =       41.68

****************************************************************************
  FLOW PROCESS FROM NODE    159.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   661.72  DOWNSTREAM(FEET) =   661.21
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.74
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     41.68
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =  11.36
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    160.00 =  1810.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.36
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.039
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.90      0.45       0.10    76
  COMMERCIAL                  C        0.45      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.39
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.35      SUBAREA RUNOFF(CFS) =     3.65
  EFFECTIVE AREA(ACRES) =    16.45   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.32  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    16.70       PEAK FLOW RATE(CFS) =       44.52

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    161.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   661.21  DOWNSTREAM(FEET) =   660.71
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.95
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  39.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      44.52
  PIPE TRAVEL TIME(MIN.) =   0.35     Tc(MIN.) =  11.71
  LONGEST FLOWPATH FROM NODE     140.00 TO NODE     161.00 =  1955.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     161.00 TO NODE     161.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.71
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.985
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
  COMMERCIAL                  B        2.85      0.45       0.10    76
  COMMERCIAL                  C        0.65      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     3.50      SUBAREA RUNOFF(CFS) =     9.27
  EFFECTIVE AREA(ACRES) =     19.95   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.34   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     20.20       PEAK FLOW RATE(CFS) =       52.98

****************************************************************************
  FLOW PROCESS FROM NODE     161.00 TO NODE     162.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   660.71  DOWNSTREAM(FEET) =   659.96
  FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.31
  ESTIMATED PIPE DIAMETER(INCH) =  42.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      52.98
  PIPE TRAVEL TIME(MIN.) =   0.49     Tc(MIN.) =  12.20
  LONGEST FLOWPATH FROM NODE     140.00 TO NODE     162.00 =  2170.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     162.00 TO NODE     162.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
      1      52.98  12.20    2.912  0.34( 0.03) 0.10    19.9      150.00
      2      50.07  13.63    2.725  0.34( 0.03) 0.10    20.2      140.00
  LONGEST FLOWPATH FROM NODE     140.00 TO NODE     162.00 =  2170.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
      1      57.73  10.54    3.179  0.43( 0.04) 0.10    18.6      130.00
      2      58.14  10.81    3.132  0.43( 0.04) 0.10    19.1      120.00
      3      63.38  16.02    2.474  0.43( 0.04) 0.10    26.9      100.00
  LONGEST FLOWPATH FROM NODE       0.00 TO NODE     162.00 =     0.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
      1     112.52  12.20    2.912  0.39( 0.04) 0.10    41.1      150.00
      2     111.05  13.63    2.725  0.39( 0.04) 0.10    43.5      140.00
      3     107.75  10.54    3.179  0.39( 0.04) 0.10    35.9      130.00
      4     108.65  10.81    3.132  0.39( 0.04) 0.10    36.8      120.00
      5     108.77  16.02    2.474  0.39( 0.04) 0.10    47.1      100.00
    TOTAL AREA(ACRES) =      47.10

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      112.52  Tc(MIN.) =   12.203
  EFFECTIVE AREA(ACRES) =     41.12  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.39  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     47.10
  LONGEST FLOWPATH FROM NODE     140.00 TO NODE     162.00 =  2170.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     162.00 TO NODE     162.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     47.10  TC(MIN.) =     12.20
  EFFECTIVE AREA(ACRES) =      41.12  AREA-AVERAGED Fm(INCH/HR)=  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.39  AREA-AVERAGED Ap =  0.10
  PEAK FLOW RATE(CFS)    =    112.52

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
      1     107.75  10.54    3.179  0.39( 0.04) 0.10    35.9      130.00
      2     108.65  10.81    3.132  0.39( 0.04) 0.10    36.8      120.00
      3     112.52  12.20    2.912  0.39( 0.04) 0.10    41.1      150.00
      4     111.05  13.63    2.725  0.39( 0.04) 0.10    43.5      140.00
      5     108.77  16.02    2.474  0.39( 0.04) 0.10    47.1      100.00
============================================================================
============================================================================
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
        (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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           Ver. 8.0  Release Date: 01/01/99  License ID 1435

                         Analysis prepared by:

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 ************************** DESCRIPTION OF STUDY **************************
* JOB #3290 WEST ONTARIO COMMERCE CENTER, MERRILL & CARPENTER              *
* PROPOSED CONDITION 100-YEAR                                              *
* WEST HALF OF BUILDING 1, NODE 200-211                                    *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3290\100PR2.DAT
  TIME/DATE OF STUDY: 06:50 08/22/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   715.00
  ELEVATION DATA: UPSTREAM(FEET) =    672.00  DOWNSTREAM(FEET) =    665.76

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.875
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.121
  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                  C        4.55      0.27       0.10    86   10.87
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      12.67
  TOTAL AREA(ACRES) =       4.55   PEAK FLOW RATE(CFS) =      12.67

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   662.62  DOWNSTREAM(FEET) =   662.04
  FLOW LENGTH(FEET) =   165.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.10
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.67
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =  11.41
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =   880.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.41
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.031
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        2.05      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.05      SUBAREA RUNOFF(CFS) =     5.54
  EFFECTIVE AREA(ACRES) =      6.60   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      6.60      PEAK FLOW RATE(CFS) =      17.84

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   662.04  DOWNSTREAM(FEET) =   661.53
```

```
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.53
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.84
  PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =  11.85
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =  1025.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.85
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.964
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C       1.60      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.60      SUBAREA RUNOFF(CFS) =     4.23
  EFFECTIVE AREA(ACRES) =      8.20   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      8.20      PEAK FLOW RATE(CFS) =      21.67

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   661.53  DOWNSTREAM(FEET) =   661.02
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.87
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.67
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =  12.26
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =  1170.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.26
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.904
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C       2.05      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.05      SUBAREA RUNOFF(CFS) =     5.31
  EFFECTIVE AREA(ACRES) =     10.25   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     10.25      PEAK FLOW RATE(CFS) =      26.54

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   661.02  DOWNSTREAM(FEET) =   660.52
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.15
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.54
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  12.66
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =  1315.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.66
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.849
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C       2.05      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.05      SUBAREA RUNOFF(CFS) =     5.21
  EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     12.30      PEAK FLOW RATE(CFS) =      31.24

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   660.52  DOWNSTREAM(FEET) =   659.50
```

```
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.32
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     31.24
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =  12.95
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    206.00 =  1460.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    206.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.95
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.811
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        1.60      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.60      SUBAREA RUNOFF(CFS) =     4.01
  EFFECTIVE AREA(ACRES) =    13.90   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    13.90       PEAK FLOW RATE(CFS) =      34.82

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    207.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   660.00  DOWNSTREAM(FEET) =   659.50
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.56
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     34.82
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =  13.32
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    207.00 =  1605.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    207.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.32
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.764
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        2.05      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.05      SUBAREA RUNOFF(CFS) =     5.05
  EFFECTIVE AREA(ACRES) =    15.95   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    15.95       PEAK FLOW RATE(CFS) =      39.28

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    208.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   659.50  DOWNSTREAM(FEET) =   658.99
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.72
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     39.28
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =  13.67
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    208.00 =  1750.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.67
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.720
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        1.60      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.60      SUBAREA RUNOFF(CFS) =     3.88
  EFFECTIVE AREA(ACRES) =    17.55   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    17.55       PEAK FLOW RATE(CFS) =      42.53

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    209.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   658.99  DOWNSTREAM(FEET) =   658.49
```

```
FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.90
ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     42.53
PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =  14.02
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    209.00 =  1895.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    209.00 TO NODE    209.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  14.02
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.679
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C        2.05      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     2.05      SUBAREA RUNOFF(CFS) =     4.89
EFFECTIVE AREA(ACRES) =     19.60   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     19.60       PEAK FLOW RATE(CFS) =      46.78

****************************************************************************
FLOW PROCESS FROM NODE    209.00 TO NODE    210.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   658.49  DOWNSTREAM(FEET) =   657.98
FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.06
ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     46.78
PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =  14.37
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    210.00 =  2040.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  14.37
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.640
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C        4.05      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     4.05      SUBAREA RUNOFF(CFS) =     9.53
EFFECTIVE AREA(ACRES) =     23.65   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     23.65       PEAK FLOW RATE(CFS) =      55.62

****************************************************************************
FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   657.98  DOWNSTREAM(FEET) =   657.40
FLOW LENGTH(FEET) =   165.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.39
ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     55.62
PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =  14.74
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =  2205.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  14.74
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.600
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C        0.25      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.25      SUBAREA RUNOFF(CFS) =     0.58
EFFECTIVE AREA(ACRES) =     23.90   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     23.90       PEAK FLOW RATE(CFS) =      55.62
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =     23.90  TC(MIN.) =     14.74
EFFECTIVE AREA(ACRES) =     23.90  AREA-AVERAGED Fm(INCH/HR)=  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
PEAK FLOW RATE(CFS)    =     55.62
============================================================================
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
        (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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           Ver. 8.0  Release Date: 01/01/99  License ID 1435

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 ************************** DESCRIPTION OF STUDY **************************
* JOB #3290 WEST ONTARIO COMMERCE CENTER, MERRILL & CARPENTER              *
* PROPOSED CONDITION 100-YEAR                                              *
* EAST HALF OF BUILDING 1, NODES 300-344                                   *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3290\100PR3.DAT
  TIME/DATE OF STUDY: 06:52 08/22/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  470.00
  ELEVATION DATA: UPSTREAM(FEET) =    672.15  DOWNSTREAM(FEET) =    667.17

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.845
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.533
  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                  C       1.40      0.27       0.10    86    8.84
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =       4.42
  TOTAL AREA(ACRES) =       1.40   PEAK FLOW RATE(CFS) =       4.42

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    312.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   662.00  DOWNSTREAM(FEET) =   658.97
  FLOW LENGTH(FEET) =   450.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.06
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.42
  PIPE TRAVEL TIME(MIN.) =   1.48    Tc(MIN.) =  10.33
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    312.00 =   920.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    312.00 TO NODE    312.00 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.) =  10.33
  RAINFALL INTENSITY(INCH/HR) =   3.22
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    1.40
  TOTAL STREAM AREA(ACRES) =    1.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.42

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    311.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   450.00
  ELEVATION DATA: UPSTREAM(FEET) =    670.90  DOWNSTREAM(FEET) =    665.75
```

```
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     8.559
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.603
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                  C        3.90      0.27       0.10    86    8.56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =      12.55
TOTAL AREA(ACRES) =       3.90   PEAK FLOW RATE(CFS) =      12.55

****************************************************************************
FLOW PROCESS FROM NODE    311.00 TO NODE    312.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   662.75  DOWNSTREAM(FEET) =   658.97
FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  19.34
ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      12.55
PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   8.59
LONGEST FLOWPATH FROM NODE    310.00 TO NODE    312.00 =   480.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    312.00 TO NODE    312.00 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.) =    8.59
RAINFALL INTENSITY(INCH/HR) =   3.60
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =     3.90
TOTAL STREAM AREA(ACRES) =     3.90
PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.55

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)        (ACRES)     NODE
    1       4.42  10.33    3.219  0.27( 0.03) 0.10     1.4      300.00
    2      12.55   8.59    3.596  0.27( 0.03) 0.10     3.9      310.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)        (ACRES)     NODE
    1      15.64  10.33    3.219  0.27( 0.03) 0.10     5.3      300.00
    2      16.66   8.59    3.596  0.27( 0.03) 0.10     5.1      310.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      16.66    Tc(MIN.) =      8.59
EFFECTIVE AREA(ACRES) =      5.06   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =       5.30
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    312.00 =   920.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    312.00 TO NODE    313.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   658.97  DOWNSTREAM(FEET) =   658.55
FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.12
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      16.66
PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =   9.04
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    313.00 =  1060.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    313.00 TO NODE    313.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =    9.04
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.486
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C        1.45      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     1.45      SUBAREA RUNOFF(CFS) =     4.51
EFFECTIVE AREA(ACRES) =      6.51   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      6.75      PEAK FLOW RATE(CFS) =      20.28
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     313.00 TO NODE     314.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   658.55  DOWNSTREAM(FEET) =   658.12
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.40
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     20.28
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =   9.49
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    314.00 =  1205.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     314.00 TO NODE     314.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.49
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.387
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.85      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.85      SUBAREA RUNOFF(CFS) =     5.59
  EFFECTIVE AREA(ACRES) =      8.36   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      8.60      PEAK FLOW RATE(CFS) =      25.29

****************************************************************************
  FLOW PROCESS FROM NODE     314.00 TO NODE     315.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   658.12  DOWNSTREAM(FEET) =   657.69
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.73
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     25.29
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =   9.91
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    315.00 =  1350.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     315.00 TO NODE     315.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.91
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.299
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.45      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.45      SUBAREA RUNOFF(CFS) =     4.27
  EFFECTIVE AREA(ACRES) =      9.81   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     10.05      PEAK FLOW RATE(CFS) =      28.90

****************************************************************************
  FLOW PROCESS FROM NODE     315.00 TO NODE     322.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   657.68  DOWNSTREAM(FEET) =   655.87
  FLOW LENGTH(FEET) =   605.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.85
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     28.90
  PIPE TRAVEL TIME(MIN.) =   1.72    Tc(MIN.) =  11.63
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    322.00 =  1955.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     322.00 TO NODE     322.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  11.63
  RAINFALL INTENSITY(INCH/HR) =   3.00
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =     9.81
  TOTAL STREAM AREA(ACRES) =    10.05
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      28.90

****************************************************************************
  FLOW PROCESS FROM NODE     320.00 TO NODE     321.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   570.00
  ELEVATION DATA: UPSTREAM(FEET) =    669.00  DOWNSTREAM(FEET) =    662.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     9.276
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.433
  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                 C        6.95      0.27       0.10    86    9.28
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      21.30
  TOTAL AREA(ACRES) =       6.95   PEAK FLOW RATE(CFS) =     21.30

****************************************************************************
  FLOW PROCESS FROM NODE    321.00 TO NODE    322.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   658.70  DOWNSTREAM(FEET) =   655.87
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.86
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.30
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    9.35
  LONGEST FLOWPATH FROM NODE    320.00 TO NODE    322.00 =   635.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    322.00 TO NODE    322.00 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.) =    9.35
  RAINFALL INTENSITY(INCH/HR) =    3.42
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =     6.95
  TOTAL STREAM AREA(ACRES) =     6.95
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      21.30

  ** CONFLUENCE DATA **
   STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
   NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)     NODE
      1      26.79  13.42     2.751  0.27( 0.03) 0.10     10.1      300.00
      1      28.90  11.63     2.997  0.27( 0.03) 0.10      9.8      310.00
      2      21.30   9.35     3.417  0.27( 0.03) 0.10      6.9      320.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
   NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)     NODE
      1      47.57  11.63     2.997  0.27( 0.03) 0.10     16.8      310.00
      2      43.91  13.42     2.751  0.27( 0.03) 0.10     17.0      300.00
      3      47.81   9.35     3.417  0.27( 0.03) 0.10     14.8      320.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      47.81    Tc(MIN.) =      9.35
  EFFECTIVE AREA(ACRES) =     14.84   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      17.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    322.00 =  1955.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    322.00 TO NODE    323.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   655.87  DOWNSTREAM(FEET) =   655.43
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.60
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      47.81
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =    9.72
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    323.00 =  2100.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    323.00 TO NODE    323.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =    9.72
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.339
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
```

```
     LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C       1.40      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.40      SUBAREA RUNOFF(CFS) =     4.17
  EFFECTIVE AREA(ACRES) =    16.24    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     18.40       PEAK FLOW RATE(CFS) =      48.40

****************************************************************************
  FLOW PROCESS FROM NODE     323.00 TO NODE     324.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   655.43  DOWNSTREAM(FEET) =   654.67
  FLOW LENGTH(FEET) =   255.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.75
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      48.40
  PIPE TRAVEL TIME(MIN.) =   0.63    Tc(MIN.) =  10.35
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     324.00 =  2355.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     324.00 TO NODE     324.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.35
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.216
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C       1.80      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.80      SUBAREA RUNOFF(CFS) =     5.17
  EFFECTIVE AREA(ACRES) =    18.04    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     20.20       PEAK FLOW RATE(CFS) =      51.76

****************************************************************************
  FLOW PROCESS FROM NODE     324.00 TO NODE     332.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   654.67  DOWNSTREAM(FEET) =   653.75
  FLOW LENGTH(FEET) =   305.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.85
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      51.76
  PIPE TRAVEL TIME(MIN.) =   0.74    Tc(MIN.) =  11.09
  LONGEST FLOWPATH FROM NODE     300.00 TO NODE     332.00 =  2660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     332.00 TO NODE     332.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  11.09
  RAINFALL INTENSITY(INCH/HR) =   3.08
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =   18.04
  TOTAL STREAM AREA(ACRES) =   20.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      51.76

****************************************************************************
  FLOW PROCESS FROM NODE     330.00 TO NODE     331.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   310.00
  ELEVATION DATA: UPSTREAM(FEET) =    666.54  DOWNSTREAM(FEET) =    662.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.258
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.978
  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                 C       2.55      0.27       0.10    86    7.26
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =       9.07
  TOTAL AREA(ACRES) =       2.55   PEAK FLOW RATE(CFS) =       9.07

****************************************************************************
  FLOW PROCESS FROM NODE     331.00 TO NODE     332.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   659.70  DOWNSTREAM(FEET) =   653.75
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.87
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.07
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   7.30
  LONGEST FLOWPATH FROM NODE    330.00 TO NODE    332.00 =   360.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    332.00 TO NODE    332.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN) =   7.30
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.962
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C       0.40      0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.40      SUBAREA RUNOFF(CFS) =     1.42
  EFFECTIVE AREA(ACRES) =      2.95   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      2.95       PEAK FLOW RATE(CFS) =      10.45

****************************************************************************
  FLOW PROCESS FROM NODE    332.00 TO NODE    332.00 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.) =   7.30
  RAINFALL INTENSITY(INCH/HR) =   3.96
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =     2.95
  TOTAL STREAM AREA(ACRES) =     2.95
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.45

  ** CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
      1      50.76  13.38    2.756  0.27( 0.03) 0.10    20.0      310.00
      1      47.36  15.21    2.551  0.27( 0.03) 0.10    20.2      300.00
      1      51.76  11.09    3.085  0.27( 0.03) 0.10    18.0      320.00
      2      10.45   7.30    3.962  0.27( 0.03) 0.10     3.0      330.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
      1      59.87  11.09    3.085  0.27( 0.03) 0.10    21.0      320.00
      2      58.01  13.38    2.756  0.27( 0.03) 0.10    22.9      310.00
      3      54.07  15.21    2.551  0.27( 0.03) 0.10    23.1      300.00
      4      54.33   7.30    3.962  0.27( 0.03) 0.10    14.8      330.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      59.87    Tc(MIN.) =     11.09
  EFFECTIVE AREA(ACRES) =     20.99   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      23.15
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    332.00 =  2660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    332.00 TO NODE    344.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   653.75  DOWNSTREAM(FEET) =   652.73
  FLOW LENGTH(FEET) =   340.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.12
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      59.87
  PIPE TRAVEL TIME(MIN.) =   0.80    Tc(MIN.) =  11.88
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    344.00 =  3000.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    344.00 TO NODE    344.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  11.88
  RAINFALL INTENSITY(INCH/HR) =   2.96
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =   20.99
```

```
  TOTAL STREAM AREA(ACRES) =    23.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      59.87

****************************************************************************
  FLOW PROCESS FROM NODE     340.00 TO NODE     341.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    460.00
  ELEVATION DATA: UPSTREAM(FEET) =     667.89  DOWNSTREAM(FEET) =     659.85

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     7.934
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.771
  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                  C        0.90       0.27       0.10    86    7.93
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =       3.03
  TOTAL AREA(ACRES) =       0.90    PEAK FLOW RATE(CFS) =       3.03

****************************************************************************
  FLOW PROCESS FROM NODE     341.00 TO NODE     342.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    656.85  DOWNSTREAM(FEET) =    656.05
  FLOW LENGTH(FEET) =     45.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS    6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    6.68
  ESTIMATED PIPE DIAMETER(INCH) =  12.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =       3.03
  PIPE TRAVEL TIME(MIN.) =    0.11     Tc(MIN.) =    8.05
  LONGEST FLOWPATH FROM NODE     340.00 TO NODE     342.00 =    505.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     342.00 TO NODE     342.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =    8.05
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.739
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        0.55       0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.55      SUBAREA RUNOFF(CFS) =     1.84
  EFFECTIVE AREA(ACRES) =     1.45    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      1.45       PEAK FLOW RATE(CFS) =       4.84

****************************************************************************
  FLOW PROCESS FROM NODE     342.00 TO NODE     343.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    656.06  DOWNSTREAM(FEET) =    655.75
  FLOW LENGTH(FEET) =     35.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS    9.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    5.75
  ESTIMATED PIPE DIAMETER(INCH) =  15.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =       4.84
  PIPE TRAVEL TIME(MIN.) =    0.10     Tc(MIN.) =    8.15
  LONGEST FLOWPATH FROM NODE     340.00 TO NODE     343.00 =    540.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     343.00 TO NODE     343.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =    8.15
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.711
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        0.85       0.27       0.10    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.85      SUBAREA RUNOFF(CFS) =     2.82
  EFFECTIVE AREA(ACRES) =     2.30    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      2.30       PEAK FLOW RATE(CFS) =       7.63

****************************************************************************
  FLOW PROCESS FROM NODE     343.00 TO NODE     344.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    655.75  DOWNSTREAM(FEET) =    652.73
  FLOW LENGTH(FEET) =    335.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   11.4 INCHES
```

```
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.49
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       7.63
PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =   9.01
LONGEST FLOWPATH FROM NODE    340.00 TO NODE    344.00 =   875.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    344.00 TO NODE    344.00 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.) =   9.01
RAINFALL INTENSITY(INCH/HR) =   3.49
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    2.30
TOTAL STREAM AREA(ACRES) =    2.30
PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.63

** CONFLUENCE DATA **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     59.87  11.88    2.959  0.27( 0.03) 0.10    21.0     320.00
    1     58.01  14.20    2.659  0.27( 0.03) 0.10    22.9     310.00
    1     54.07  16.04    2.472  0.27( 0.03) 0.10    23.1     300.00
    1     54.33   8.13    3.716  0.27( 0.03) 0.10    14.8     330.00
    2      7.63   9.01    3.494  0.27( 0.03) 0.10     2.3     340.00

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

** PEAK FLOW RATE TABLE **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     61.66   8.13    3.716  0.27( 0.03) 0.10    16.9     330.00
    2     66.32  11.88    2.959  0.27( 0.03) 0.10    23.3     320.00
    3     63.80  14.20    2.659  0.27( 0.03) 0.10    25.2     310.00
    4     59.44  16.04    2.472  0.27( 0.03) 0.10    25.5     300.00
    5     63.25   9.01    3.494  0.27( 0.03) 0.10    18.6     340.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     66.32    Tc(MIN.) =    11.88
EFFECTIVE AREA(ACRES) =    23.29   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     25.45
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    344.00 =  3000.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =     25.45  TC(MIN.) =     11.88
EFFECTIVE AREA(ACRES) =     23.29  AREA-AVERAGED Fm(INCH/HR)=  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.10
PEAK FLOW RATE(CFS)    =     66.32

** PEAK FLOW RATE TABLE **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     61.66   8.13    3.716  0.27( 0.03) 0.10    16.9     330.00
    2     63.25   9.01    3.494  0.27( 0.03) 0.10    18.6     340.00
    3     66.32  11.88    2.959  0.27( 0.03) 0.10    23.3     320.00
    4     63.80  14.20    2.659  0.27( 0.03) 0.10    25.2     310.00
    5     59.44  16.04    2.472  0.27( 0.03) 0.10    25.5     300.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

1

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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 ************************** DESCRIPTION OF STUDY **************************
* JOB #3290 WEST ONTARIO COMMERCE CENTER, MERRILL & CARPENTER              *
* PROPOSED CONDITION 100-YEAR                                              *
* BUILDINGS 3-5, NODES 400-453                                             *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3290\100PR4.DAT
  TIME/DATE OF STUDY: 14:59 08/22/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   270.00
  ELEVATION DATA: UPSTREAM(FEET) =    685.00  DOWNSTREAM(FEET) =    681.37

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.756
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.152
  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        2.50      0.45       0.10    76    6.76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =       9.24
  TOTAL AREA(ACRES) =       2.50   PEAK FLOW RATE(CFS) =       9.24

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   678.59  DOWNSTREAM(FEET) =   672.56
  FLOW LENGTH(FEET) =   670.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.72
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.24
  PIPE TRAVEL TIME(MIN.) =   1.66    Tc(MIN.) =   8.42
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    412.00 =   940.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    412.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.42
  RAINFALL INTENSITY(INCH/HR) =   3.64
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.45
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    2.50
  TOTAL STREAM AREA(ACRES) =    2.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.24

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    411.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   690.00
  ELEVATION DATA: UPSTREAM(FEET) =    683.38  DOWNSTREAM(FEET) =    677.32
```

```
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.708
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.150
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        3.00      0.45       0.10    76   10.71
COMMERCIAL                  C        0.50      0.27       0.10    86   10.71
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =       9.79
TOTAL AREA(ACRES) =       3.50   PEAK FLOW RATE(CFS) =       9.79

****************************************************************************
FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   675.10  DOWNSTREAM(FEET) =   672.60
FLOW LENGTH(FEET) =   280.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.74
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       9.79
PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =  11.40
LONGEST FLOWPATH FROM NODE    410.00 TO NODE    412.00 =   970.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    412.00 TO NODE    412.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  11.40
RAINFALL INTENSITY(INCH/HR) =   3.03
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.43
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    3.50
TOTAL STREAM AREA(ACRES) =    3.50
PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.79

** CONFLUENCE DATA **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1      9.24   8.42    3.639  0.45( 0.05) 0.10     2.5     400.00
    2      9.79  11.40    3.034  0.43( 0.04) 0.10     3.5     410.00

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

** PEAK FLOW RATE TABLE **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1     17.93   8.42    3.639  0.44( 0.04) 0.10     5.1     400.00
    2     17.47  11.40    3.034  0.44( 0.04) 0.10     6.0     410.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     17.93    Tc(MIN.) =     8.42
EFFECTIVE AREA(ACRES) =     5.08   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.44  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      6.00
LONGEST FLOWPATH FROM NODE    410.00 TO NODE    412.00 =   970.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    412.00 TO NODE    422.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   672.56  DOWNSTREAM(FEET) =   670.95
FLOW LENGTH(FEET) =   190.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.80
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      17.93
PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   8.82
LONGEST FLOWPATH FROM NODE    410.00 TO NODE    422.00 =  1160.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    422.00 TO NODE    422.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   8.82
RAINFALL INTENSITY(INCH/HR) =   3.54
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.44
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    5.08
TOTAL STREAM AREA(ACRES) =    6.00
PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.93

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

```
  FLOW PROCESS FROM NODE     420.00 TO NODE     421.00 IS CODE =  21
 ----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
 ======================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    580.00
  ELEVATION DATA: UPSTREAM(FEET) =     683.22  DOWNSTREAM(FEET) =     676.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     9.451
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.395
  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                  C        2.75      0.27       0.10    86    9.45
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =        8.34
  TOTAL AREA(ACRES) =       2.75   PEAK FLOW RATE(CFS) =       8.34

 **********************************************************************
  FLOW PROCESS FROM NODE     421.00 TO NODE     422.00 IS CODE =  31
 ----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 ======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    672.00  DOWNSTREAM(FEET) =    670.95
  FLOW LENGTH(FEET) =     45.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    9.43
  ESTIMATED PIPE DIAMETER(INCH) =  15.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        8.34
  PIPE TRAVEL TIME(MIN.) =    0.08     Tc(MIN.) =    9.53
  LONGEST FLOWPATH FROM NODE     420.00 TO NODE     422.00 =    625.00 FEET.

 **********************************************************************
  FLOW PROCESS FROM NODE     422.00 TO NODE     422.00 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.) =    9.53
  RAINFALL INTENSITY(INCH/HR) =    3.38
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =     2.75
  TOTAL STREAM AREA(ACRES) =     2.75
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.34

  ** CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)        (ACRES)     NODE
      1      17.93   8.82    3.538   0.44( 0.04) 0.10      5.1      400.00
      1      17.47  11.81    2.970   0.44( 0.04) 0.10      6.0      410.00
      2       8.34   9.53    3.378   0.27( 0.03) 0.10      2.8      420.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)        (ACRES)     NODE
      1      26.02   8.82    3.538   0.38( 0.04) 0.10      7.6      400.00
      2      24.79  11.81    2.970   0.39( 0.04) 0.10      8.8      410.00
      3      26.16   9.53    3.378   0.38( 0.04) 0.10      8.1      420.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.16     Tc(MIN.) =      9.53
  EFFECTIVE AREA(ACRES) =      8.05   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.38  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       8.75
  LONGEST FLOWPATH FROM NODE     410.00 TO NODE     422.00 =  1160.00 FEET.

 **********************************************************************
  FLOW PROCESS FROM NODE     422.00 TO NODE     432.00 IS CODE =  31
 ----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 ======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    670.95  DOWNSTREAM(FEET) =    668.78
  FLOW LENGTH(FEET) =    227.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    8.97
  ESTIMATED PIPE DIAMETER(INCH) =  27.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       26.16
  PIPE TRAVEL TIME(MIN.) =    0.42     Tc(MIN.) =    9.95
  LONGEST FLOWPATH FROM NODE     410.00 TO NODE     432.00 =  1387.00 FEET.

 **********************************************************************
  FLOW PROCESS FROM NODE     432.00 TO NODE     432.00 IS CODE =   1
 ----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 ======================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.95
```

```
RAINFALL INTENSITY(INCH/HR) =   3.29
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.38
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    8.05
TOTAL STREAM AREA(ACRES) =    8.75
PEAK FLOW RATE(CFS) AT CONFLUENCE =     26.16

****************************************************************************
FLOW PROCESS FROM NODE    430.00 TO NODE    431.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   210.00
ELEVATION DATA: UPSTREAM(FEET) =    683.09  DOWNSTREAM(FEET) =    680.51

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.221
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.363
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        0.85      0.45       0.10    76    6.22
COMMERCIAL                  C        0.50      0.27       0.10    86    6.22
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.39
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =       5.25
TOTAL AREA(ACRES) =       1.35   PEAK FLOW RATE(CFS) =       5.25

****************************************************************************
FLOW PROCESS FROM NODE    431.00 TO NODE    432.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   673.73  DOWNSTREAM(FEET) =   668.78
FLOW LENGTH(FEET) =   550.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.87
ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       5.25
PIPE TRAVEL TIME(MIN.) =   1.56    Tc(MIN.) =   7.78
LONGEST FLOWPATH FROM NODE    430.00 TO NODE    432.00 =   760.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    432.00 TO NODE    432.00 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.) =   7.78
RAINFALL INTENSITY(INCH/HR) =   3.81
AREA AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.39
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    1.35
TOTAL STREAM AREA(ACRES) =    1.35
PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.25

** CONFLUENCE DATA **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     26.02   9.25    3.440  0.38( 0.04) 0.10     7.6     400.00
    1     24.79  12.23    2.908  0.39( 0.04) 0.10     8.8     410.00
    1     26.16   9.95    3.291  0.38( 0.04) 0.10     8.1     420.00
    2      5.25   7.78    3.815  0.39( 0.04) 0.10     1.4     430.00

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

** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     30.75   9.25    3.440  0.38( 0.04) 0.10     9.0     400.00
    2     30.68   9.95    3.291  0.38( 0.04) 0.10     9.4     420.00
    3     28.79  12.23    2.908  0.39( 0.04) 0.10    10.1     410.00
    4     29.56   7.78    3.815  0.38( 0.04) 0.10     7.8     430.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     30.75    Tc(MIN.) =     9.25
EFFECTIVE AREA(ACRES) =     8.98   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.38  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     10.10
LONGEST FLOWPATH FROM NODE    410.00 TO NODE    432.00 =  1387.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    432.00 TO NODE    442.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   668.78  DOWNSTREAM(FEET) =   667.48
FLOW LENGTH(FEET) =   155.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.92
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
```

```
PIPE-FLOW(CFS) =      30.75
PIPE TRAVEL TIME(MIN.) =    0.29     Tc(MIN.) =    9.54
LONGEST FLOWPATH FROM NODE     410.00 TO NODE     442.00 =  1542.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     442.00 TO NODE     442.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =    9.54
RAINFALL INTENSITY(INCH/HR) =    3.38
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.38
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =     8.98
TOTAL STREAM AREA(ACRES) =    10.10
PEAK FLOW RATE(CFS) AT CONFLUENCE =      30.75

****************************************************************************
FLOW PROCESS FROM NODE     440.00 TO NODE     441.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =    435.00
ELEVATION DATA: UPSTREAM(FEET) =     682.25  DOWNSTREAM(FEET) =     677.22

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     8.427
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.637
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                  C        1.15      0.27       0.10    86    8.43
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =       3.74
TOTAL AREA(ACRES) =       1.15   PEAK FLOW RATE(CFS) =       3.74

****************************************************************************
FLOW PROCESS FROM NODE     441.00 TO NODE     442.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    670.00  DOWNSTREAM(FEET) =    667.48
FLOW LENGTH(FEET) =     46.00   MANNING'S N =  0.012
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN  12.0 INCH PIPE IS    5.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  10.75
ESTIMATED PIPE DIAMETER(INCH) =  12.00     NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       3.74
PIPE TRAVEL TIME(MIN.) =    0.07     Tc(MIN.) =    8.50
LONGEST FLOWPATH FROM NODE     440.00 TO NODE     442.00 =    481.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     442.00 TO NODE     442.00 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.) =    8.50
RAINFALL INTENSITY(INCH/HR) =    3.62
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =     1.15
TOTAL STREAM AREA(ACRES) =     1.15
PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.74

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS)  (MIN.) (INCH/HR)  (INCH/HR)        (ACRES)     NODE
    1     30.75    9.54    3.377  0.38( 0.04) 0.10      9.0      400.00
    1     30.68   10.24    3.235  0.38( 0.04) 0.10      9.4      420.00
    1     28.79   12.53    2.866  0.39( 0.04) 0.10     10.1      410.00
    1     29.56    8.08    3.729  0.38( 0.04) 0.10      7.8      430.00
    2      3.74    8.50    3.618  0.27( 0.03) 0.10      1.1      440.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS)  (MIN.) (INCH/HR)  (INCH/HR)        (ACRES)     NODE
    1     33.23    8.08    3.729  0.37( 0.04) 0.10      8.9      430.00
    2     34.23    9.54    3.377  0.37( 0.04) 0.10     10.1      400.00
    3     34.02   10.24    3.235  0.37( 0.04) 0.10     10.6      420.00
    4     31.74   12.53    2.866  0.37( 0.04) 0.10     11.3      410.00
    5     33.64    8.50    3.618  0.37( 0.04) 0.10      9.3      440.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      34.23     Tc(MIN.) =      9.54
EFFECTIVE AREA(ACRES) =     10.13    AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.37   AREA-AVERAGED Ap =  0.10
```

```
  TOTAL AREA(ACRES) =      11.25
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    442.00 =  1542.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    442.00 TO NODE    453.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   667.50  DOWNSTREAM(FEET) =   665.00
  FLOW LENGTH(FEET) =   264.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.56
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      34.23
  PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =  10.00
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    453.00 =  1806.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    453.00 TO NODE    453.00 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.) =  10.00
  RAINFALL INTENSITY(INCH/HR) =   3.28
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.37
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =   10.13
  TOTAL STREAM AREA(ACRES) =   11.25
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      34.23

****************************************************************************
  FLOW PROCESS FROM NODE    450.00 TO NODE    451.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   345.00
  ELEVATION DATA: UPSTREAM(FEET) =    682.50  DOWNSTREAM(FEET) =    676.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.078
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.038
  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                  C        1.15      0.27       0.10    86    7.08
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =       4.15
  TOTAL AREA(ACRES) =       1.15   PEAK FLOW RATE(CFS) =       4.15

****************************************************************************
  FLOW PROCESS FROM NODE    451.00 TO NODE    452.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   672.00  DOWNSTREAM(FEET) =   665.50
  FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.82
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.15
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   7.48
  LONGEST FLOWPATH FROM NODE    450.00 TO NODE    452.00 =   560.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    452.00 TO NODE    452.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.48
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.905
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        0.85      0.27       0.10    86
  NATURAL POOR COVER
  "OPEN BRUSH"                C        0.55      0.07       1.00    96
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.09
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.45
  SUBAREA AREA(ACRES) =     1.40      SUBAREA RUNOFF(CFS) =     4.87
  EFFECTIVE AREA(ACRES) =      2.55   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.12   AREA-AVERAGED Ap =  0.29
  TOTAL AREA(ACRES) =      2.55       PEAK FLOW RATE(CFS) =        8.88

****************************************************************************
  FLOW PROCESS FROM NODE    452.00 TO NODE    453.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   665.50  DOWNSTREAM(FEET) =   665.00
  FLOW LENGTH(FEET) =   115.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.3 INCHES
```

```
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.10
ESTIMATED PIPE DIAMETER(INCH) =  21.00     NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        8.88
PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =   7.86
LONGEST FLOWPATH FROM NODE    450.00 TO NODE    453.00 =   675.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    453.00 TO NODE    453.00 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.) =   7.86
RAINFALL INTENSITY(INCH/HR) =   3.79
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.12
AREA-AVERAGED Ap =  0.29
EFFECTIVE STREAM AREA(ACRES) =    2.55
TOTAL STREAM AREA(ACRES) =    2.55
PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.88

** CONFLUENCE DATA **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     33.23   8.55    3.606  0.37( 0.04) 0.10     8.9     430.00
    1     34.23  10.00    3.283  0.37( 0.04) 0.10    10.1     400.00
    1     34.02  10.70    3.151  0.37( 0.04) 0.10    10.6     420.00
    1     31.74  13.02    2.802  0.37( 0.04) 0.10    11.3     410.00
    1     33.64   8.96    3.505  0.37( 0.04) 0.10     9.3     440.00
    2      8.88   7.86    3.792  0.12( 0.04) 0.29     2.6     450.00

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

** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     41.67   8.55    3.606  0.26( 0.04) 0.14    11.4     430.00
    2     41.84   8.96    3.505  0.26( 0.04) 0.14    11.8     440.00
    3     41.91  10.00    3.283  0.26( 0.04) 0.14    12.7     400.00
    4     41.39  10.70    3.151  0.27( 0.04) 0.14    13.1     420.00
    5     38.28  13.02    2.802  0.27( 0.04) 0.14    13.8     410.00
    6     41.03   7.86    3.792  0.25( 0.04) 0.15    10.7     450.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     41.91    Tc(MIN.) =    10.00
EFFECTIVE AREA(ACRES) =    12.68   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.26  AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =      13.80
LONGEST FLOWPATH FROM NODE    410.00 TO NODE    453.00 =  1806.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =     13.80  TC(MIN.) =     10.00
EFFECTIVE AREA(ACRES) =     12.68  AREA-AVERAGED Fm(INCH/HR)=  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.26  AREA-AVERAGED Ap =  0.14
PEAK FLOW RATE(CFS)    =     41.91

** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     41.03   7.86    3.792  0.25( 0.04) 0.15    10.7     450.00
    2     41.67   8.55    3.606  0.26( 0.04) 0.14    11.4     430.00
    3     41.84   8.96    3.505  0.26( 0.04) 0.14    11.8     440.00
    4     41.91  10.00    3.283  0.26( 0.04) 0.14    12.7     400.00
    5     41.39  10.70    3.151  0.27( 0.04) 0.14    13.1     420.00
    6     38.28  13.02    2.802  0.27( 0.04) 0.14    13.8     410.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS

1
```

```
****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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          Ver. 8.0  Release Date: 01/01/99  License ID 1435

                        Analysis prepared by:

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 ************************** DESCRIPTION OF STUDY **************************
* JOB #3290 WEST ONTARIO COMMERCE CENTER, MERRIL & CARPENTER               *
* PROPOSED CONDITION 100-YEAR                                              *
* BUILDING 6, NODES 500-515                                                *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3290\100PR5.DAT
  TIME/DATE OF STUDY: 16:30 08/22/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   630.00
  ELEVATION DATA: UPSTREAM(FEET) =    682.81  DOWNSTREAM(FEET) =    674.92

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.618
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.359
  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                  C       3.25      0.27       0.10    86    9.62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =       9.75
  TOTAL AREA(ACRES) =       3.25   PEAK FLOW RATE(CFS) =       9.75

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    514.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   670.92  DOWNSTREAM(FEET) =   670.00
  FLOW LENGTH(FEET) =    28.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.17
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.75
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   9.66
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    514.00 =   658.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    514.00 TO NODE    514.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   9.66
  RAINFALL INTENSITY(INCH/HR) =   3.35
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.27
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    3.25
  TOTAL STREAM AREA(ACRES) =    3.25
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       9.75

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    511.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   265.00
  ELEVATION DATA: UPSTREAM(FEET) =    681.30  DOWNSTREAM(FEET) =    678.97
```

```
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     7.300
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.964
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                  C        1.75      0.27       0.10    86    7.30
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =       6.20
TOTAL AREA(ACRES) =       1.75   PEAK FLOW RATE(CFS) =       6.20

****************************************************************************
FLOW PROCESS FROM NODE    511.00 TO NODE    512.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   673.97  DOWNSTREAM(FEET) =   673.00
FLOW LENGTH(FEET) =   338.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.02
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       6.20
PIPE TRAVEL TIME(MIN.) =   1.40    Tc(MIN.) =   8.70
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    512.00 =   603.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    512.00 TO NODE    513.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    673.00  DOWNSTREAM(FEET) =    672.00
CHANNEL LENGTH THRU SUBAREA(FEET) =   290.00   CHANNEL SLOPE =  0.0034
CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   3.000
MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
CHANNEL FLOW THRU SUBAREA(CFS) =       6.20
FLOW VELOCITY(FEET/SEC) =   1.16   FLOW DEPTH(FEET) =   0.26
TRAVEL TIME(MIN.) =   4.15   Tc(MIN.) =  12.85
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    513.00 =   893.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    512.00 TO NODE    513.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  12.85
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.823
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
NATURAL POOR COVER
"OPEN BRUSH"                C        0.70      0.07       1.00    96
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.07
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
SUBAREA AREA(ACRES) =     0.70       SUBAREA RUNOFF(CFS) =     1.74
EFFECTIVE AREA(ACRES) =     2.45   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.11  AREA-AVERAGED Ap =  0.36
TOTAL AREA(ACRES) =     2.45       PEAK FLOW RATE(CFS) =       6.20
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
FLOW PROCESS FROM NODE    513.00 TO NODE    514.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   672.00  DOWNSTREAM(FEET) =   670.00
FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.19
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       6.20
PIPE TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =  13.98
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    514.00 =  1243.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    514.00 TO NODE    514.00 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.) =  13.98
RAINFALL INTENSITY(INCH/HR) =   2.68
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.11
AREA-AVERAGED Ap =  0.36
EFFECTIVE STREAM AREA(ACRES) =     2.45
TOTAL STREAM AREA(ACRES) =     2.45
PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.20

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1       9.75   9.66    3.351  0.27( 0.03) 0.10      3.3      500.00
    2       6.20  13.98    2.684  0.11( 0.04) 0.36      2.5      510.00
```

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

** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     15.11   9.66    3.351  0.17( 0.03) 0.19     4.9      500.00
    2     13.99  13.98    2.684  0.15( 0.03) 0.21     5.7      510.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     15.11    Tc(MIN.) =     9.66
EFFECTIVE AREA(ACRES) =     4.94   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.17  AREA-AVERAGED Ap =  0.19
TOTAL AREA(ACRES) =       5.70
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    514.00 =  1243.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    514.00 TO NODE    515.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   670.00  DOWNSTREAM(FEET) =   666.00
FLOW LENGTH(FEET) =   276.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.19
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     15.11
PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =  10.16
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    515.00 =  1519.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    514.00 TO NODE    515.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  10.16
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.251
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C        0.45      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.45      SUBAREA RUNOFF(CFS) =     1.31
EFFECTIVE AREA(ACRES) =     5.39   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.17  AREA-AVERAGED Ap =  0.18
TOTAL AREA(ACRES) =      6.15      PEAK FLOW RATE(CFS) =      15.63
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =      6.15  TC(MIN.) =     10.16
EFFECTIVE AREA(ACRES) =       5.39  AREA-AVERAGED Fm(INCH/HR)=  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.17  AREA-AVERAGED Ap =  0.18
PEAK FLOW RATE(CFS)    =     15.63

** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     15.63  10.16    3.251  0.17( 0.03) 0.18     5.4      500.00
    2     14.37  14.49    2.627  0.16( 0.03) 0.20     6.1      510.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS

1
```

INTERIM CONDITION

```
****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
      (c) Copyright 1983-99 Advanced Engineering Software (aes)
          Ver. 8.0  Release Date: 01/01/99  License ID 1435

                        Analysis prepared by:

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 ************************** DESCRIPTION OF STUDY **************************
* WEST ONTARIO COMMERCE CENTER                                            *
* OFFSITE RUNOFF INTERIM CONDITION                                        *
* 100-YEAR                                                                *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3290\OFF.DAT
  TIME/DATE OF STUDY: 10:03 10/04/2017
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   715.00
  ELEVATION DATA: UPSTREAM(FEET) =    689.00  DOWNSTREAM(FEET) =    681.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.348
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.215
  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 POOR COVER
  "OPEN BRUSH"                 B        2.45      0.16       1.00    92   17.87
  COMMERCIAL                   B        0.60      0.45       0.10    76   10.35
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.17
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.82
  SUBAREA RUNOFF(CFS) =       8.45
  TOTAL AREA(ACRES) =       3.05   PEAK FLOW RATE(CFS) =       8.45

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  681.00  DOWNSTREAM ELEVATION(FEET) =  675.00
  STREET LENGTH(FEET) =   610.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.25
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.43
    HALFSTREET FLOOD WIDTH(FEET) =   13.63
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.75
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.18
  STREET FLOW TRAVEL TIME(MIN.) =   3.70   Tc(MIN.) =  14.05
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.676
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "OPEN BRUSH"                 B        1.95      0.16       1.00    92
  COMMERCIAL                   B        0.50      0.45       0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.17
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.82
  SUBAREA AREA(ACRES) =    2.45      SUBAREA RUNOFF(CFS) =    5.60
  EFFECTIVE AREA(ACRES) =    5.50    AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.17  AREA-AVERAGED Ap =  0.82
```

```
TOTAL AREA(ACRES) =     5.50          PEAK FLOW RATE(CFS) =       12.57

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  14.34
FLOW VELOCITY(FEET/SEC.) =  2.80   DEPTH*VELOCITY(FT*FT/SEC.) =   1.25
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =  1325.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  675.00  DOWNSTREAM ELEVATION(FEET) =  667.00
STREET LENGTH(FEET) =  1280.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 25.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.40
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.49
  HALFSTREET FLOOD WIDTH(FEET) =   16.60
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.44
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.20
STREET FLOW TRAVEL TIME(MIN.) =   8.73   Tc(MIN.) =  22.77
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.003
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.75      0.45       0.10    76
NATURAL POOR COVER
"OPEN BRUSH"                B        0.35      0.16       1.00    92
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.26
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.25
SUBAREA AREA(ACRES) =     2.10       SUBAREA RUNOFF(CFS) =     3.66
EFFECTIVE AREA(ACRES) =     7.60     AREA-AVERAGED Fm(INCH/HR) =  0.12
AREA-AVERAGED Fp(INCH/HR) =  0.18   AREA-AVERAGED Ap =  0.66
TOTAL AREA(ACRES) =     7.60         PEAK FLOW RATE(CFS) =       12.90

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.48   HALFSTREET FLOOD WIDTH(FEET) =  15.90
FLOW VELOCITY(FEET/SEC.) =  2.37   DEPTH*VELOCITY(FT*FT/SEC.) =   1.13
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    603.00 =  2605.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  667.00  DOWNSTREAM ELEVATION(FEET) =  659.60
STREET LENGTH(FEET) =  1032.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 25.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.62
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.59
  HALFSTREET FLOOD WIDTH(FEET) =   21.45
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.05
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.79
STREET FLOW TRAVEL TIME(MIN.) =   5.63   Tc(MIN.) =  28.41
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.754
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.35      0.45       0.10    76
NATURAL POOR COVER
"OPEN BRUSH"                B        0.95      0.16       1.00    92
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.47
SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =     3.44
EFFECTIVE AREA(ACRES) =     9.90     AREA-AVERAGED Fm(INCH/HR) =  0.11
AREA-AVERAGED Fp(INCH/HR) =  0.18   AREA-AVERAGED Ap =  0.62
TOTAL AREA(ACRES) =     9.90         PEAK FLOW RATE(CFS) =       14.64

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.59   HALFSTREET FLOOD WIDTH(FEET) =  21.45
FLOW VELOCITY(FEET/SEC.) =  3.06   DEPTH*VELOCITY(FT*FT/SEC.) =   1.79
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    604.00 =  3637.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    604.00 TO NODE    605.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   654.90  DOWNSTREAM(FEET) =   643.21
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  24.09
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     14.64
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =  28.44
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    605.00 =  3687.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    617.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   641.33  DOWNSTREAM(FEET) =   641.21
  FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.10
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     14.64
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =  29.09
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    617.00 =  3807.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    617.00 TO NODE    617.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    453.00 TO NODE    453.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =  10.00   RAINFALL INTENSITY(INCH/HR) =  3.28
  EFFECTIVE AREA(ACRES) =    13.80
  TOTAL AREA(ACRES) =    13.80         PEAK FLOW RATE(CFS) =     41.90
  AREA-AVERAGED Fm(INCH/HR) =   0.04  AREA-AVERAGED Fp(INCH/HR) =   0.26
  AREA-AVERAGED Ap =  0.14
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
        CONFLUENCE ANALYSES.

****************************************************************************
  FLOW PROCESS FROM NODE    453.00 TO NODE    611.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   665.00  DOWNSTREAM(FEET) =   664.80
  FLOW LENGTH(FEET) -    40.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.90
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     41.90
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  10.08
  LONGEST FLOWPATH FROM NODE    453.00 TO NODE    611.00 =  3847.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    611.00 TO NODE    611.00 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.) =  10.08
  RAINFALL INTENSITY(INCH/HR) =   3.27
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.26
  AREA-AVERAGED Ap =  0.14
  EFFECTIVE STREAM AREA(ACRES) =   13.80
  TOTAL STREAM AREA(ACRES) =   13.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     41.90

****************************************************************************
  FLOW PROCESS FROM NODE    515.00 TO NODE    515.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =  10.20   RAINFALL INTENSITY(INCH/HR) =  3.24
  EFFECTIVE AREA(ACRES) =     6.15
  TOTAL AREA(ACRES) =     6.15         PEAK FLOW RATE(CFS) =     15.60
  AREA-AVERAGED Fm(INCH/HR) =   0.03  AREA-AVERAGED Fp(INCH/HR) =   0.17
  AREA-AVERAGED Ap =  0.18
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
        CONFLUENCE ANALYSES.

****************************************************************************
  FLOW PROCESS FROM NODE    515.00 TO NODE    611.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
ELEVATION DATA: UPSTREAM(FEET) =   666.00  DOWNSTREAM(FEET) =   664.80
FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.61
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      15.60
PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =  10.48
LONGEST FLOWPATH FROM NODE    515.00 TO NODE    611.00 =   130.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    611.00 TO NODE    611.00 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.) =  10.48
RAINFALL INTENSITY(INCH/HR) =   3.19
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.17
AREA-AVERAGED Ap =  0.18
EFFECTIVE STREAM AREA(ACRES) =    6.15
TOTAL STREAM AREA(ACRES) =    6.15
PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.60

** CONFLUENCE DATA **
 STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1     41.90  10.08    3.265  0.26( 0.04) 0.14    13.8     453.00
    2     15.60  10.48    3.190  0.17( 0.03) 0.18     6.2     515.00

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

** PEAK FLOW RATE TABLE **
 STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1     57.26  10.08    3.265  0.23( 0.03) 0.15    19.7     453.00
    2     56.52  10.48    3.190  0.23( 0.03) 0.15    20.0     515.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     57.26    Tc(MIN.) =    10.08
EFFECTIVE AREA(ACRES) =    19.72   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.15
TOTAL AREA(ACRES) =     19.95
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    611.00 =  3847.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    611.00 TO NODE    612.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   664.80  DOWNSTREAM(FEET) =   663.70
FLOW LENGTH(FEET) =   368.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  33.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.59
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      57.26
PIPE TRAVEL TIME(MIN.) =   0.93    Tc(MIN.) =  11.01
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    612.00 =  4215.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    611.00 TO NODE    612.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  11.01
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.097
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C       2.65      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     2.65      SUBAREA RUNOFF(CFS) =     7.32
EFFECTIVE AREA(ACRES) =    22.37   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.15
TOTAL AREA(ACRES) =    22.60       PEAK FLOW RATE(CFS) =      61.66

****************************************************************************
FLOW PROCESS FROM NODE    612.00 TO NODE    613.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   663.70  DOWNSTREAM(FEET) =   662.40
FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  34.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.75
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      61.66
PIPE TRAVEL TIME(MIN.) =   1.04    Tc(MIN.) =  12.05
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    613.00 =  4635.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    612.00 TO NODE    613.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
MAINLINE Tc(MIN) =  12.05
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.934
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C       0.60      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.60       SUBAREA RUNOFF(CFS) =     1.57
EFFECTIVE AREA(ACRES) =     22.97    AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.23    AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =     23.20        PEAK FLOW RATE(CFS) =       61.66
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

******************************************************************************
FLOW PROCESS FROM NODE     613.00 TO NODE     614.00 IS CODE =  31
------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   662.40  DOWNSTREAM(FEET) =   661.10
FLOW LENGTH(FEET) =   430.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  35.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.68
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     61.66
PIPE TRAVEL TIME(MIN.) =   1.07    Tc(MIN.) =  13.12
LONGEST FLOWPATH FROM NODE     453.00 TO NODE     614.00 =  5065.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE     613.00 TO NODE     614.00 IS CODE =  81
------------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
MAINLINE Tc(MIN) =  13.12
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.788
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C       0.60      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.60       SUBAREA RUNOFF(CFS) =     1.49
EFFECTIVE AREA(ACRES) =     23.57    AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.23    AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =     23.80        PEAK FLOW RATE(CFS) =       61.66
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

******************************************************************************
FLOW PROCESS FROM NODE     614.00 TO NODE     615.00 IS CODE =  31
------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   661.10  DOWNSTREAM(FEET) =   659.80
FLOW LENGTH(FEET) =   430.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  35.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.68
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     61.66
PIPE TRAVEL TIME(MIN.) =   1.07    Tc(MIN.) =  14.20
LONGEST FLOWPATH FROM NODE     453.00 TO NODE     615.00 =  5495.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE     614.00 TO NODE     615.00 IS CODE =  81
------------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
MAINLINE Tc(MIN) =  14.20
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.659
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C       0.50      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.50       SUBAREA RUNOFF(CFS) =     1.18
EFFECTIVE AREA(ACRES) =     24.07    AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.23    AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =     24.30        PEAK FLOW RATE(CFS) =       61.66
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

******************************************************************************
FLOW PROCESS FROM NODE     615.00 TO NODE     616.00 IS CODE =  31
------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   659.80  DOWNSTREAM(FEET) =   657.00
FLOW LENGTH(FEET) =   264.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  10.75
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     61.66
PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =  14.61
LONGEST FLOWPATH FROM NODE     453.00 TO NODE     616.00 =  5759.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     616.00 TO NODE     616.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  14.61
  RAINFALL INTENSITY(INCH/HR) =   2.61
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.23
  AREA-AVERAGED Ap =  0.14
  EFFECTIVE STREAM AREA(ACRES) =   24.07
  TOTAL STREAM AREA(ACRES) =   24.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     61.66

****************************************************************************
  FLOW PROCESS FROM NODE     162.00 TO NODE     162.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =  12.20   RAINFALL INTENSITY(INCH/HR) =  2.91
  EFFECTIVE AREA(ACRES) =    41.12
  TOTAL AREA(ACRES) =    47.10          PEAK FLOW RATE(CFS) =    112.50
  AREA-AVERAGED Fm(INCH/HR) =   0.04  AREA-AVERAGED Fp(INCH/HR) =   0.39
  AREA-AVERAGED Ap =  0.10
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
        CONFLUENCE ANALYSES.

****************************************************************************
  FLOW PROCESS FROM NODE     162.00 TO NODE     616.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   659.96  DOWNSTREAM(FEET) =   657.00
  FLOW LENGTH(FEET) =   142.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.16
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    112.50
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =  12.34
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    616.00 =   272.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     616.00 TO NODE     616.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  12.34
  RAINFALL INTENSITY(INCH/HR) =   2.89
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.39
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =   41.12
  TOTAL STREAM AREA(ACRES) =   47.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    112.50

****************************************************************************
  FLOW PROCESS FROM NODE     211.00 TO NODE     211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =  14.74   RAINFALL INTENSITY(INCH/HR) =  2.60
  EFFECTIVE AREA(ACRES) =    23.90
  TOTAL AREA(ACRES) =    23.90          PEAK FLOW RATE(CFS) =     55.60
  AREA-AVERAGED Fm(INCH/HR) =   0.03  AREA-AVERAGED Fp(INCH/HR) =   0.27
  AREA-AVERAGED Ap =  0.10
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
        CONFLUENCE ANALYSES.

****************************************************************************
  FLOW PROCESS FROM NODE     211.00 TO NODE     616.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   657.40  DOWNSTREAM(FEET) =   657.00
  FLOW LENGTH(FEET) =    48.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.24
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     55.60
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  14.82
  LONGEST FLOWPATH FROM NODE    211.00 TO NODE    616.00 =    48.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     616.00 TO NODE     616.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =  14.82
```

```
RAINFALL INTENSITY(INCH/HR) =   2.59
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.27
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =   23.90
TOTAL STREAM AREA(ACRES) =   23.90
PEAK FLOW RATE(CFS) AT CONFLUENCE =      55.60

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1      61.66  14.61    2.614  0.23( 0.03) 0.14    24.1      453.00
    1      60.96  15.01    2.572  0.23( 0.03) 0.14    24.3      515.00
    2     112.50  12.34    2.893  0.39( 0.04) 0.10    41.1      162.00
    3      55.60  14.82    2.592  0.27( 0.03) 0.10    23.9      211.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     221.93  12.34    2.893  0.31( 0.03) 0.11    81.3      162.00
    2     218.46  14.61    2.614  0.31( 0.03) 0.11    88.7      453.00
    3     215.96  15.01    2.572  0.31( 0.03) 0.11    89.3      515.00
    4     217.54  14.82    2.592  0.31( 0.03) 0.11    89.2      211.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =    221.93    Tc(MIN.) =    12.34
EFFECTIVE AREA(ACRES) =    81.35   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.31  AREA-AVERAGED Ap =  0.11
TOTAL AREA(ACRES) =     95.30
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    616.00 =  5759.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    616.00 TO NODE    617.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   657.00  DOWNSTREAM(FEET) =   641.21
FLOW LENGTH(FEET) =   344.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  25.79
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =    221.93
PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =  12.56
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    617.00 =  6103.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    617.00 TO NODE    617.00 IS CODE =  11
----------------------------------------------------------------------------
>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

** MAIN STREAM CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     221.93  12.56    2.862  0.31( 0.03) 0.11    81.3      162.00
    2     218.46  14.83    2.591  0.31( 0.03) 0.11    88.7      453.00
    3     217.54  15.04    2.569  0.31( 0.03) 0.11    89.2      211.00
    4     215.96  15.24    2.549  0.31( 0.03) 0.11    89.3      515.00
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    617.00 =  6103.00 FEET.

** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1      14.64  29.09    1.729  0.18( 0.11) 0.62     9.9      600.00
LONGEST FLOWPATH FROM NODE      0.00 TO NODE    617.00 =     0.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1     232.68  12.56    2.862  0.28( 0.04) 0.14    85.6      162.00
    2     229.89  14.83    2.591  0.28( 0.04) 0.14    93.8      453.00
    3     229.03  15.04    2.569  0.28( 0.04) 0.14    94.3      211.00
    4     227.51  15.24    2.549  0.28( 0.04) 0.14    94.5      515.00
    5     160.21  29.09    1.729  0.26( 0.04) 0.16    99.2      600.00
  TOTAL AREA(ACRES) =    105.20

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      232.68  Tc(MIN.) =    12.560
EFFECTIVE AREA(ACRES) =     85.62  AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.28  AREA-AVERAGED Ap =  0.14
TOTAL AREA(ACRES) =    105.20
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    617.00 =  6103.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    617.00 TO NODE    617.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
FLOW PROCESS FROM NODE    617.00 TO NODE    618.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
ELEVATION DATA: UPSTREAM(FEET) =   641.21  DOWNSTREAM(FEET) =   640.72
FLOW LENGTH(FEET) =   487.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  90.0 INCH PIPE IS  72.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.13
ESTIMATED PIPE DIAMETER(INCH) =  90.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =    232.68
PIPE TRAVEL TIME(MIN.) =   1.33    Tc(MIN.) =  13.89
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    618.00 =  6590.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    617.00 TO NODE    618.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  13.89
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.695
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C        3.45      0.27       0.10    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    3.45      SUBAREA RUNOFF(CFS) =    8.28
EFFECTIVE AREA(ACRES) =    89.07   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.28  AREA-AVERAGED Ap =  0.13
TOTAL AREA(ACRES) =   108.65       PEAK FLOW RATE(CFS) =     232.68
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
FLOW PROCESS FROM NODE    618.00 TO NODE    619.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   640.72  DOWNSTREAM(FEET) =   640.30
FLOW LENGTH(FEET) =   422.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  90.0 INCH PIPE IS  72.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.09
ESTIMATED PIPE DIAMETER(INCH) =  90.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =    232.68
PIPE TRAVEL TIME(MIN.) =   1.15    Tc(MIN.) =  15.04
LONGEST FLOWPATH FROM NODE    453.00 TO NODE    619.00 =  7012.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    619.00 TO NODE    619.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  15.04
RAINFALL INTENSITY(INCH/HR) =   2.57
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.28
AREA-AVERAGED Ap =  0.13
EFFECTIVE STREAM AREA(ACRES) =   89.07
TOTAL STREAM AREA(ACRES) =  108.65
PEAK FLOW RATE(CFS) AT CONFLUENCE =    232.68

****************************************************************************
FLOW PROCESS FROM NODE    344.00 TO NODE    344.00 IS CODE =   7
----------------------------------------------------------------------------
>>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN.) =  11.90   RAINFALL INTENSITY(INCH/HR) =  2.96
EFFECTIVE AREA(ACRES) =    23.29
TOTAL AREA(ACRES) =    25.45        PEAK FLOW RATE(CFS) =     66.30
AREA-AVERAGED Fm(INCH/HR) =   0.03  AREA-AVERAGED Fp(INCH/HR) =   0.27
AREA-AVERAGED Ap =  0.10
NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
       CONFLUENCE ANALYSES.

****************************************************************************
FLOW PROCESS FROM NODE    344.00 TO NODE    619.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   652.73  DOWNSTREAM(FEET) =   642.68
FLOW LENGTH(FEET) =    84.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  29.23
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     66.30
PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =  11.95
LONGEST FLOWPATH FROM NODE    344.00 TO NODE    619.00 =   356.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    619.00 TO NODE    619.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  11.95
RAINFALL INTENSITY(INCH/HR) =   2.95
AREA-AVERAGED Fm(INCH/HR) =  0.03
```

AREA-AVERAGED Fp(INCH/HR) = 0.27
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 23.29
TOTAL STREAM AREA(ACRES) = 25.45
PEAK FLOW RATE(CFS) AT CONFLUENCE = 66.30

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	232.68	15.04	2.569	0.28(0.04)	0.13	89.1	162.00
1	229.89	17.31	2.361	0.28(0.04)	0.14	97.2	453.00
1	229.03	17.52	2.344	0.28(0.04)	0.14	97.8	211.00
1	227.51	17.72	2.328	0.28(0.04)	0.14	98.0	515.00
1	160.21	31.81	1.639	0.26(0.04)	0.16	102.7	600.00
2	66.30	11.95	2.949	0.27(0.03)	0.10	23.3	344.00

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	290.35	15.04	2.569	0.28(0.04)	0.13	112.4	162.00
2	282.85	17.31	2.361	0.28(0.04)	0.13	120.5	453.00
3	281.60	17.52	2.344	0.28(0.04)	0.13	121.1	211.00
4	279.72	17.72	2.328	0.27(0.04)	0.13	121.2	515.00
5	196.77	31.81	1.639	0.26(0.04)	0.15	126.0	600.00
6	278.92	11.95	2.949	0.28(0.04)	0.13	94.0	344.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 290.35 Tc(MIN.) = 15.04
EFFECTIVE AREA(ACRES) = 112.36 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.28 AREA-AVERAGED Ap = 0.13
TOTAL AREA(ACRES) = 134.10
LONGEST FLOWPATH FROM NODE 453.00 TO NODE 619.00 = 7012.00 FEET.

==========

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 134.10 TC(MIN.) = 15.04
EFFECTIVE AREA(ACRES) = 112.36 AREA-AVERAGED Fm(INCH/HR)= 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.28 AREA-AVERAGED Ap = 0.13
PEAK FLOW RATE(CFS) = 290.35

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	278.92	11.95	2.949	0.28(0.04)	0.13	94.0	344.00
2	290.35	15.04	2.569	0.28(0.04)	0.13	112.4	162.00
3	282.85	17.31	2.361	0.28(0.04)	0.13	120.5	453.00
4	281.60	17.52	2.344	0.28(0.04)	0.13	121.1	211.00
5	279.72	17.72	2.328	0.27(0.04)	0.13	121.2	515.00
6	196.77	31.81	1.639	0.26(0.04)	0.15	126.0	600.00

==========
==========

END OF RATIONAL METHOD ANALYSIS

1

APPENDIX C

HYDRAULIC CALCULATIONS

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	2		5.500														
CD	2	4	1		6.500														

W S P G W PAGE NO 1
WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -
JOB #3290 WEST ONTARIO COMMERCE CENTER

HEADING LINE NO 2 IS -
PUBLIC STORM DRAIN IN MERRILL AVE

HEADING LINE NO 3 IS -
DOUBLE 66" RCP

W S P G W PAGE NO 2
WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *
U/S DATA STATION INVERT SECT W S ELEV
1122.120 640.970 1 653.000

ELEMENT NO 2 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
1181.220 641.990 1 .013 .000 .000 .000 0

ELEMENT NO 3 IS A TRANSITION * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE
1201.220 642.030 2 .013 .000 .000

ELEMENT NO 4 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
1242.470 642.110 2 .013 .000 .000 .000 0

ELEMENT NO 5 IS A SYSTEM HEADWORKS *
U/S DATA STATION INVERT SECT W S ELEV
1242.470 642.110 2 .000

JOB #3290 WEST ONTARIO COMMERCE CENTER
PUBLIC STORM DRAIN IN MERRILL AVE
DOUBLE 66" RCP

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1122.120	640.970	12.030	653.000	292.00	6.15	.59	653.59	.00	3.37	.00	5.500	.000	.00	2 .0
59.100	.0173					.0019	.11	12.03	.00	2.18	.013	.00	.00	PIPE
1181.220	641.990	11.122	653.112	292.00	6.15	.59	653.70	.00	3.37	.00	5.500	.000	.00	2 .0
TRANS STR	.0020					.0025	.05	11.12	.00		.013	.00	.00	PIPE
1201.220	642.030	10.639	652.669	292.00	8.80	1.20	653.87	.00	4.59	.00	6.500	.000	.00	1 .0
41.250	.0019					.0031	.13	10.64	.00	6.50	.013	.00	.00	PIPE
1242.470	642.110	10.687	652.797	292.00	8.80	1.20	654.00	.00	4.59	.00	6.500	.000	.00	1 .0

DOWNSTREAM (2) 66" PIPES

DATE: 8/23/2017
TIME: 16:42

F0515P

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	24	4			2.00														
CD	36	4			3.00														
CD	42	4			3.50														
CD	48	4			4.00														
CD	54	4			4.50														
CD	60	4			5.00														
CD	66	4			5.50														

F 0 5 1 5 P

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

3290 -

HEADING LINE NO 2 IS -

HELLMAN AVENUE

HEADING LINE NO 3 IS -

100

F 0 5 1 5 P

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

	U/S DATA	STATION	INVERT	SECT	W S ELEV
		1007.22	645.71	66	657.56

ELEMENT NO 2 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		1015.00	645.78	66	0.013	0.00	0.00	0.00	0

ELEMENT NO 3 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		1032.67	645.96	66	0.013	22.50	45.00	0.00	0

ELEMENT NO 4 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		1344.29	649.08	66	0.013	0.00	0.00	0.00	0

ELEMENT NO 5 IS A JUNCTION * * * * * * *

	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		1344.29	649.09	48	48	42	0.013	107.0	53.0	649.09	649.09	90.00	90.00

ELEMENT NO 6 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		1610.01	651.47	48	0.013	0.00	0.00	0.00	0

ELEMENT NO 7 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		2042.05	653.71	48	0.013	0.00	0.00	0.00	0

ELEMENT NO 8 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		2474.01	655.95	48	0.013	0.00	0.00	0.00	0

ELEMENT NO 9 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		2608.10	656.70	48	0.013	0.00	0.00	0.00	0

ELEMENT NO 10 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		2897.80	658.14	48	0.013	544.00	31.00	0.00	0

ELEMENT NO 11 IS A JUNCTION * * * * * * *

	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		2897.80	658.15	48	24	24	0.013	2.5	2.5	658.65	658.65	90.00	90.00

F 0 5 1 5 P

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 12 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		2901.80	658.24	48	0.013	0.00	0.00	0.00	0

ELEMENT NO 13 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		3067.56	659.07	48	0.013	544.00	19.00	0.00	0

ELEMENT NO 14 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		3088.69	659.18	48	0.013	0.00	0.00	0.00	0

ELEMENT NO 15 IS A REACH * * *

	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		3268.68	660.08	48	0.013	556.00	24.00	0.00	0

ELEMENT NO 16 IS A JUNCTION * * * * * * *

	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		3268.68	660.09	36	36	0	0.013	41.0	0.0	660.58	0.00	45.00	0.00

ELEMENT NO 17 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	3320.43	660.34	36	0.013	556.00	24.00	0.00	0

ELEMENT NO 18 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	3320.43	660.34	36	0.00

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

WATER SURFACE PROFILE LISTING

3290 -
HELLMAN AVENUE
100

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1007.22	645.71	11.850	657.560	222.0	9.34	1.356	658.916	0.00	4.169	5.50	0.00	0.00	0	0.00
7.78	0.00900					.004370	0.03		3.381			0.00		
1015.00	645.78	11.814	657.594	222.0	9.34	1.356	658.950	0.00	4.169	5.50	0.00	0.00	0	0.00
17.67	0.01019					.004370	0.08		3.246			0.00		
1032.67	645.96	11.903	657.863	222.0	9.34	1.356	659.219	0.00	4.169	5.50	0.00	0.00	0	0.00
311.62	0.01001					.004370	1.36		3.264			0.00		
1344.29	649.08	10.145	659.225	222.0	9.34	1.356	660.581	0.00	4.169	5.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.003116	0.00					0.00		
1344.29	649.09	13.159	662.249	62.0	4.93	0.378	662.627	0.00	2.374	4.00	0.00	0.00	0	0.00
265.72	0.00896					.001863	0.50		1.895			0.00		
1610.01	651.47	11.274	662.744	62.0	4.93	0.378	663.122	0.00	2.374	4.00	0.00	0.00	0	0.00
432.04	0.00519					.001863	0.80		2.231			0.00		
2042.05	653.71	9.839	663.549	62.0	4.93	0.378	663.927	0.00	2.374	4.00	0.00	0.00	0	0.00
431.96	0.00519					.001863	0.80		2.231			0.00		
2474.01	655.95	8.404	664.354	62.0	4.93	0.378	664.732	0.00	2.374	4.00	0.00	0.00	0	0.00
134.09	0.00559					.001863	0.25		2.180			0.00		
2608.10	656.70	7.903	664.603	62.0	4.93	0.378	664.981	0.00	2.374	4.00	0.00	0.00	0	0.00
289.70	0.00497					.001863	0.54		2.261			0.00		
2897.80	658.14	7.047	665.187	62.0	4.93	0.378	665.565	0.00	2.374	4.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.001719	0.00					0.00		
2897.80	658.15	7.154	665.304	57.0	4.54	0.319	665.623	0.00	2.272	4.00	0.00	0.00	0	0.00
4.00	0.02250					.001575	0.01		1.404			0.00		

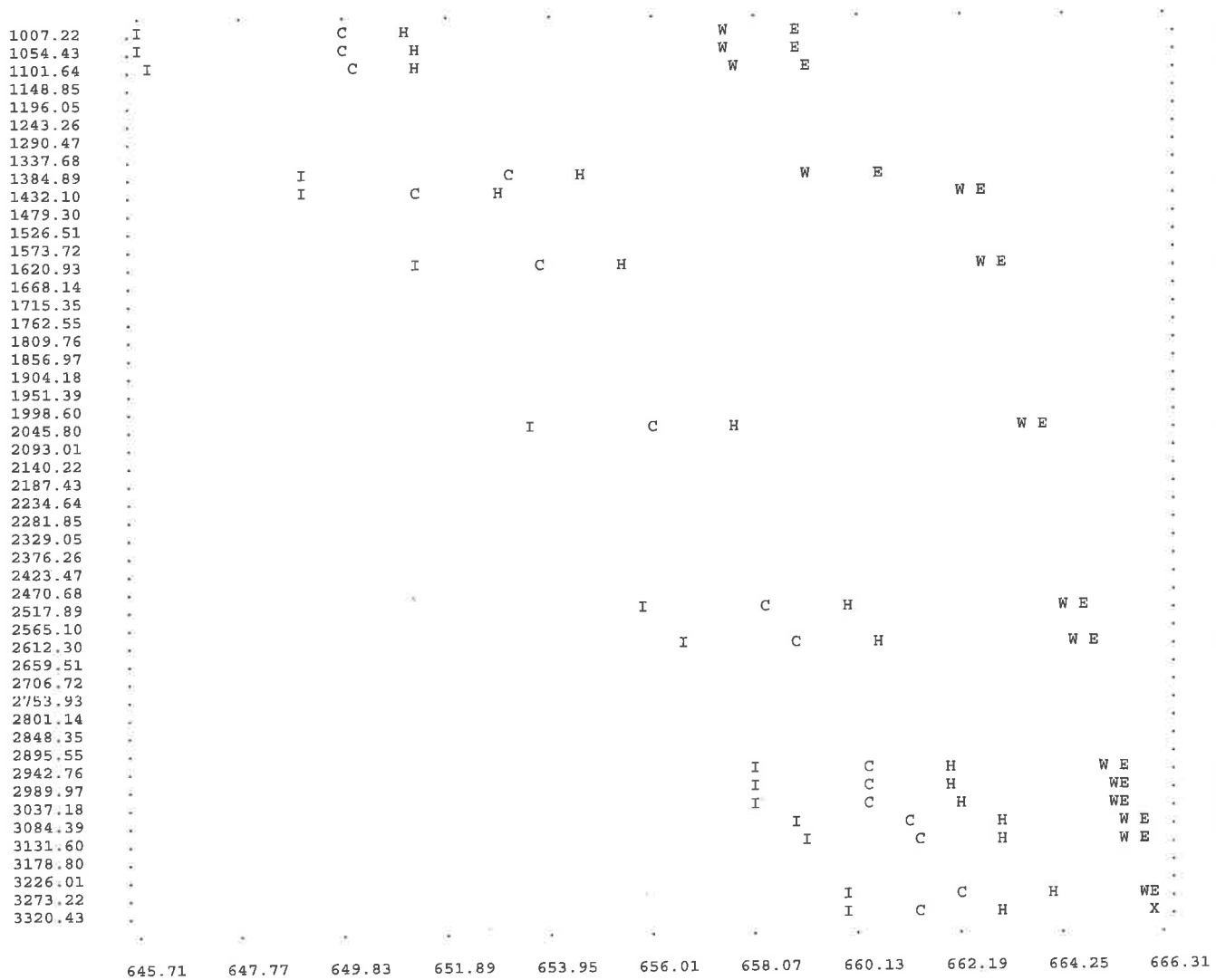
WATER SURFACE PROFILE LISTING

3290 -
HELLMAN AVENUE
100

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2901.80	658.24	7.071	665.311	57.0	4.54	0.319	665.630	0.00	2.272	4.00	0.00	0.00	0	0.00
165.76	0.00501					.001575	0.26		2.142			0.00		
3067.56	659.07	6.531	665.601	57.0	4.54	0.319	665.920	0.00	2.272	4.00	0.00	0.00	0	0.00
21.13	0.00521					.001575	0.03		2.117			0.00		
3088.69	659.18	6.454	665.634	57.0	4.54	0.319	665.953	0.00	2.272	4.00	0.00	0.00	0	0.00
179.99	0.00500					.001575	0.28		2.143			0.00		
3268.68	660.08	5.871	665.951	57.0	4.54	0.319	666.270	0.00	2.272	4.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.001075	0.00					0.00		
3268.68	660.09	6.101	666.191	16.0	2.26	0.080	666.271	0.00	1.277	3.00	0.00	0.00	0	0.00
51.75	0.00483					.000575	0.03		1.215			0.00		

3320.43	660.34	5.889	666.229	16.0	2.26	0.080	666.309	0.00	1.277		3.00	0.00	0.00	0	0.00□

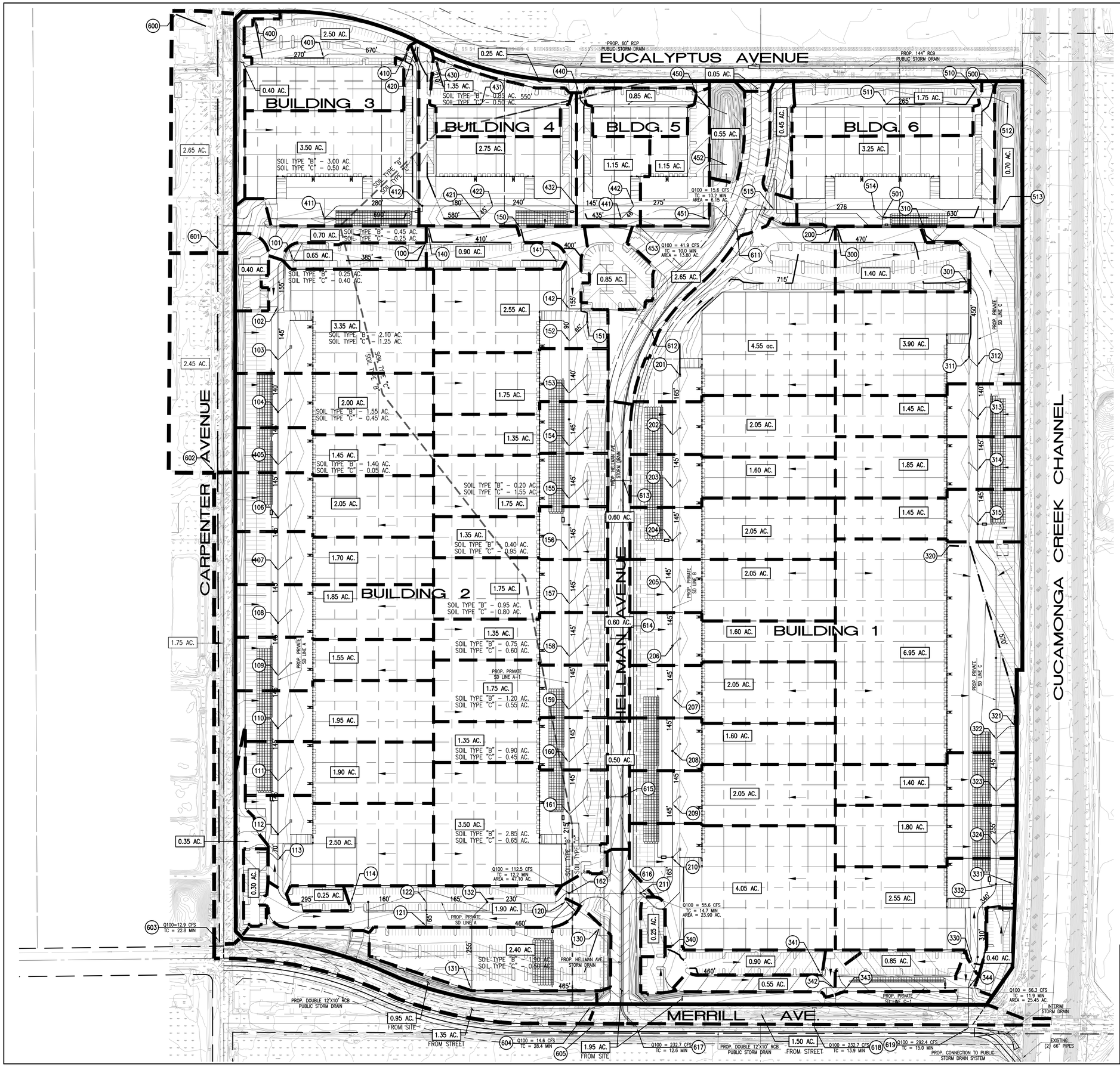
3290 -
HELLMAN AVENUE
100

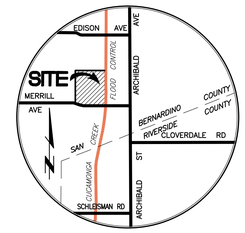


N O T E S
1. GLOSSARY
   I = INVERT ELEVATION
   C = CRITICAL DEPTH
   W = WATER SURFACE ELEVATION
   H = HEIGHT OF CHANNEL
   E = ENERGY GRADE LINE
   X = CURVES CROSSING OVER
   B = BRIDGE ENTRANCE OR EXIT
   Y = WALL ENTRANCE OR EXIT
2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY□

APPENDIX D

HYDROLOGY MAP





VICINITY MAP

N.T.S.

LEGEND

- PROJECT BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- SOIL TYPE BOUNDARY
- 1.00 AC. SUBAREA AREA
- 100 NODE NUMBER

0 50 100 200 300

SCALE:1"=100'

Last Update:10/6/17
O:\3200-3299\3290\3290HYD.dwg

PREPARED FOR:

ONTARIO LAND VENTURES, LLC
4100 MACARTHUR BOULEVARD, SUITE 120
NEWPORT BEACH, CA 92660
PHONE: (949) 954-3087
FAX: (213) 627-2138

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
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LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

CITY OF ONTARIO
PUBLIC WORKS DEPARTMENT

PROPOSED HYDROLOGY MAP
WEST ONTARIO COMMERCE CENTER
MERRILL AVENUE, CARPENTER AVENUE, AND EUCALYPTUS AVENUE

Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director _____ R.C.E. XXXXX

Sheet 1 of 1 Sheets

3290/1 OF 1 SHEET

PRELIMINARY
WATER QUALITY MANAGEMENT PLAN
(P-WQMP)

FOR:
WEST ONTARIO COMMERCE CENTER – BUILDING 1
MERRILL AVENUE, CARPENTER AVENUE, AND EUCALYPTUS AVENUE
ONTARIO, CALIFORNIA
APNS: 0218-261-016, -32 & 0218-271-04, -08, -10, -13, -18

ONTARIO LAND DEVELOPMENT FILE NO. PDEV16-_____

PREPARED FOR:
REAL ESTATE DEVELOPMENT ASSOCIATES
4100 MACARTHUR BOULEVARD, SUITE 120
NEWPORT BEACH, CA 92660
PHONE: (949) 954-3087
CONTACT: BILL GOLTERMANN

NOVEMBER 28, 2016

JOB NO. 3290

PREPARED BY:
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14349 FIRESTONE BLVD.
LA MIRADA, CALIFORNIA 90638
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FAX: (714) 521-4173
CONTACT: MATTHEW CRUZ (matthewc@thieneseng.com)

PRELIMINARY
WATER QUALITY MANAGEMENT PLAN
(P-WQMP)

FOR

"WEST ONTARIO COMMERCE CENTER BUILDING 1"

PREPARED BY MATTHEW CRUZ
UNDER THE SUPERVISION OF

_____

REINHARD STENZEL DATE
R.C.E. 56155
EXP. 12/31/18

Preliminary Water Quality Management Plan (PWQMP)

For compliance with Santa Ana Regional Water Quality Control Board

Order Number R8-2002-0012 (NPDES Permit No. CAS618036)

for

Project Name:	**West Ontario Commerce Center – Building 1**
Ontario Project #:	**PDEV16-_____**
Project Description:	**Light Industrial**
Applicant Name:	**Real Estate Development Associates**
Applicant Address:	**4100 MacArthur Boulevard, Suite 120 Newport Beach, CA 92660**
Project Address:	**Merrill Avenue, Carpenter Avenue, and Eucalyptus Avenue**
Size of Development:	**49.40 Acres**

1st Submittal Date: 11/28/2016

Preliminary Water Quality Management Plan (PWQMP)

1. Introduction

The Preliminary Water Quality Management Plan (PWQMP) is a planning tool to improve integration of required water quality elements, stormwater management, water conservation, rainwater harvesting and re-use, and flood management in land use planning and the City's development process. The Preliminary WQMP will assist project applicants and planners in properly designing and laying out project sites so that water quality may be incorporated in the most effective manner and at the lowest cost for the developer.

The San Bernardino County Municipal Separate Storm Sewer System Permit (MS4 Permit) requires project-specific Water Quality Management plans (WQMP) to be prepared for all priority new development and significant redevelopment projects listed in Section 2 of this document. The MS4 Permit stipulates that the City of Ontario require priority project applicants to submit a Preliminary project-specific WQMP, as early as possible, during the environmental review or planning phase of a development project and that the Preliminary WQMP be approved prior to the issuance of land use entitlement.

2. Priority Projects (requiring a Preliminary WQMP)

Land Use entitlement shall not be issued for any of the listed projects, below, until a Preliminary WQMP has been approved by the City's Engineering Department. For construction projects not going through entitlement, a Preliminary and Final project-specific WQMP shall be approved, prior to the issuance of construction permits:

Check the appropriate project category below, for this project:

Check below	**Project Categories**
X	1. All significant re-development projects. Significant re-development is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site subject to discretionary approval of the Permittee. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. Where redevelopment results in an increase of less than fifty percent of the impervious surfaces of a previously existing developed site, and the existing development was not subject to WQMP requirements, the numeric sizing criteria discussed below applies only to the addition or replacement, and not to the entire developed site. Where redevelopment results in an increase of fifty percent or more of the impervious surfaces of a previously existing developed site, the numeric sizing criteria applies to the entire development (new and existing).

Check below	**Project Categories**
	2. New development projects that create 10,000 square feet or more of impervious surface (collectively over the entire project site) including commercial, industrial, residential housing subdivisions (i.e., detached single family home subdivisions, multi-family attached subdivisions or townhomes, condominiums, apartments, etc.), mixed-use, and public projects. This category includes development projects on public and private land, which fall under the planning and building authority of the permitting agency.
	3. Automotive repair shops (with SIC codes 5013, 5014, 5541, 7532- 7534, 7536-7539).
	4. Restaurants and Food Service Establishments where the land area of development is 5,000 square feet or more.
	5. Developments of 2,500 square feet of impervious surface or more adjacent to (within 200 feet) or discharging directly into environmentally sensitive areas (ESA's) such as areas designated in the Ocean Plan as areas of special biological significance or waterbodies listed on the CWA Section 303(d) list of impaired waters.
	6. Parking lots of 5,000 square feet or more exposed to storm water. Parking lot is defined as land area or facility for the temporary storage of motor vehicles.
	7. Retail Gasoline Outlets (RGOs) that are either 5,000 sq ft or more, or have a projected average daily traffic of 100 or more vehicles per day.
	8. *This project is not covered under any of the categories listed above.

* If the development is not covered under any of the project categories listed in Section 2, the project is not required to design and install Site Design/LID BMPs or Treatment Control BMPs to treat the design storm event (Design Capture Volume) described in Section 4.

3. Preliminary WQMP Objectives

Through a combination of Site Design/LID BMPs (where feasible), Source Control, and/or Treatment Control BMPs, project-specific WQMPs shall address all identified pollutants and hydrologic conditions of concern from new development and significant re-development projects for the categories of projects (priority projects) listed in Section 2. Under each type of BMP, listed below, please indicate which BMPs are planned to be implemented and included in the Final WQMP for the project:

A. Site Design/LID (Low Impact Design) for Reducing Stormwater Runoff:

The MS4 Permit requires each priority development project to infiltrate, harvest and use, evapotranspire, or bio-treat the runoff from a 2-yr, 24-hour storm event (Design Capture Volume). If site conditions do not permit infiltration, harvest and use, evapotranspiration, and/or bio-treatment of the entire Design Capture Volume, at the project site, Site Design/LID techniques are required to be implemented to the Maximum Extent Practicable, at the project site, and the remainder of the DCV shall be infiltrated, harvested, bio-treated or treated by alternative measures.

Project applicants shall submit a Preliminary WQMP that documents the LID/Site Design BMPs, proposed for the project. Please indicate, in the table below, which Site Design/LID BMPs will be utilized on this project to accomplish this requirement:

Site Design/LID Practice	Planned	Not Planned
Provide at least the minimum effective area required for LID BMPs, to comply with the WQMP (see Table 3-1 below).		**X[1]**
Grade parking lot areas/drive aisles/roof drains to sheet flow runoff into landscaped swales, via curb cuts or zero-face curbs or otherwise disconnect direct drainage from MS4.		**X[2]**
Design landscaped areas as swales and grade to accept runoff from building roofs, parking lots and project roadways.		**X[2]**
Install surface retention basins or infiltration trenches to receive impervious area runoff.		**X[2]**
Install pervious pavement in parking stalls, alleys, driveways, gutters, walkways, trails or patios.		**X[2]**
Install underground stormwater retention chambers where downstream landscaped areas are limited.	**X**	
Install approved Stormwater Drywells in detention areas.		**X[2]**
Construct streets, sidewalks, and parking lot stalls to the minimum widths necessary.	**X**	
Install on-site Biotreatment basins/trenches with underdrains, where soil type is poorly draining.		**X[1]**
Install "Engineered Soil" to increase uptake/soil storage capacity and/or evapotranspiration.		**X[1]**
Install Rainwater Harvesting/Use Equipment.		**X[1]**
Utilize approved off-site retention/infiltration, biotreatment or proprietary treatment, where it is infeasible to install, on-site.		**X[1]**

[1] Project capable of retaining the full DCV onsite and not required to demonstrate this site design.
[2] A majority of the site will be captured and retained by the proposed underground infiltration facilities.

Table 3-1 Minimum Effective Area[1] Required for LID BMPs (surface + subsurface facilities) for Project WQMP to Demonstrate Infeasibility[2] (% of site)

Project Type	New Development	Re-Development
SF/MF Residential < 7 du/ac	10%	5%
SF/MF Residential < 7 - 18 du/ac	7%	3.5%
SF/MF Residential > 18 du/ac	5%	2.5%
Mixed Use, Commercial/Industrial w/FAR< 1.0	10%	5%
Mixed Use, Commercial/Industrial w/FAR 1.0-2.0	7%	3.5%
Mixed Use, Commercial/Industrial w/FAR> 2.0	5%	2.5%
Podium (parking under > 75% of project)	3%	1.5%
Zoning allowing development to property lines	2%	1%
Transit Oriented Development[3]	5%	2.5%
Parking	5%	2.5%

[1] "Effective area" is defined as land area which 1) is suitable for a retention/infiltration BMP (based on infeasibility criteria) and 2) is located down-gradient from building roof or paved areas, so that it may receive gravity flow runoff.
[2] Criteria only required if the project WQMP seeks to demonstrate that the full DCV cannot be feasibly managed on-site.
[3] Transit oriented development is defined as a project with development center within one half mile of a mass transit center.
Key: du/ac = dwelling units/acre, FAR = Floor Area Ratio = ratio of gross floor area of building to gross lot area, MF = Multi Family, SF = Single Family

B. Source Control BMPs – The following BMPs are designed to control stormwater pollutants and runoff water at the location where it is generated. Please indicate which of the listed BMPs are planned to be implemented for the project:

Source Control BMPs	Planned	Not Planned
Minimize non-stormwater site runoff through efficient irrigation system design and controllers.	**X**	
Minimize trash and debris in storm runoff through a regular parking lot, storage yard and roadway sweeping program.	**X**	
Provide proper covers/roofs and secondary containment for outside material storage & work areas.		**X[1]**
Provide solid roofs over all trash enclosures.	**X**	
Site Owner(s)/Property Manager/HOA or POA will be familiar with the project WQMP and stormwater BMPs.	**X**	
Owner or HOA or POA to provide Education/Training of site occupants and employees on stormwater BMPs.	**X**	
Install stormwater placards/stenciled messages with a "No Dumping" message on all on-site/off-site storm drain inlets.	**X**	
Provide contained equipment/vehicle wash rack areas that discharge to sanitary sewer.		**X[2]**

[1] Not applicable. No outside material storage or work areas. Secondary containment not needed.
[2] Not applicable, no vehicle wash areas.

C. Treatment Control BMPs – The following BMPs are designed to control stormwater pollutants where it is not feasible to install on-site Site Design/LID BMPs, with the requisite capacity to treat the Design Capture Volume for identified Pollutants of Concern or where pretreatment of stormwater runoff is required, ahead of infiltration BMPs. Please indicate which of the listed BMPs are planned to be implemented for the project:

Treatment Control BMP	Planned	Not Planned
Gravity Separator devices for pretreatment of sediment, trash/litter or Oil & Grease	**X**	
Proprietary Biofiltration vaults/devices		**X**
Media Cartridge Filtration Vaults		**X**
Proprietary Filter Inserts for on-site storm drain inlets or retention basin/trench overflow drains		**X**
Regional Treatment facilities are installed or are planned for installation, off-site, and provide a superior level of treatment or clear advantage to on-site treatment BMPs		**X**

4. Volume-based calculation (approximate) for sizing on-site or off-site Stormwater Retention/Infiltration, Harvest & Re-Use or Biotreatment facilities

1) Calculate the "Watershed Imperviousness Ratio", i, which is equal to the percent of impervious area in the BMP Drainage Area divided by 100.

2) Calculate the composite runoff coefficient C_{BMP} for the Drainage Area above using the following equation:

$$\mathbf{C_{BMP} = 0.858i^3 - 0.78i^2 + 0.774i + 0.04}$$

where: $\mathbf{C_{BMP}}$ = composite runoff coefficient; and,

i = watershed imperviousness ratio.

3) Determine the area-averaged "6-hour Mean Storm Rainfall", P_6, for the Drainage Area. This is calculated by multiplying the area averaged 2-year 1-hour value (0.55"-0.6") by the appropriate regression coefficient from Table 1 (1.4807). The 2-yr, 1-hr value for southern Ontario is approximately to 0.5" (P_6 = 0.5*1.4807 = 0.74 and northern Ontario is approximately 0.6" in/hr (P_6 = 0.6*1.4807 = 0.89).

4) Determine the appropriate drawdown time. Use the regression constant a = 1.582 for 24 hours and a = 1.963 for 48 hours. *Note: Regression constants are provided for both 24 hour and 48 hour drawdown times; however, 48 hour drawdown times should be used in most areas of California. Drawdown times in excess of 48 hours should be used with caution as vector breeding can be a problem after water has stood in excess of 72 hours. (Use of the 24 hour drawdown time should be limited to drainage areas with coarse soils (Class 'A' soils, that readily drain.)*

5) Calculate the "Maximized Detention Volume", P_0, using the following equation:

$$\mathbf{P_0 = a \cdot C_{BMP} \cdot P_6}$$

where: $\mathbf{P_0}$ = Maximized Detention Volume, in inches

a = 1.582 for 24 hour and a = 1.963 for 48 hour drawdown,

$\mathbf{C_{BMP}}$ = composite runoff coefficient; and,

$\mathbf{P_6}$ = 6-hour Mean Storm Rainfall, in inches

6) Calculate the "Target Capture Volume", V_0, using the following equation:

$$\mathbf{V_0 = (P_0 \cdot A) / 12}$$

where: $\mathbf{V_0}$ = Target Capture Volume, in acre-feet

$\mathbf{P_0}$ = Maximized Detention Volume, in inches; and,

A = BMP Drainage Area, in acres

Project Volume-based calculation (approximate) for planned on-site or off-site Stormwater Retention/Infiltration, Harvest & Re-Use or Biotreatment facilities:

Variable	Factor/Formula	DA 1 DMA 1 UG Chambers	DA 1 DMA 2 UG Chambers	DA 2 DMA 1 UG Chambers	DA 2 DMA 2 UG Chambers	DA 2 DMA 2 UG Chambers
Ratio of impervious surface/total site surface	(i)	0.95	0.95	0.95	0.95	0.95
C_{BMP}= runoff coefficient	$0.858i^3 - 0.78i^2 + 0.774i + 0.04 =$	0.807	0.807	0.807	0.807	0.807
P_6	**P_6 = 2-yr,1- hr depth*1.4807 =	0.825	0.825	0.825	0.825	0.825
Detention Volume-acre inches	P_0 = a * C_{BMP} * P_6 =	1.31	1.31	1.31	1.31	1.31
Drawdown rate of basin/trench (a)	1.582 for 24-hr drawdown or 1.963 for 48-hr drawdown =	1.963	1.963	1.963	1.963	1.963
Project Total Area (ac)	(A)	9.30	12.60	11.00	13.35	2.25
Design Capture Volume, cu. ft. (DCV)	V_0 = [(P_0 * A)/12]*43560 =	44,106	59,756	52,168	63,313	10,671
Retention/treatment Volume provided, cu. ft.	Dimensions of retention basin, trench, underground system or biotreatment basin provided =	44,198	59,878	52,205	63,380	10,674

**For P_6 value, use site coordinates and NOAA website to determine project's average 2-yr, 1-hr rainfall depth, at: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html
*Includes 0.60 acres of offsite run-on.

5. Hydrologic Conditions of Concern (HCOC) and use of the on-line San Bernardino County HCOC Map for determining necessary mitigation steps necessary if there are HCOCs downstream of a project:

Project applicants may access the on-line HCOC Map at: http://sbcounty.permitrack.com/WAP/. The map will indicate any hydrology concerns with downstream waterways that are hydraulically connected to the project and will indicate if there are any approved regional projects downstream that could be utilized for off-site mitigation of HCOCs. Please indicate here if the project will or will not be able to retain/infilter, harvest and use or biotreat and detain the DCV, on-site, as calculated in Section 4 and if there are HCOCs identified downstream of the project:

Retain or Harvest/Use the DCV on site?	Yes	**X**	No	
Biotreat the DCV but not infilter the runoff?	Yes		No	**X**
HCOCs identified downstream of site?	Yes		No	**X**

If the entire DCV will not be retained on site, the DCV is biotreated but not infiltered or additional detention capacity is needed to address identified HCOCs, downstream of the site, please list here, what additional mitigation measures will be utilized (on-site or off-site) to address HCOCs (see Section 4.2.1-4.2.3 of the SB County WQMP Technical Guidance):

The entire DCV will be retained on site.

6. Site Plan and Conceptual Grading/Drainage Plan requirements for submission with the Preliminary WQMP:

Provide a Site Plan and Conceptual Grading/Drainage Plan along with this Preliminary WQMP, which conceptually shows the proposed locations of buildings, homes, parking lots, parks, new paved roadways, landscaped areas, drainage patterns and drainage sub-areas, methods of conveyance, proposed retention/infiltration, harvest & use or biotreatment facilities that are planned for installation. Where it is determined to be infeasible to capture and detain design storm runoff volumes, on-site, please include other design features, as described in Section 3, above. Include numbered or lettered notes on the Site Plan with a legend detailing other BMPs, as described in Section 3.

DCV CALCULATIONS

www.nws.noaa.gov

NOAA's National Weather Service
Hydrometeorological Design Studies Center
Precipitation Frequency Data Server (PFDS)

Home Site Map News Organization Search NWS All NOAA Go

General Info
- Homepage
- Current Projects
- FAQ
- Glossary

Precipitation Frequency (PF)
- PF Data Server
- PF in GIS Format
- PF Maps
- Temporal Distr.
- Time Series Data
- PFDS Perform.
- PF Documents

Probable Maximum Precipitation (PMP)
- PMP Documents

Miscellaneous
- Publications
- AEP Storm Analysis
- Record Precipitation

Contact Us
- Inquiries
- List-server

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

DATA DESCRIPTION

Data type: precipitation depth **Units:** english **Time series type:** partial duration

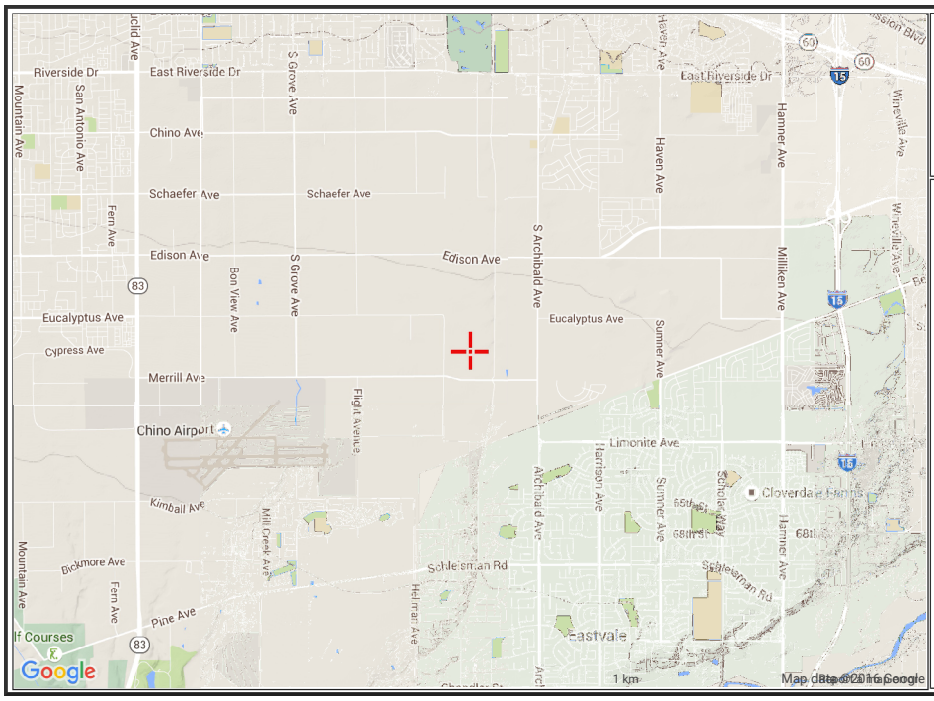
SELECT LOCATION

1. Manually:

a) Enter location (decimal degrees, use "-" for S and W): latitude: 33.986167 longitude: -117.603244 submit

b) Select station (click here for a list of stations used in frequency analysis for CA): select station

2. Use map:



a) Select location (move crosshair or double click)

b) Click on station icon (☐ show stations on map)

LOCATION INFORMATION:
Name: Ontario, California, US*
Latitude: 33.9862°
Longitude: -117.6032°
Elevation: 663 ft*

* source: Google Maps

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular PF graphical Supplementary information Print Page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years) 1	2	5	10	25	50	100	200	500	1000
5-min	0.112 (0.093-0.135)	0.147 (0.123-0.178)	0.193 (0.161-0.234)	0.230 (0.190-0.282)	0.280 (0.223-0.355)	0.318 (0.248-0.413)	0.357 (0.271-0.475)	0.397 (0.292-0.543)	0.450 (0.318-0.644)	0.492 (0.335-0.729)
10-min	0.160 (0.134-0.193)	0.211 (0.176-0.255)	0.277 (0.230-0.336)	0.330 (0.272-0.404)	0.402 (0.320-0.509)	0.456 (0.355-0.592)	0.512 (0.388-0.681)	0.568 (0.419-0.779)	0.645 (0.456-0.923)	0.705 (0.480-1.05)
15-min	0.193 (0.161-0.234)	0.255 (0.213-0.309)	0.335 (0.278-0.406)	0.399 (0.329-0.489)	0.486 (0.387-0.616)	0.552 (0.430-0.716)	0.619 (0.470-0.823)	0.687 (0.507-0.942)	0.780 (0.551-1.12)	0.852 (0.580-1.26)
30-min	0.287 (0.239-0.347)	0.378 (0.315-0.458)	0.496 (0.413-0.603)	0.592 (0.488-0.725)	0.720 (0.574-0.914)	0.818 (0.637-1.06)	0.918 (0.697-1.22)	1.02 (0.752-1.40)	1.16 (0.817-1.66)	1.26 (0.861-1.88)
60-min	0.423 (0.353-0.511)	0.557 (0.465-0.675)	0.731 (0.608-0.888)	0.872 (0.719-1.07)	1.06 (0.845-1.35)	1.21 (0.939-1.56)	1.35 (1.03-1.80)	1.50 (1.11-2.06)	1.71 (1.20-2.44)	1.86 (1.27-2.76)
2-hr	0.627 (0.523-0.758)	0.824 (0.687-0.998)	1.08 (0.894-1.31)	1.28 (1.05-1.56)	1.54 (1.23-1.96)	1.74 (1.36-2.26)	1.94 (1.47-2.58)	2.14 (1.58-2.93)	2.41 (1.70-3.45)	2.62 (1.78-3.88)
3-hr	0.783 (0.654-0.947)	1.03 (0.858-1.25)	1.34 (1.11-1.63)	1.59 (1.31-1.94)	1.91 (1.52-2.42)	2.15 (1.68-2.79)	2.40 (1.82-3.19)	2.64 (1.95-3.62)	2.97 (2.09-4.24)	3.21 (2.19-4.77)
6-hr	1.10 (0.919-1.33)	1.45 (1.21-1.75)	1.88 (1.56-2.28)	2.23 (1.84-2.73)	2.68 (2.13-3.40)	3.01 (2.35-3.91)	3.35 (2.54-4.45)	3.68 (2.72-5.05)	4.13 (2.91-5.90)	4.46 (3.04-6.62)
12-hr	1.44 (1.20-1.74)	1.90 (1.58-2.30)	2.48 (2.06-3.01)	2.94 (2.43-3.61)	3.55 (2.83-4.50)	4.00 (3.12-5.19)	4.45 (3.38-5.93)	4.91 (3.62-6.72)	5.50 (3.89-7.87)	5.96 (4.06-8.83)
24-hr	1.90 (1.68-2.19)	2.53 (2.24-2.93)	3.34 (2.95-3.87)	3.99 (3.49-4.65)	4.84 (4.10-5.84)	5.48 (4.55-6.75)	6.12 (4.96-7.72)	6.77 (5.34-8.77)	7.63 (5.78-10.3)	8.29 (6.06-11.6)
2-day	2.30 (2.04-2.66)	3.12 (2.76-3.60)	4.18 (3.69-4.84)	5.04 (4.40-5.88)	6.19 (5.24-7.46)	7.07 (5.86-8.70)	7.96 (6.44-10.0)	8.87 (6.99-11.5)	10.1 (7.64-13.6)	11.0 (8.08-15.4)

3-day	**2.48** (2.19–2.86)	**3.40** (3.00–3.92)	**4.61** (4.06–5.33)	**5.59** (4.89–6.52)	**6.92** (5.86–8.35)	**7.95** (6.60–9.79)	**9.00** (7.29–11.3)	**10.1** (7.95–13.1)	**11.6** (8.75–15.6)	**12.7** (9.30–17.7)
4-day	**2.68** (2.37–3.09)	**3.70** (3.27–4.28)	**5.05** (4.45–5.85)	**6.15** (5.38–7.18)	**7.65** (6.48–9.22)	**8.81** (7.31–10.8)	**10.0** (8.10–12.6)	**11.2** (8.85–14.5)	**12.9** (9.77–17.4)	**14.2** (10.4–19.8)
7-day	**3.10** (2.75–3.58)	**4.31** (3.81–4.97)	**5.90** (5.20–6.83)	**7.20** (6.30–8.40)	**8.99** (7.61–10.8)	**10.4** (8.61–12.8)	**11.8** (9.56–14.9)	**13.3** (10.5–17.2)	**15.3** (11.6–20.6)	**16.9** (12.3–23.5)
10-day	**3.37** (2.98–3.89)	**4.69** (4.14–5.41)	**6.44** (5.67–7.45)	**7.88** (6.89–9.19)	**9.86** (8.35–11.9)	**11.4** (9.46–14.0)	**13.0** (10.5–16.4)	**14.6** (11.5–19.0)	**16.9** (12.8–22.8)	**18.7** (13.7–26.1)
20-day	**4.02** (3.56–4.64)	**5.65** (4.99–6.52)	**7.84** (6.91–9.07)	**9.67** (8.45–11.3)	**12.2** (10.3–14.7)	**14.2** (11.8–17.5)	**16.3** (13.2–20.6)	**18.5** (14.6–24.0)	**21.6** (16.4–29.2)	**24.1** (17.6–33.6)
30-day	**4.74** (4.20–5.47)	**6.68** (5.90–7.71)	**9.31** (8.21–10.8)	**11.5** (10.1–13.5)	**14.7** (12.4–17.7)	**17.2** (14.3–21.2)	**19.8** (16.1–25.0)	**22.6** (17.8–29.3)	**26.6** (20.1–35.9)	**29.8** (21.8–41.6)
45-day	**5.63** (4.98–6.49)	**7.91** (6.99–9.13)	**11.1** (9.75–12.8)	**13.8** (12.0–16.1)	**17.6** (14.9–21.2)	**20.7** (17.2–25.5)	**24.1** (19.5–30.3)	**27.6** (21.8–35.8)	**32.7** (24.8–44.2)	**36.9** (27.0–51.5)
60-day	**6.52** (5.77–7.52)	**9.10** (8.04–10.5)	**12.7** (11.2–14.7)	**15.8** (13.8–18.4)	**20.3** (17.2–24.5)	**24.0** (19.9–29.5)	**27.9** (22.6–35.2)	**32.2** (25.4–41.7)	**38.4** (29.1–51.8)	**43.5** (31.8–60.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in csv format: precipitation frequency estimates Submit

Main Link Categories:
Home | NWC(OHD)

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center (formerly OHD)
1325 East West Highway
Silver Spring, MD 20910
Page Author: HDSC webmaster
Page last modified: August 27, 2014

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Worksheet H: Factor of Safety and Design Infiltration Rate Worksheet
Applicable to: Entire Site

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	2	0.50
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.75	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00

Combined Safety Factor, $S_{TOT} = S_A \times S_B$	2.50
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)	3.0
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$	1.20

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A double-ring infiltrometer test will be conducted at the project site to support a minimum measured infiltration result of 3.0 in/hr. The design infiltration rate is 1.20 in/hr after applying the appropriate safety factor. This design rate is suitable for infiltration facilities.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

FLOW-BASED BMP DESIGN

DA 1 DMA 1 – BIOCLEAN NUTRIENT SEPARATING BAFFLE BOX

Region		Valley	
Drainage Area (acres)		9.30	acres
Drainage Area (sq-ft)		**405,108**	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
1-hr 2-yr from NOAA		0.557	
Itensity Coeff		**0.2787**	
Intensity BMP (in/hr)		**0.310**	
Flow (cfs)	Q =	**2.33**	

Use NSBB-5-10.5-84
80% @ 75 Micron treats 2.57 cfs

DA 1 DMA 2 – BIOCLEAN NUTRIENT SEPARATING BAFFLE BOX

Region		Valley	
Drainage Area (acres)		12.60	acres
Drainage Area (sq-ft)		**548,856**	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
1-hr 2-yr from NOAA		0.557	
Itensity Coeff		**0.2787**	
Intensity BMP (in/hr)		**0.310**	
Flow (cfs)	Q =	**3.16**	

Use NSBB-6-12-84
80% @ 75 Micron treats 3.53 cfs

DA 2 DMA 1 – BIOCLEAN NUTRIENT SEPARATING BAFFLE BOX

Region		Valley	
Drainage Area (acres)		11.00	acres
Drainage Area (sq-ft)		**479,160**	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
1-hr 2-yr from NOAA		0.557	
Itensity Coeff		**0.2787**	
Intensity BMP (in/hr)		**0.310**	
Flow (cfs)	Q =	**2.76**	

Use NSBB-6-12-84
80% @ 75 Micron treats 3.53 cfs

DA 2 DMA 2 – BIOCLEAN NUTRIENT SEPARATING BAFFLE BOX

Region		Valley	
Drainage Area (acres)		13.35	acres
Drainage Area (sq-ft)		**581,526**	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
1-hr 2-yr from NOAA		0.557	
Itensity Coeff		**0.2787**	
Intensity BMP (in/hr)		**0.310**	
Flow (cfs)	Q =	**3.34**	

Use NSBB-6-12-84

80% @ 75 Micron treats 3.53 cfs

DA 2 DMA 3 – BIOCLEAN NUTRIENT SEPARATING BAFFLE BOX

Region		Valley	
Drainage Area (acres)		2.25	acres
Drainage Area (sq-ft)		**98,010**	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
1-hr 2-yr from NOAA		0.557	
Itensity Coeff		**0.2787**	
Intensity BMP (in/hr)		**0.310**	
Flow (cfs)	Q =	**0.56**	

Use NSBB-3-6-72

80% @ 75 Micron treats 0.88 cfs

VOLUME-BASED BMP DESIGN

DA 1 DMA 1 - UNDERGROUND INFILTRATION CHAMBERS

Region		Valley	
Drainage Area (acres)		9.30	acres
Drainage Area (sq-ft)		405,108	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		1.4807	
Mean 6-hr (P6)		0.825	
Drawdown Rate (a)		1.963	
DCV		44,106	cu-ft
DCV		1.013	acre-ft

StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management™

MC-3500 Site Calculator

Project Information:

Project Name:	West Ontario Commerce Center
Location:	Ontario, CA
Date:	11/28/2016
Engineer:	
StormTech RPM:	

System Requirements

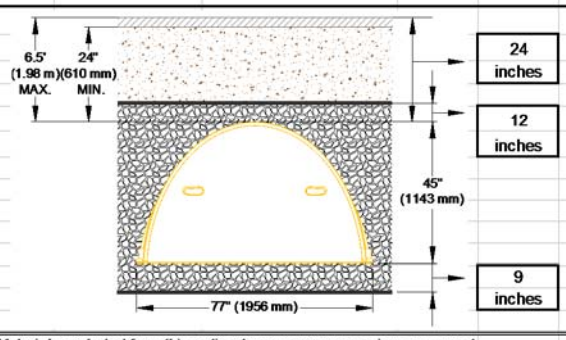
Units		Imperial	
Required Storage Volume		44106	CF
Stone Porosity (Industry Standard = 40%)		33	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		50	feet
Storage Volume per Chamber		166.8	CF
Storage Volume per End Cap		41.4	CF

System Sizing

Number of Chambers Required	262	each
Number of End Caps Required	12	each
Bed Size (including perimeter stone)	14,063	square feet
Stone Required (including perimeter stone)	2497	tons
Volume of Excavation	3386	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	4285	square yards
Length of Isolator Row	320.1	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	555	square yards
Woven Isolator Row Fabric (20% Safety Factor)	704	square yards
Installed Storage Volume	44,198	cubic feet

Controlled by Width (Rows)

Maximum Width =	50	feet
4 rows of 44 chambers		
2 row of 43 chambers		
Maximum Length =	320.11	feet
Maximum Width =	44.25	feet



*This represents the estimated material and site work costs (US dollars) for the project. Materials excluded from this estimate are conveyance pipe, pavement design, etc. It is always advisable to seek detailed construction costs from local installers. Please contact STORMTECH at 888-892-2694 for additional cost information.

DA 1 DMA 2 - UNDERGROUND INFILTRATION CHAMBERS

Region		Valley	
Drainage Area (acres)		12.60	acres
Drainage Area (sq-ft)		548,856	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		1.4807	
Mean 6-hr (P6)		0.825	
Drawdown Rate (a)		1.963	
DCV		59,756	cu-ft
DCV		1.372	acre-ft

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MC-3500 Site Calculator

Project Information:

Project Name:	West Ontario Commerce Center
Location:	Ontario, CA
Date:	11/28/2016
Engineer:	
StormTech RPM:	

System Requirements

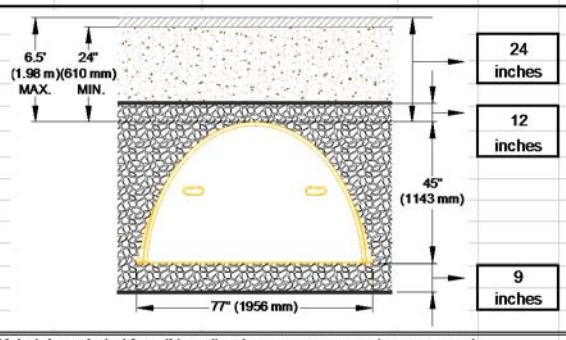
Units		Imperial	
Required Storage Volume		59756	CF
Stone Porosity (Industry Standard = 40%)		33	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		50	feet
Storage Volume per Chamber		166.8	CF
Storage Volume per End Cap		41.4	CF

System Sizing

Number of Chambers Required	356	each
Number of End Caps Required	12	each
Bed Size (including perimeter stone)	19,035	square feet
Stone Required (including perimeter stone)	3374	tons
Volume of Excavation	4582	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	5779	square yards
Length of Isolator Row	434.8	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	754	square yards
Woven Isolator Row Fabric (20% Safety Factor)	957	square yards
Installed Storage Volume	59,878	cubic feet

Controlled by Width (Rows)

Maximum Width =		50	feet
2 rows of	60	chambers	
4 row of	59	chambers	
Maximum Length =		434.79	feet
Maximum Width =		44.25	feet



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DA 2 DMA 1 - UNDERGROUND INFILTRATION CHAMBERS

Region		Valley	
Drainage Area (acres)		11.00	acres
Drainage Area (sq-ft)		479,160	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		1.4807	
Mean 6-hr (P6)		0.825	
Drawdown Rate (a)		1.963	
DCV		52,168	cu-ft
DCV		1.198	acre-ft

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MC-3500 Site Calculator

Project Information:

Project Name:	West Ontario Commerce Center
Location:	Ontario, CA
Date:	11/28/2016
Engineer:	
StormTech RPM:	

System Requirements

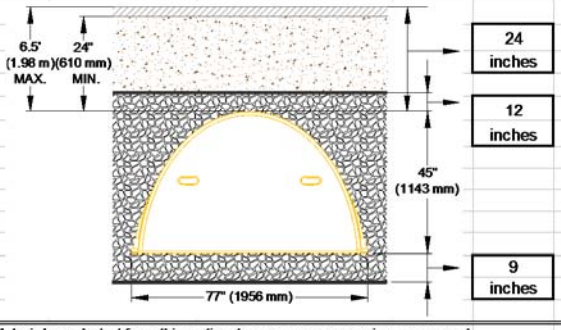
Units		Imperial	
Required Storage Volume		52168	CF
Stone Porosity (Industry Standard = 40%)		33	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		50	feet
Storage Volume per Chamber		166.8	CF
Storage Volume per End Cap		41.4	CF

System Sizing

Number of Chambers Required	310	each
Number of End Caps Required	12	each
Bed Size (including perimeter stone)	16,600	square feet
Stone Required (including perimeter stone)	2944	tons
Volume of Excavation	3996	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	5045	square yards
Length of Isolator Row	377.5	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	654	square yards
Woven Isolator Row Fabric (20% Safety Factor)	830	square yards
Installed Storage Volume	52,205	cubic feet

Controlled by Width (Rows)

Maximum Width =			50	feet
4	rows of	52	chambers	
2	row of	51	chambers	
Maximum Length =			377.45	feet
Maximum Width =			44.25	feet



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DA 2 DMA 2 - UNDERGROUND INFILTRATION CHAMBERS

Region		Valley	
Drainage Area (acres)		13.35	acres
Drainage Area (sq-ft)		581,526	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		1.4807	
Mean 6-hr (P6)		0.825	
Drawdown Rate (a)		1.963	
DCV		63,313	cu-ft
DCV		1.453	acre-ft

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MC-3500 Site Calculator

Project Information:

Project Name:	West Ontario Commerce Center
Location:	Ontario, CA
Date:	11/28/2016
Engineer:	
StormTech RPM:	

System Requirements

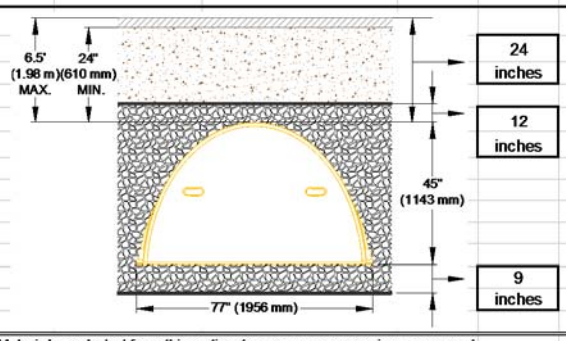
Units		Imperial	
Required Storage Volume		63313	CF
Stone Porosity (Industry Standard = 40%)		33	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		50	feet
Storage Volume per Chamber		166.8	CF
Storage Volume per End Cap		41.4	CF

System Sizing

Number of Chambers Required	377	each
Number of End Caps Required	12	each
Bed Size (including perimeter stone)	20,140	square feet
Stone Required (including perimeter stone)	3569	tons
Volume of Excavation	4849	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	6105	square yards
Length of Isolator Row	456.3	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	791	square yards
Woven Isolator Row Fabric (20% Safety Factor)	1004	square yards
Installed Storage Volume	63,380	cubic feet

Controlled by Width (Rows)

Maximum Width =		50	feet
5 rows of	63	chambers	
1 row of	62	chambers	
Maximum Length =		456.29	feet
Maximum Width =		44.25	feet



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DA 2 DMA 3 - UNDERGROUND INFILTRATION CHAMBERS

Region		Valley	
Drainage Area (acres)		2.25	acres
Drainage Area (sq-ft)		98,010	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		1.4807	
Mean 6-hr (P6)		0.825	
Drawdown Rate (a)		1.963	
DCV		10,671	cu-ft
DCV		0.245	acre-ft

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Subsurface Stormwater Management™

MC-3500 Site Calculator

Project Information:

Project Name:	West Ontario Commerce Center
Location:	Ontario, CA
Date:	11/28/2016
Engineer:	
StormTech RPM:	

System Requirements

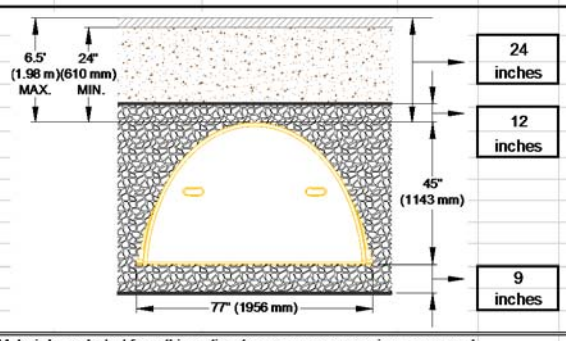
Units		Imperial	
Required Storage Volume		10671	CF
Stone Porosity (Industry Standard = 40%)		33	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		20	feet
Storage Volume per Chamber		166.8	CF
Storage Volume per End Cap		41.4	CF

System Sizing

Number of Chambers Required	63	each
Number of End Caps Required	4	each
Bed Size (including perimeter stone)	3,597	square feet
Stone Required (including perimeter stone)	662	tons
Volume of Excavation	866	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	1325	square yards
Length of Isolator Row	234.1	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	406	square yards
Woven Isolator Row Fabric (20% Safety Factor)	515	square yards
Installed Storage Volume	10,674	cubic feet

Controlled by Width (Rows)

Maximum Width =		20	feet
1 row of	32	chambers	
1 row of	31	chambers	
Maximum Length =		234.11	feet
Maximum Width =		15.58	feet



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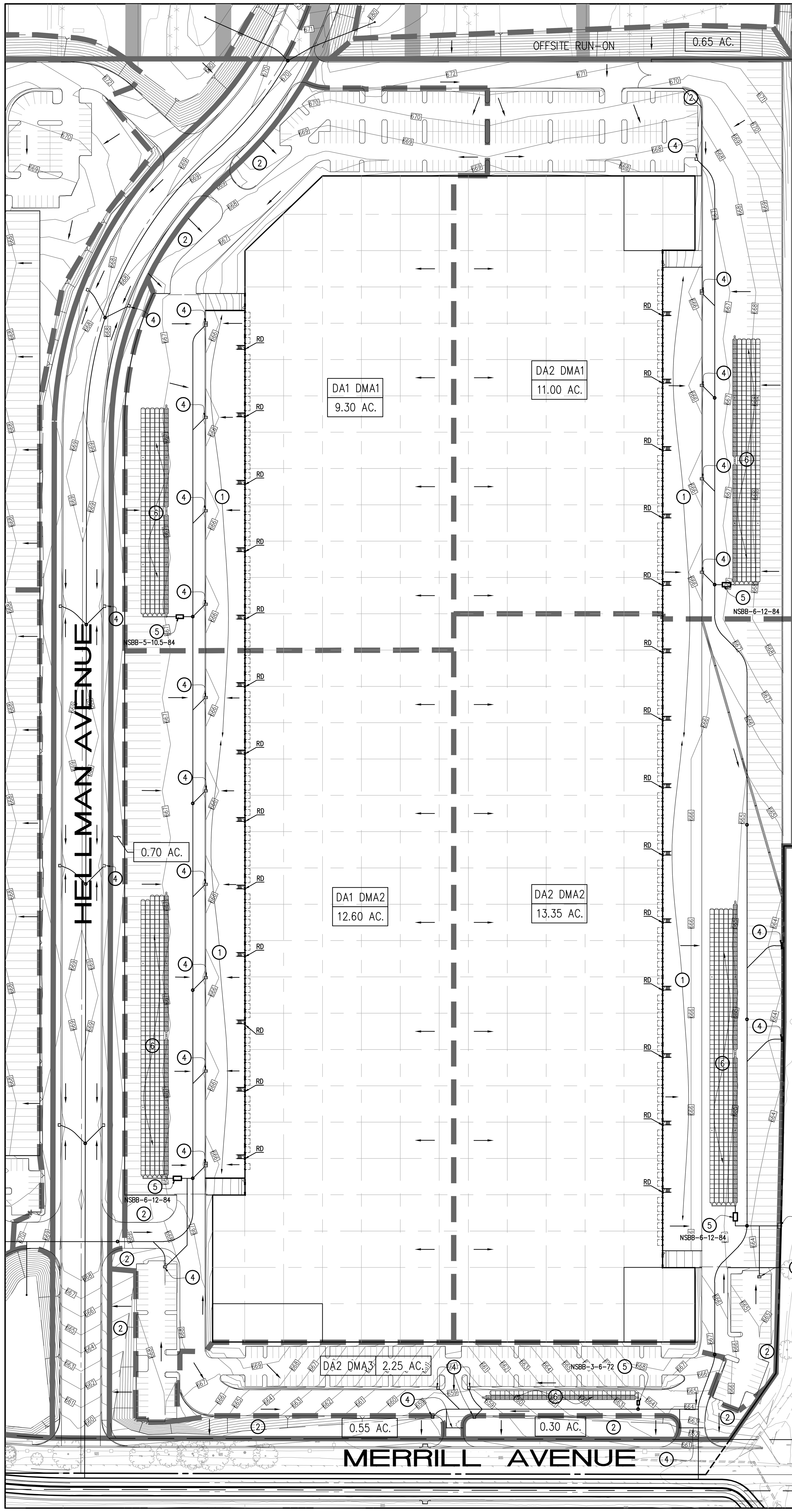
INFILTRATION FEASIBILITY

(PENDING)



0 40 80 160 240

SCALE: 1"=80'

SITE SPECIFIC DATA*			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS)			
PEAK FLOW RATE (CFS)			
PEAK STORM DURATION (YEARS)			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
OUTLET PIPE 1			
RIM ELEVATION			
SURFACE LOADING REQUIREMENT			
FRAME AND COVER			ø30"
GRADE RINGS/NECKING			ø30"
KNOWN GROUNDWATER ELEVATION			
NOTES:			
*PER ENGINEER OF RECORD			

NSBB PERFORMANCE DATA	
TREATMENT FLOW RATE (CFS)	2.57
SETTLING AREA (SF)	52.50
LOADING RATE (GPM/SF)	21.97
SCREEN SYSTEM STORAGE CAPACITY (CF)	24.97
SEDIMENT STORAGE CAPACITY (CF)	147.45
80% TSS REMOVAL @ 75 MICRONS	

NSBB STORAGE CAPACITIES				
FILTRATION SCREEN CAPACITY				
	LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
	5.92	2.67	1.58	24.97
SEDIMENT CHAMBER CAPACITY				
CHAMBER 1	3.33	5.00	3.00	49.95
CHAMBER 2	3.25	5.00	3.00	48.75
CHAMBER 3	3.25	5.00	3.00	48.75

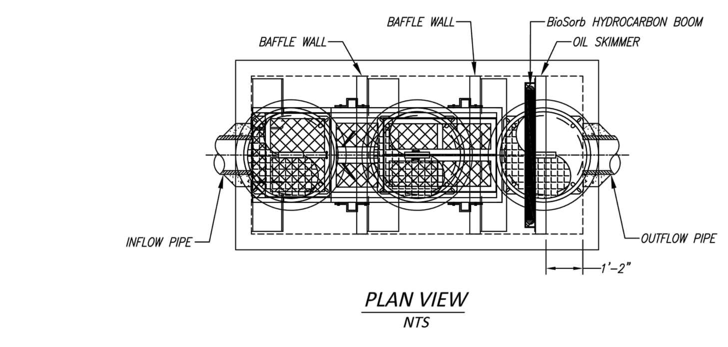
GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
3. SLIDING LIDS FOR SCREEN SYSTEM, SKIMBOSS AND ALTERNATIVE HATCHES AVAILABLE UPON REQUEST.
4. FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

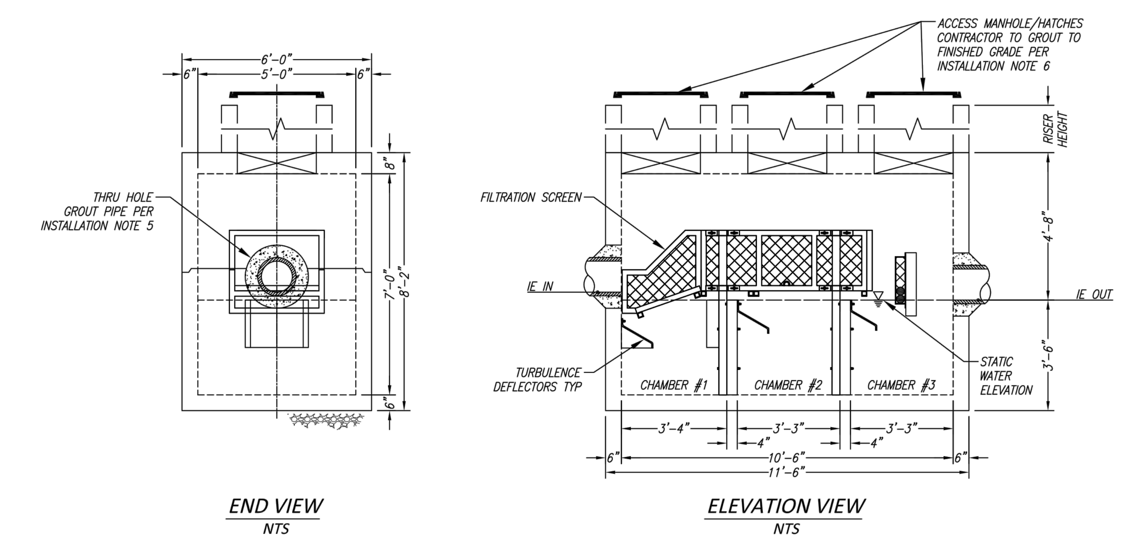
INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF OIL SKIMMER.
5. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
6. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

11/11/15JUSTIN



PLAN VIEW
NTS



END VIEW
NTS

ELEVATION VIEW
NTS

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PROPRIETARY AND CONFIDENTIAL:

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NSBB-5-10.5-84
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA*			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS)			
PEAK FLOW RATE (CFS)			
PEAK STORM DURATION (YEARS)			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
OUTLET PIPE 1			
RIM ELEVATION			
SURFACE LOADING REQUIREMENT			
FRAME AND COVER			ø36"
GRADE RINGS/NECKING			ø36"
KNOWN GROUNDWATER ELEVATION			
NOTES:			
*PER ENGINEER OF RECORD			

NSBB PERFORMANCE DATA	
TREATMENT FLOW RATE (CFS)	3.53
SETTLING AREA (SF)	72
LOADING RATE (GPM/SF)	22.00
SCREEN SYSTEM STORAGE CAPACITY (CF)	41.27
SEDIMENT STORAGE CAPACITY (CF)	203.94
80% TSS REMOVAL @ 75 MICRONS	

NSBB STORAGE CAPACITIES				
FILTRATION SCREEN CAPACITY				
	LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
	6.00	3.17	2.17	41.27
SEDIMENT CHAMBER CAPACITY				
CHAMBER 1	3.83	6.00	3.00	68.94
CHAMBER 2	3.75	6.00	3.00	67.50
CHAMBER 3	3.75	6.00	3.00	67.50

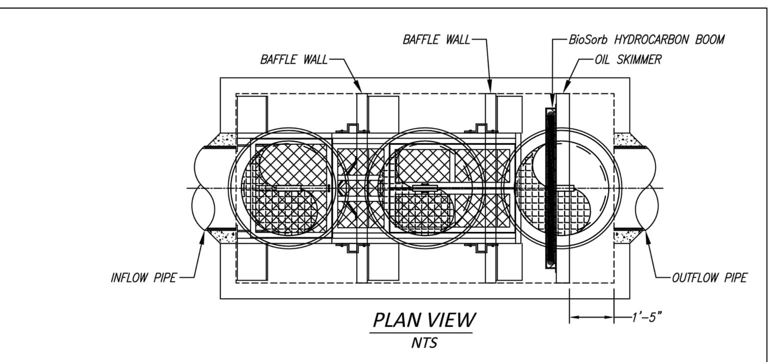
GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
3. SLIDING LIDS FOR SCREEN SYSTEM, SKIMBOSS AND ALTERNATIVE HATCHES AVAILABLE UPON REQUEST.
4. FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

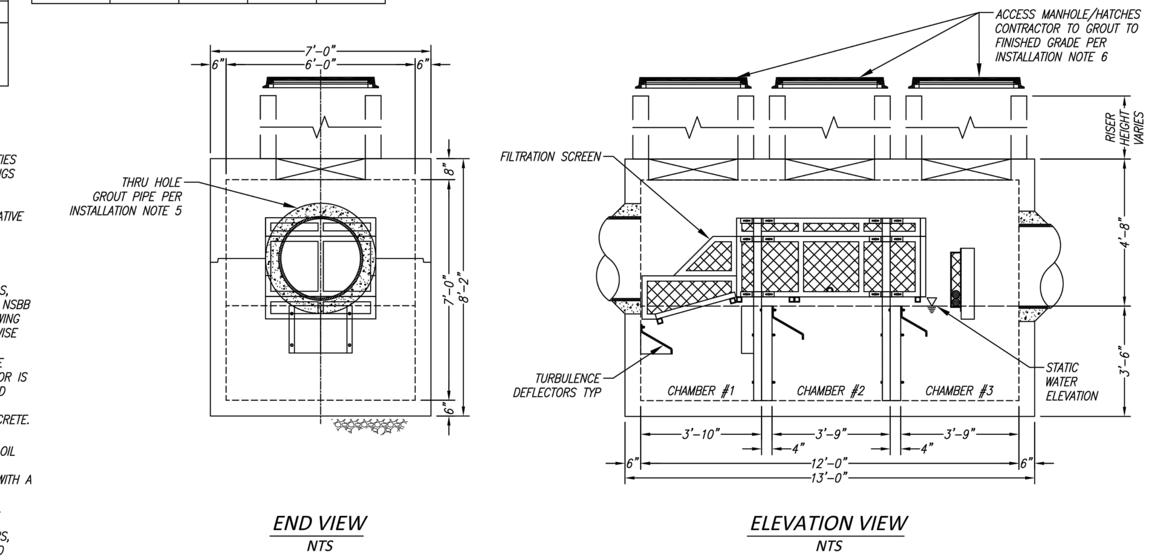
INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF OIL SKIMMER.
5. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
6. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

11/11/15JUSTIN



PLAN VIEW
NTS



END VIEW
NTS

ELEVATION VIEW
NTS

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NSBB-6-12-84
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA*			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS)			
PEAK FLOW RATE (CFS)			
PEAK STORM DURATION (YEARS)			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
OUTLET PIPE 1			
RIM ELEVATION			
SURFACE LOADING REQUIREMENT			
FRAME AND COVER			ø24"
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			
NOTES:			
*PER ENGINEER OF RECORD			

NSBB PERFORMANCE DATA	
TREATMENT FLOW RATE (CFS)	0.88
SETTLING AREA (SF)	18
LOADING RATE (GPM/SF)	21.94
SCREEN SYSTEM STORAGE CAPACITY (CF)	5.08
SEDIMENT STORAGE CAPACITY (CF)	50.94
80% TSS REMOVAL @ 75 MICRONS	

NSBB STORAGE CAPACITIES				
FILTRATION SCREEN CAPACITY				
	LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
	2.87	1.33	1.33	5.08
SEDIMENT CHAMBER CAPACITY				
CHAMBER 1	2.83	3.00	3.00	25.47
CHAMBER 2	2.83	3.00	3.00	25.47

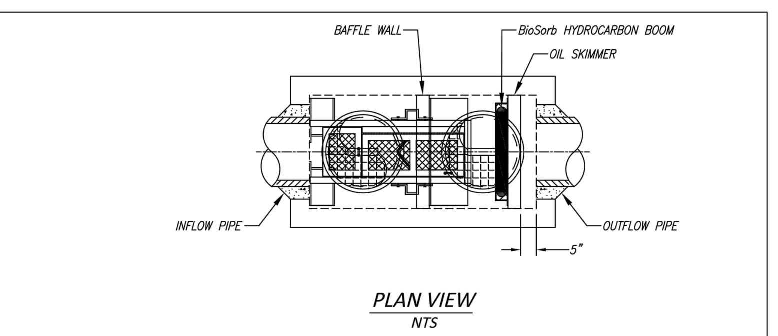
GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
3. SLIDING LIDS FOR SCREEN SYSTEM, SKIMBOSS AND ALTERNATIVE HATCHES AVAILABLE UPON REQUEST.
4. FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

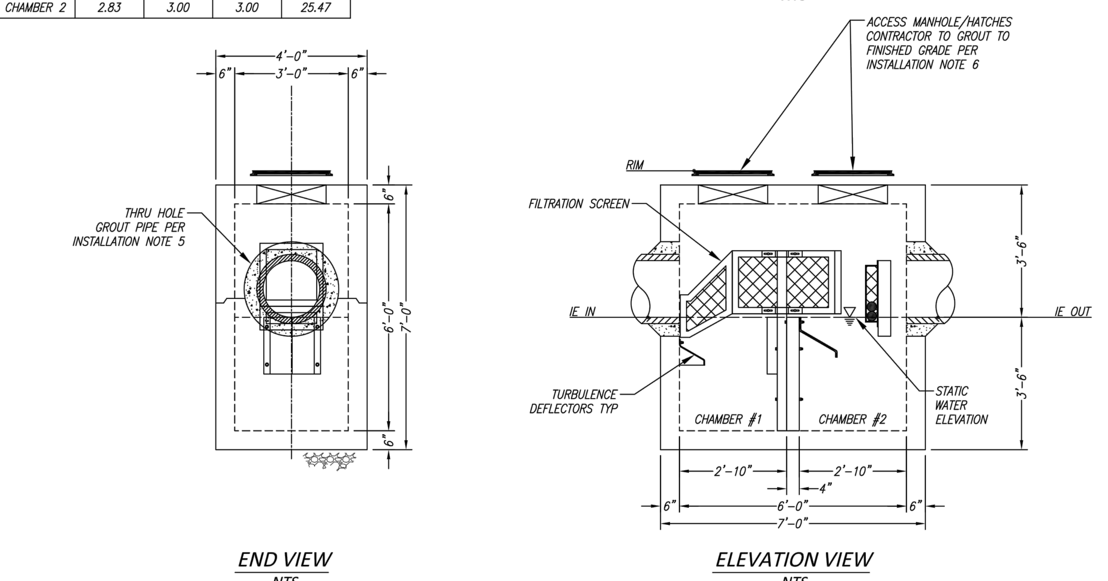
INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF OIL SKIMMER.
5. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
6. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

11/11/15JUSTIN



PLAN VIEW
NTS



END VIEW
NTS

ELEVATION VIEW
NTS

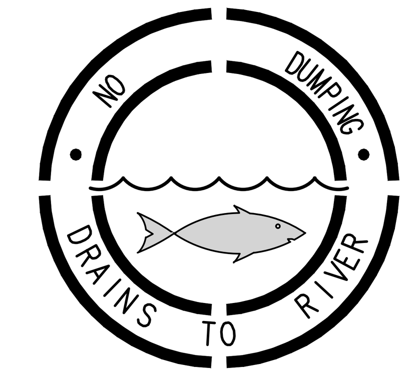
THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 6,428,692; 7,294,256; 7,846,327; 7,153,417; 7,270,747; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:

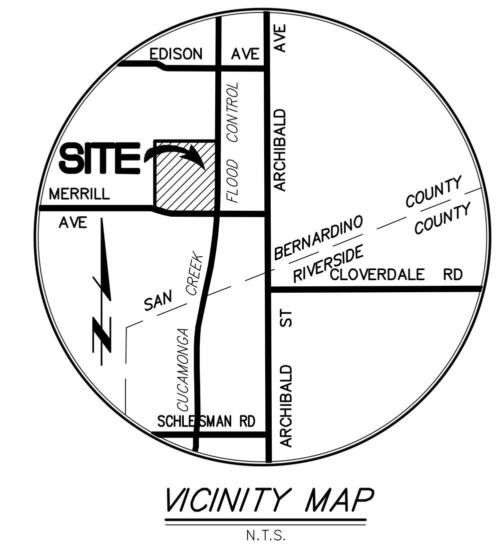
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF BIO CLEAN ENVIRONMENTAL SERVICES, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF BIO CLEAN ENVIRONMENTAL SERVICES, INC. IS PROHIBITED.

BIO CLEAN
biocleanenvironmental.com

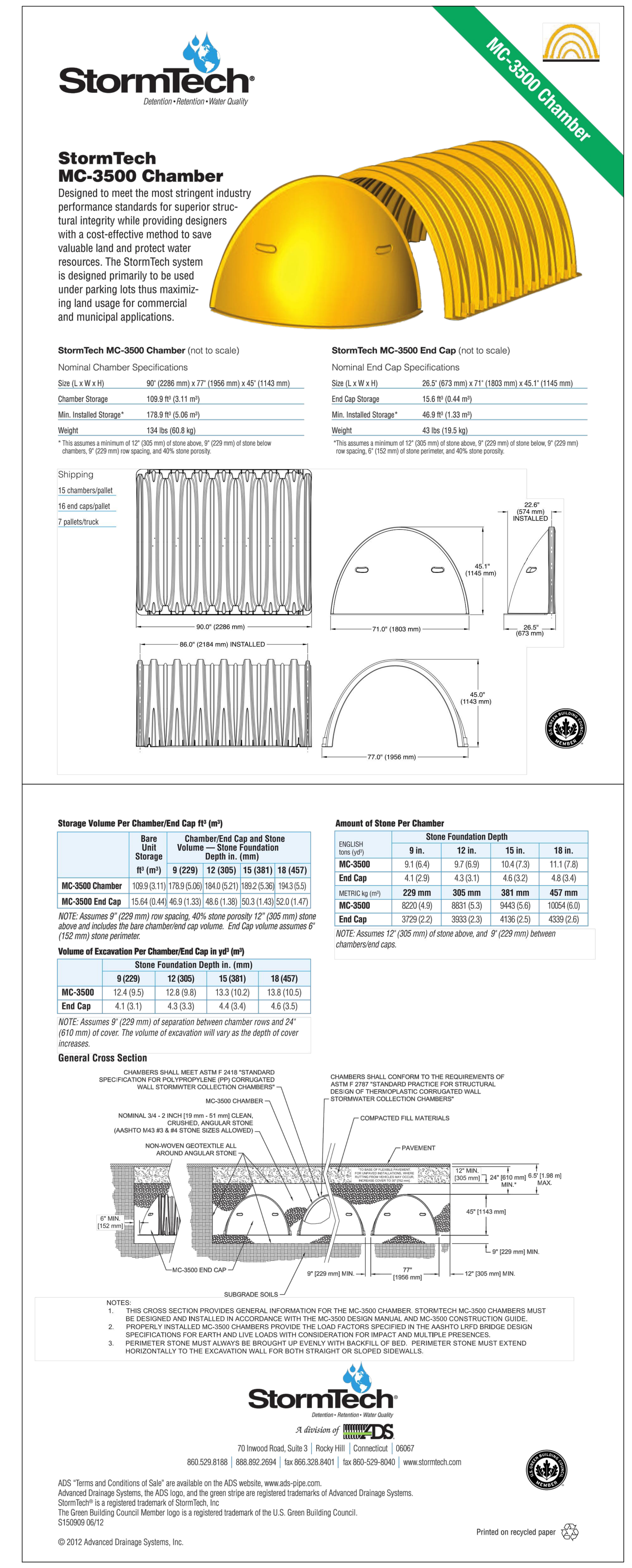
NSBB-3-6-72
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL



SAMPLE STENCIL TO BE USED AT GRATE AND CURB OPENING INLETS
SAMPLE CATCH BASIN STENCIL



VICINITY MAP
N.T.S.



LEGEND

1. ABOVEGROUND LOADING DOCK
2. LANDSCAPE/IRRIGATION
3. NOT USED
4. STORM DRAIN SYSTEM SIGNS "NO DUMPING - DRAINS TO RIVER"
5. BIO CLEAN NUTRIENT SEPARATING BAFFLE BOX MODEL # PER PLAN
6. MC-3500 UNDERGROUND CHAMBERS
7. NOT USED

NOTES:

RD	ROOF DRAIN
▬▬▬	BOUNDARY
▬ ▬	DRAINAGE AREAS
←	FLOW DIRECTION

Last Update: 11/28/16
O:\3200-3299\3290\3290BMPSITEMAP.dwg

PREPARED BY:

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CITY OF ONTARIO
PUBLIC WORKS DEPARTMENT

WQMP SITE MAP
WEST ONTARIO COMMERCE CENTER
MERRILL AVENUE, CARPENTER AVENUE, AND EUCALYPTUS AVENUE
BUILDING 1

Designed by ______
Date ______
Checked by ______
Date ______
Designed by ______
Date ______
Checked by ______
Date ______

Approved by Date ______

Public Works Director R.C.E. ______

Sheet 1 of 1 Sheets

3290/1 OF 1 SHEET

PRELIMINARY
WATER QUALITY MANAGEMENT PLAN
(P-WQMP)

FOR:
WEST ONTARIO COMMERCE CENTER – BUILDING 2
MERRILL AVENUE, CARPENTER AVENUE, AND EUCALYPTUS AVENUE
ONTARIO, CALIFORNIA
APNS: 0218-261-16, -22, -23, -32

ONTARIO LAND DEVELOPMENT FILE NO. PDEV16-_____

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NOVEMBER 28, 2016

JOB NO. 3290

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PRELIMINARY
WATER QUALITY MANAGEMENT PLAN
(P-WQMP)

FOR

"WEST ONTARIO COMMERCE CENTER BUILDING 2"

PREPARED BY MATTHEW CRUZ
UNDER THE SUPERVISION OF

_____

REINHARD STENZEL DATE
R.C.E. 56155
EXP. 12/31/18

Preliminary Water Quality Management Plan (PWQMP)

For compliance with Santa Ana Regional Water Quality Control Board

Order Number R8-2002-0012 (NPDES Permit No. CAS618036)

for

Project Name:	**West Ontario Commerce Center – Building 2**
Ontario Project #:	**PDEV16-_____**
Project Description:	**Light Industrial**
Applicant Name:	**Real Estate Development Associates**
Applicant Address:	**4100 MacArthur Boulevard, Suite 120 Newport Beach, CA 92660**
Project Address:	**Merrill Avenue, Carpenter Avenue, and Eucalyptus Avenue**
Size of Development:	**48.00 Acres**

1st Submittal Date: 11/28/2016

Preliminary Water Quality Management Plan (PWQMP)

1. Introduction

The Preliminary Water Quality Management Plan (PWQMP) is a planning tool to improve integration of required water quality elements, stormwater management, water conservation, rainwater harvesting and re-use, and flood management in land use planning and the City's development process. The Preliminary WQMP will assist project applicants and planners in properly designing and laying out project sites so that water quality may be incorporated in the most effective manner and at the lowest cost for the developer.

The San Bernardino County Municipal Separate Storm Sewer System Permit (MS4 Permit) requires project-specific Water Quality Management plans (WQMP) to be prepared for all priority new development and significant redevelopment projects listed in Section 2 of this document. The MS4 Permit stipulates that the City of Ontario require priority project applicants to submit a Preliminary project-specific WQMP, as early as possible, during the environmental review or planning phase of a development project and that the Preliminary WQMP be approved prior to the issuance of land use entitlement.

2. Priority Projects (requiring a Preliminary WQMP)

Land Use entitlement shall not be issued for any of the listed projects, below, until a Preliminary WQMP has been approved by the City's Engineering Department. For construction projects not going through entitlement, a Preliminary and Final project-specific WQMP shall be approved, prior to the issuance of construction permits:

Check the appropriate project category below, for this project:

Check below	**Project Categories**
X	1. All significant re-development projects. Significant re-development is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site subject to discretionary approval of the Permittee. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. Where redevelopment results in an increase of less than fifty percent of the impervious surfaces of a previously existing developed site, and the existing development was not subject to WQMP requirements, the numeric sizing criteria discussed below applies only to the addition or replacement, and not to the entire developed site. Where redevelopment results in an increase of fifty percent or more of the impervious surfaces of a previously existing developed site, the numeric sizing criteria applies to the entire development (new and existing).

Check below	**Project Categories**
	2. New development projects that create 10,000 square feet or more of impervious surface (collectively over the entire project site) including commercial, industrial, residential housing subdivisions (i.e., detached single family home subdivisions, multi-family attached subdivisions or townhomes, condominiums, apartments, etc.), mixed-use, and public projects. This category includes development projects on public and private land, which fall under the planning and building authority of the permitting agency.
	3. Automotive repair shops (with SIC codes 5013, 5014, 5541, 7532- 7534, 7536-7539).
	4. Restaurants and Food Service Establishments where the land area of development is 5,000 square feet or more.
	5. Developments of 2,500 square feet of impervious surface or more adjacent to (within 200 feet) or discharging directly into environmentally sensitive areas (ESA's) such as areas designated in the Ocean Plan as areas of special biological significance or waterbodies listed on the CWA Section 303(d) list of impaired waters.
	6. Parking lots of 5,000 square feet or more exposed to storm water. Parking lot is defined as land area or facility for the temporary storage of motor vehicles.
	7. Retail Gasoline Outlets (RGOs) that are either 5,000 sq ft or more, or have a projected average daily traffic of 100 or more vehicles per day.
	8. *This project is not covered under any of the categories listed above.

* If the development is not covered under any of the project categories listed in Section 2, the project is not required to design and install Site Design/LID BMPs or Treatment Control BMPs to treat the design storm event (Design Capture Volume) described in Section 4.

3. Preliminary WQMP Objectives

Through a combination of Site Design/LID BMPs (where feasible), Source Control, and/or Treatment Control BMPs, project-specific WQMPs shall address all identified pollutants and hydrologic conditions of concern from new development and significant re-development projects for the categories of projects (priority projects) listed in Section 2. Under each type of BMP, listed below, please indicate which BMPs are planned to be implemented and included in the Final WQMP for the project:

A. Site Design/LID (Low Impact Design) for Reducing Stormwater Runoff:

The MS4 Permit requires each priority development project to infiltrate, harvest and use, evapotranspire, or bio-treat the runoff from a 2-yr, 24-hour storm event (Design Capture Volume). If site conditions do not permit infiltration, harvest and use, evapotranspiration, and/or bio-treatment of the entire Design Capture Volume, at the project site, Site Design/LID techniques are required to be implemented to the Maximum Extent Practicable, at the project site, and the remainder of the DCV shall be infiltrated, harvested, bio-treated or treated by alternative measures.

Project applicants shall submit a Preliminary WQMP that documents the LID/Site Design BMPs, proposed for the project. Please indicate, in the table below, which Site Design/LID BMPs will be utilized on this project to accomplish this requirement:

Site Design/LID Practice	Planned	Not Planned
Provide at least the minimum effective area required for LID BMPs, to comply with the WQMP (see Table 3-1 below).		**X[1]**
Grade parking lot areas/drive aisles/roof drains to sheet flow runoff into landscaped swales, via curb cuts or zero-face curbs or otherwise disconnect direct drainage from MS4.		**X[2]**
Design landscaped areas as swales and grade to accept runoff from building roofs, parking lots and project roadways.		**X[2]**
Install surface retention basins or infiltration trenches to receive impervious area runoff.	**X**	
Install pervious pavement in parking stalls, alleys, driveways, gutters, walkways, trails or patios.		**X[2]**
Install underground stormwater retention chambers where downstream landscaped areas are limited.	**X**	
Install approved Stormwater Drywells in detention areas.		**X[2]**
Construct streets, sidewalks, and parking lot stalls to the minimum widths necessary.	**X**	
Install on-site Biotreatment basins/trenches with underdrains, where soil type is poorly draining.		**X[1]**
Install "Engineered Soil" to increase uptake/soil storage capacity and/or evapotranspiration.		**X[1]**
Install Rainwater Harvesting/Use Equipment.		**X[1]**
Utilize approved off-site retention/infiltration, biotreatment or proprietary treatment, where it is infeasible to install, on-site.		**X[1]**

[1] Project capable of retaining the full DCV onsite and not required to demonstrate this site design.
[2] A majority of the site will be captured and retained by the proposed underground infiltration facilities.

Table 3-1 Minimum Effective Area[1] Required for LID BMPs (surface + subsurface facilities) for Project WQMP to Demonstrate Infeasibility[2] (% of site)

Project Type	New Development	Re-Development
SF/MF Residential < 7 du/ac	10%	5%
SF/MF Residential < 7 - 18 du/ac	7%	3.5%
SF/MF Residential > 18 du/ac	5%	2.5%
Mixed Use, Commercial/Industrial w/FAR< 1.0	10%	5%
Mixed Use, Commercial/Industrial w/FAR 1.0-2.0	7%	3.5%
Mixed Use, Commercial/Industrial w/FAR> 2.0	5%	2.5%
Podium (parking under > 75% of project)	3%	1.5%
Zoning allowing development to property lines	2%	1%
Transit Oriented Development[3]	5%	2.5%
Parking	5%	2.5%

[1] "Effective area" is defined as land area which 1) is suitable for a retention/infiltration BMP (based on infeasibility criteria) and 2) is located down-gradient from building roof or paved areas, so that it may receive gravity flow runoff.
[2] Criteria only required if the project WQMP seeks to demonstrate that the full DCV cannot be feasibly managed on-site.
[3] Transit oriented development is defined as a project with development center within one half mile of a mass transit center.
Key: du/ac = dwelling units/acre, FAR = Floor Area Ratio = ratio of gross floor area of building to gross lot area, MF = Multi Family, SF = Single Family

B. Source Control BMPs – The following BMPs are designed to control stormwater pollutants and runoff water at the location where it is generated. Please indicate which of the listed BMPs are planned to be implemented for the project:

Source Control BMPs	Planned	Not Planned
Minimize non-stormwater site runoff through efficient irrigation system design and controllers.	**X**	
Minimize trash and debris in storm runoff through a regular parking lot, storage yard and roadway sweeping program.	**X**	
Provide proper covers/roofs and secondary containment for outside material storage & work areas.		**X[1]**
Provide solid roofs over all trash enclosures.	**X**	
Site Owner(s)/Property Manager/HOA or POA will be familiar with the project WQMP and stormwater BMPs.	**X**	
Owner or HOA or POA to provide Education/Training of site occupants and employees on stormwater BMPs.	**X**	
Install stormwater placards/stenciled messages with a "No Dumping" message on all on-site/off-site storm drain inlets.	**X**	
Provide contained equipment/vehicle wash rack areas that discharge to sanitary sewer.		**X[2]**

[1] Not applicable. No outside material storage or work areas. Secondary containment not needed.
[2] Not applicable, no vehicle wash areas.

C. Treatment Control BMPs – The following BMPs are designed to control stormwater pollutants where it is not feasible to install on-site Site Design/LID BMPs, with the requisite capacity to treat the Design Capture Volume for identified Pollutants of Concern or where pretreatment of stormwater runoff is required, ahead of infiltration BMPs. Please indicate which of the listed BMPs are planned to be implemented for the project:

Treatment Control BMP	Planned	Not Planned
Gravity Separator devices for pretreatment of sediment, trash/litter or Oil & Grease	X	
Proprietary Biofiltration vaults/devices		X
Media Cartridge Filtration Vaults		X
Proprietary Filter Inserts for on-site storm drain inlets or retention basin/trench overflow drains	X	
Regional Treatment facilities are installed or are planned for installation, off-site, and provide a superior level of treatment or clear advantage to on-site treatment BMPs		X

4. Volume-based calculation (approximate) for sizing on-site or off-site Stormwater Retention/Infiltration, Harvest & Re-Use or Biotreatment facilities

1) Calculate the "Watershed Imperviousness Ratio", i, which is equal to the percent of impervious area in the BMP Drainage Area divided by 100.

2) Calculate the composite runoff coefficient C_{BMP} for the Drainage Area above using the following equation:

$$\mathbf{C_{BMP} = 0.858i^3 - 0.78i^2 + 0.774i + 0.04}$$

where: $\mathbf{C_{BMP}}$ = composite runoff coefficient; and,

i = watershed imperviousness ratio.

3) Determine the area-averaged "6-hour Mean Storm Rainfall", P_6, for the Drainage Area. This is calculated by multiplying the area averaged 2-year 1-hour value (0.55"-0.6") by the appropriate regression coefficient from Table 1 (1.4807). The 2-yr, 1-hr value for southern Ontario is approximately to 0.5" (P_6 = 0.5*1.4807 = 0.74 and northern Ontario is approximately 0.6" in/hr (P_6 = 0.6*1.4807 = 0.89).

4) Determine the appropriate drawdown time. Use the regression constant a = 1.582 for 24 hours and a = 1.963 for 48 hours. *Note: Regression constants are provided for both 24 hour and 48 hour drawdown times; however, 48 hour drawdown times should be used in most areas of California. Drawdown times in excess of 48 hours should be used with caution as vector breeding can be a problem after water has stood in excess of 72 hours. (Use of the 24 hour drawdown time should be limited to drainage areas with coarse soils (Class 'A' soils, that readily drain.)*

5) Calculate the "Maximized Detention Volume", P_0, using the following equation:

$$\mathbf{P_0 = a \cdot C_{BMP} \cdot P_6}$$

where: $\mathbf{P_0}$ = Maximized Detention Volume, in inches

a = 1.582 for 24 hour and a = 1.963 for 48 hour drawdown,

$\mathbf{C_{BMP}}$ = composite runoff coefficient; and,

$\mathbf{P_6}$ = 6-hour Mean Storm Rainfall, in inches

6) Calculate the "Target Capture Volume", V_0, using the following equation:

$$\mathbf{V_0 = (P_0 \cdot A) / 12}$$

where: $\mathbf{V_0}$ = Target Capture Volume, in acre-feet

$\mathbf{P_0}$ = Maximized Detention Volume, in inches; and,

A = BMP Drainage Area, in acres

Project Volume-based calculation (approximate) for planned on-site or off-site Stormwater Retention/Infiltration, Harvest & Re-Use or Biotreatment facilities:

Variable	**Factor/Formula**	**DA1 DMA 1 Infiltration Basin**	**DA 1 DMA 2 UG Chambers**	**DA 1 DMA 3 UG Chambers**
Ratio of impervious surface/total site surface	(i)	0.95	0.95	0.95
C_{BMP}= runoff coefficient	$0.858i^3 - 0.78i^2 + 0.774i + 0.04 =$	0.807	0.807	0.807
P_6	**P_6 = 2-yr,1- hr depth*1.4807 =	0.825	0.825	0.825
Detention Volume-acre inches	$P_0 = a * C_{BMP} * P_6 =$	1.31	1.31	1.31
Drawdown rate of basin/trench (a)	1.582 for 24-hr drawdown or 1.963 for 48-hr drawdown =	1.963	1.963	1.963
Project Total Area (ac)	(A)	25.85	10.70	10.85
Design Capture Volume, cu. ft. (DCV)	$V_0 = [(P_0 * A)/12]*43560 =$	122,595	50,745	51,457
Retention/treatment Volume provided, cu. ft.	Dimensions of retention basin, trench, underground system or biotreatment basin provided =	123,314	50,870	51,538

**For P_6 value, use site coordinates and NOAA website to determine project's average 2-yr, 1-hr rainfall depth, at: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html
*Includes 0.60 acres of offsite run-on.

5. Hydrologic Conditions of Concern (HCOC) and use of the on-line San Bernardino County HCOC Map for determining necessary mitigation steps necessary if there are HCOCs downstream of a project:

Project applicants may access the on-line HCOC Map at: http://sbcounty.permitrack.com/WAP/. The map will indicate any hydrology concerns with downstream waterways that are hydraulically connected to the project and will indicate if there are any approved regional projects downstream that could be utilized for off-site mitigation of HCOCs. Please indicate here if the project will or will not be able to retain/infilter, harvest and use or biotreat and detain the DCV, on-site, as calculated in Section 4 and if there are HCOCs identified downstream of the project:

Retain or Harvest/Use the DCV on site?	Yes	**X**	No	
Biotreat the DCV but not infilter the runoff?	Yes		No	**X**
HCOCs identified downstream of site?	Yes		No	**X**

If the entire DCV will not be retained on site, the DCV is biotreated but not infiltered or additional detention capacity is needed to address identified HCOCs, downstream of the site, please list here, what additional mitigation measures will be utilized (on-site or off-site) to address HCOCs (see Section 4.2.1-4.2.3 of the SB County WQMP Technical Guidance):

The entire DCV will be retained on site.

6. Site Plan and Conceptual Grading/Drainage Plan requirements for submission with the Preliminary WQMP:

Provide a Site Plan and Conceptual Grading/Drainage Plan along with this Preliminary WQMP, which conceptually shows the proposed locations of buildings, homes, parking lots, parks, new paved roadways, landscaped areas, drainage patterns and drainage sub-areas, methods of conveyance, proposed retention/infiltration, harvest & use or biotreatment facilities that are planned for installation. Where it is determined to be infeasible to capture and detain design storm runoff volumes, on-site, please include other design features, as described in Section 3, above. Include numbered or lettered notes on the Site Plan with a legend detailing other BMPs, as described in Section 3.

DCV CALCULATIONS

www.nws.noaa.gov

NOAA's National Weather Service
Hydrometeorological Design Studies Center
Precipitation Frequency Data Server (PFDS)

Home Site Map News Organization Search NWS All NOAA Go

General Info
- Homepage
- Current Projects
- FAQ
- Glossary

Precipitation Frequency (PF)
- PF Data Server
- PF in GIS Format
- PF Maps
- Temporal Distr.
- Time Series Data
- PFDS Perform.
- PF Documents

Probable Maximum Precipitation (PMP)
- PMP Documents

Miscellaneous
- Publications
- AEP Storm Analysis
- Record Precipitation

Contact Us
- Inquiries
- List-server

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

DATA DESCRIPTION

Data type: precipitation depth **Units:** english **Time series type:** partial duration

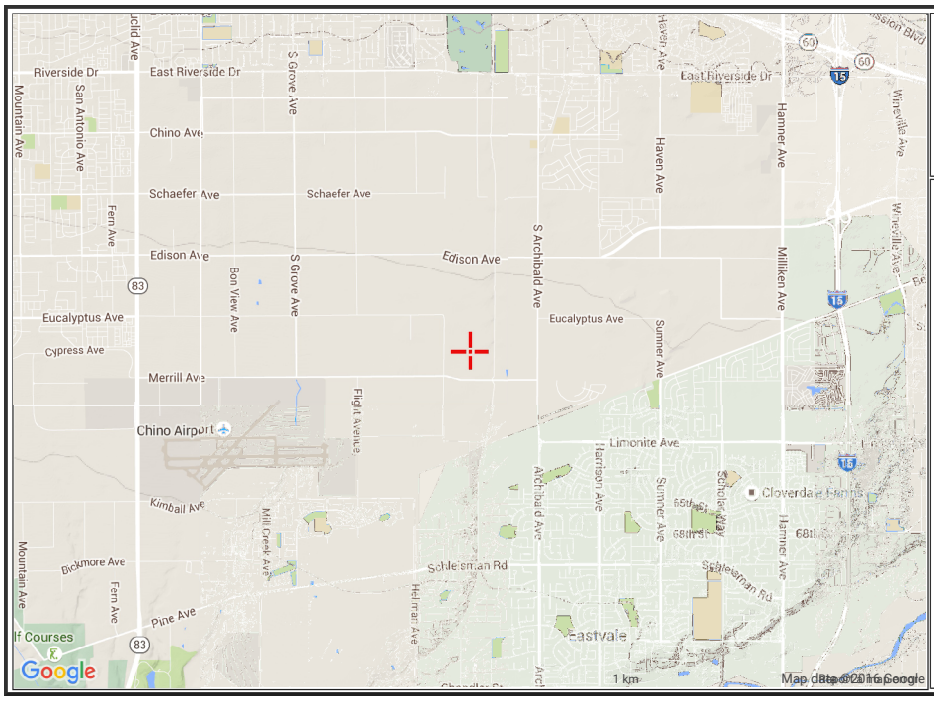
SELECT LOCATION

1. Manually:

a) Enter location (decimal degrees, use "-" for S and W): latitude: 33.986167 longitude: -117.603244 submit

b) Select station (click here for a list of stations used in frequency analysis for CA): select station

2. Use map:



a) Select location (move crosshair or double click)

b) Click on station icon (☐ show stations on map)

LOCATION INFORMATION:
Name: Ontario, California, US*
Latitude: 33.9862°
Longitude: -117.6032°
Elevation: 663 ft*

* source: Google Maps

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular PF graphical Supplementary information Print Page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years) 1	2	5	10	25	50	100	200	500	1000
5-min	0.112 (0.093-0.135)	0.147 (0.123-0.178)	0.193 (0.161-0.234)	0.230 (0.190-0.282)	0.280 (0.223-0.355)	0.318 (0.248-0.413)	0.357 (0.271-0.475)	0.397 (0.292-0.543)	0.450 (0.318-0.644)	0.492 (0.335-0.729)
10-min	0.160 (0.134-0.193)	0.211 (0.176-0.255)	0.277 (0.230-0.336)	0.330 (0.272-0.404)	0.402 (0.320-0.509)	0.456 (0.355-0.592)	0.512 (0.388-0.681)	0.568 (0.419-0.779)	0.645 (0.456-0.923)	0.705 (0.480-1.05)
15-min	0.193 (0.161-0.234)	0.255 (0.213-0.309)	0.335 (0.278-0.406)	0.399 (0.329-0.489)	0.486 (0.387-0.616)	0.552 (0.430-0.716)	0.619 (0.470-0.823)	0.687 (0.507-0.942)	0.780 (0.551-1.12)	0.852 (0.580-1.26)
30-min	0.287 (0.239-0.347)	0.378 (0.315-0.458)	0.496 (0.413-0.603)	0.592 (0.488-0.725)	0.720 (0.574-0.914)	0.818 (0.637-1.06)	0.918 (0.697-1.22)	1.02 (0.752-1.40)	1.16 (0.817-1.66)	1.26 (0.861-1.88)
60-min	0.423 (0.353-0.511)	0.557 (0.465-0.675)	0.731 (0.608-0.888)	0.872 (0.719-1.07)	1.06 (0.845-1.35)	1.21 (0.939-1.56)	1.35 (1.03-1.80)	1.50 (1.11-2.06)	1.71 (1.20-2.44)	1.86 (1.27-2.76)
2-hr	0.627 (0.523-0.758)	0.824 (0.687-0.998)	1.08 (0.894-1.31)	1.28 (1.05-1.56)	1.54 (1.23-1.96)	1.74 (1.36-2.26)	1.94 (1.47-2.58)	2.14 (1.58-2.93)	2.41 (1.70-3.45)	2.62 (1.78-3.88)
3-hr	0.783 (0.654-0.947)	1.03 (0.858-1.25)	1.34 (1.11-1.63)	1.59 (1.31-1.94)	1.91 (1.52-2.42)	2.15 (1.68-2.79)	2.40 (1.82-3.19)	2.64 (1.95-3.62)	2.97 (2.09-4.24)	3.21 (2.19-4.77)
6-hr	1.10 (0.919-1.33)	1.45 (1.21-1.75)	1.88 (1.56-2.28)	2.23 (1.84-2.73)	2.68 (2.13-3.40)	3.01 (2.35-3.91)	3.35 (2.54-4.45)	3.68 (2.72-5.05)	4.13 (2.91-5.90)	4.46 (3.04-6.62)
12-hr	1.44 (1.20-1.74)	1.90 (1.58-2.30)	2.48 (2.06-3.01)	2.94 (2.43-3.61)	3.55 (2.83-4.50)	4.00 (3.12-5.19)	4.45 (3.38-5.93)	4.91 (3.62-6.72)	5.50 (3.89-7.87)	5.96 (4.06-8.83)
24-hr	1.90 (1.68-2.19)	2.53 (2.24-2.93)	3.34 (2.95-3.87)	3.99 (3.49-4.65)	4.84 (4.10-5.84)	5.48 (4.55-6.75)	6.12 (4.96-7.72)	6.77 (5.34-8.77)	7.63 (5.78-10.3)	8.29 (6.06-11.6)
2-day	2.30 (2.04-2.66)	3.12 (2.76-3.60)	4.18 (3.69-4.84)	5.04 (4.40-5.88)	6.19 (5.24-7.46)	7.07 (5.86-8.70)	7.96 (6.44-10.0)	8.87 (6.99-11.5)	10.1 (7.64-13.6)	11.0 (8.08-15.4)

3-day	**2.48** (2.19–2.86)	**3.40** (3.00–3.92)	**4.61** (4.06–5.33)	**5.59** (4.89–6.52)	**6.92** (5.86–8.35)	**7.95** (6.60–9.79)	**9.00** (7.29–11.3)	**10.1** (7.95–13.1)	**11.6** (8.75–15.6)	**12.7** (9.30–17.7)
4-day	**2.68** (2.37–3.09)	**3.70** (3.27–4.28)	**5.05** (4.45–5.85)	**6.15** (5.38–7.18)	**7.65** (6.48–9.22)	**8.81** (7.31–10.8)	**10.0** (8.10–12.6)	**11.2** (8.85–14.5)	**12.9** (9.77–17.4)	**14.2** (10.4–19.8)
7-day	**3.10** (2.75–3.58)	**4.31** (3.81–4.97)	**5.90** (5.20–6.83)	**7.20** (6.30–8.40)	**8.99** (7.61–10.8)	**10.4** (8.61–12.8)	**11.8** (9.56–14.9)	**13.3** (10.5–17.2)	**15.3** (11.6–20.6)	**16.9** (12.3–23.5)
10-day	**3.37** (2.98–3.89)	**4.69** (4.14–5.41)	**6.44** (5.67–7.45)	**7.88** (6.89–9.19)	**9.86** (8.35–11.9)	**11.4** (9.46–14.0)	**13.0** (10.5–16.4)	**14.6** (11.5–19.0)	**16.9** (12.8–22.8)	**18.7** (13.7–26.1)
20-day	**4.02** (3.56–4.64)	**5.65** (4.99–6.52)	**7.84** (6.91–9.07)	**9.67** (8.45–11.3)	**12.2** (10.3–14.7)	**14.2** (11.8–17.5)	**16.3** (13.2–20.6)	**18.5** (14.6–24.0)	**21.6** (16.4–29.2)	**24.1** (17.6–33.6)
30-day	**4.74** (4.20–5.47)	**6.68** (5.90–7.71)	**9.31** (8.21–10.8)	**11.5** (10.1–13.5)	**14.7** (12.4–17.7)	**17.2** (14.3–21.2)	**19.8** (16.1–25.0)	**22.6** (17.8–29.3)	**26.6** (20.1–35.9)	**29.8** (21.8–41.6)
45-day	**5.63** (4.98–6.49)	**7.91** (6.99–9.13)	**11.1** (9.75–12.8)	**13.8** (12.0–16.1)	**17.6** (14.9–21.2)	**20.7** (17.2–25.5)	**24.1** (19.5–30.3)	**27.6** (21.8–35.8)	**32.7** (24.8–44.2)	**36.9** (27.0–51.5)
60-day	**6.52** (5.77–7.52)	**9.10** (8.04–10.5)	**12.7** (11.2–14.7)	**15.8** (13.8–18.4)	**20.3** (17.2–24.5)	**24.0** (19.9–29.5)	**27.9** (22.6–35.2)	**32.2** (25.4–41.7)	**38.4** (29.1–51.8)	**43.5** (31.8–60.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in csv format: precipitation frequency estimates Submit

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center (formerly OHD)
1325 East West Highway
Silver Spring, MD 20910
Page Author: HDSC webmaster
Page last modified: August 27, 2014

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Worksheet H: Factor of Safety and Design Infiltration Rate Worksheet
Applicable to: Entire Site

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	2	0.50
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.75	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00

Combined Safety Factor, $S_{TOT} = S_A \times S_B$	2.50
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)	3.0
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$	1.20

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A double-ring infiltrometer test will be conducted at the project site to support a minimum measured infiltration result of 3.0 in/hr. The design infiltration rate is 1.20 in/hr after applying the appropriate safety factor. This design rate is suitable for infiltration facilities.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

FLOW-BASED BMP DESIGN

DA 1 DMA 2 – BIOCLEAN NUTRIENT SEPARATING BAFFLE BOX

Region		Valley	
Drainage Area (acres)		10.70	acres
Drainage Area (sq-ft)		**466,092**	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
1-hr 2-yr from NOAA		0.557	
Itensity Coeff		**0.2787**	
Intensity BMP (in/hr)		**0.310**	
Flow (cfs)	Q =	**2.68**	

Use NSBB-6-12-84
80% @ 75 Micron treats 3.53 cfs

DA 1 DMA 3 – BIOCLEAN NUTRIENT SEPARATING BAFFLE BOX

Region		Valley	
Drainage Area (acres)		10.85	acres
Drainage Area (sq-ft)		**472,626**	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
1-hr 2-yr from NOAA		0.557	
Itensity Coeff		**0.2787**	
Intensity BMP (in/hr)		**0.310**	
Flow (cfs)	Q =	**2.72**	

Use NSBB-6-12-84
80% @ 75 Micron treats 3.53 cfs

VOLUME-BASED BMP DESIGN

DA 1 DMA 1 – INFILTRATION BASIN

Region		Valley	
Drainage Area (acres)		25.85	acres
Drainage Area (sq-ft)		1,126,026	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.807**	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		**1.4807**	
Mean 6-hr (P6)		**0.825**	
Drawdown Rate (a)		1.963	
DCV		**122,595**	cu-ft
DCV		**2.814**	acre-ft

3290 INFILTRATION BASIN

Elevation	Depth (feet)	Area (sq. ft.)	Volume (c.f.)	∑ Volume (c.f.)	∑ Volume (ac-ft)
656.00	0	51645			
			26,319	26,319	0.60
656.50	0.50	53630			
			27,315	53,634	1.23
657.00	1.00	55630			
			28,321	81,955	1.88
657.50	1.50	57655			
			29,338	111,293	2.55
658.00	2.00	59695			
			12,021	123,314	2.83
658.20	2.20	60515			
			18,340	141,654	3.25
658.50	2.50	61755			
			31,396	173,050	3.97
659.00	3.00	63830			
			65,938	238,988	5.49
660.00	4.00	68045			

DA 1 DMA 2 - UNDERGROUND INFILTRATION CHAMBERS

Region		Valley	
Drainage Area (acres)		10.70	acres
Drainage Area (sq-ft)		466,092	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		1.4807	
Mean 6-hr (P6)		0.825	
Drawdown Rate (a)		1.963	
DCV		50,745	cu-ft
DCV		1.165	acre-ft

StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management™

MC-3500 Site Calculator

Project Information:

Project Name:	West Ontario Commerce Center
Location:	Ontario, CA
Date:	11/28/2016
Engineer:	
StormTech RPM:	

System Requirements

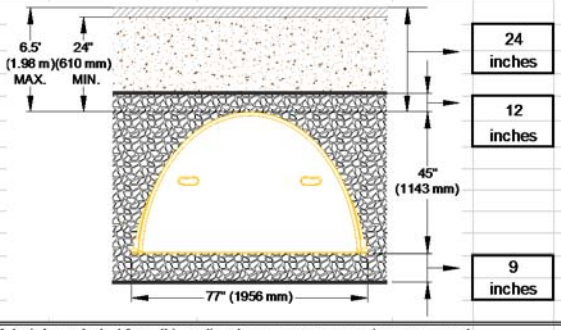
Units		Imperial	
Required Storage Volume		50745	CF
Stone Porosity (Industry Standard = 40%)		33	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		50	feet
Storage Volume per Chamber		166.8	CF
Storage Volume per End Cap		41.4	CF

System Sizing

Number of Chambers Required	302	each
Number of End Caps Required	12	each
Bed Size (including perimeter stone)	16,180	square feet
Stone Required (including perimeter stone)	2871	tons
Volume of Excavation	3895	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	4923	square yards
Length of Isolator Row	370.3	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	642	square yards
Woven Isolator Row Fabric (20% Safety Factor)	815	square yards
Installed Storage Volume	50,870	cubic feet

Controlled by Width (Rows)

Maximum Width =	50	feet
2 rows of 51 chambers		
4 row of 50 chambers		
Maximum Length =	370.28	feet
Maximum Width =	44.25	feet



*This represents the estimated material and site work costs (US dollars) for the project. Materials excluded from this estimate are conveyance pipe, pavement design, etc. It is always advisable to seek detailed construction costs from local installers. Please contact STORMTECH at 888-892-2694 for additional cost information.

DA 1 DMA 3 - UNDERGROUND INFILTRATION CHAMBERS

Region		Valley	
Drainage Area (acres)		10.85	acres
Drainage Area (sq-ft)		472,626	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.557	
P6 Coeff		1.4807	
Mean 6-hr (P6)		0.825	
Drawdown Rate (a)		1.963	
DCV		51,457	cu-ft
DCV		1.181	acre-ft

StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management™

MC-3500 Site Calculator

Project Information:

Project Name:	West Ontario Commerce Center
Location:	Ontario, CA
Date:	11/28/2016
Engineer:	
StormTech RPM:	

System Requirements

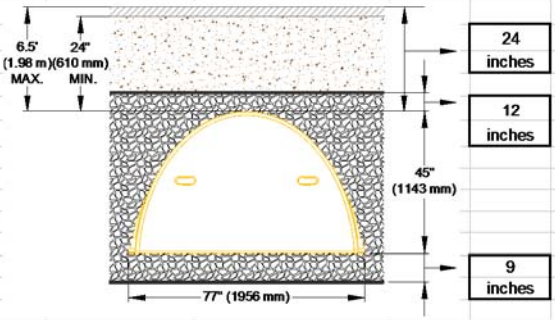
Units		Imperial	
Required Storage Volume		51457	CF
Stone Porosity (Industry Standard = 40%)		33	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		50	feet
Storage Volume per Chamber		166.8	CF
Storage Volume per End Cap		41.4	CF

System Sizing

Number of Chambers Required	306	each
Number of End Caps Required	12	each
Bed Size (including perimeter stone)	16,386	square feet
Stone Required (including perimeter stone)	2906	tons
Volume of Excavation	3945	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	4978	square yards
Length of Isolator Row	370.3	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	642	square yards
Woven Isolator Row Fabric (20% Safety Factor)	815	square yards
Installed Storage Volume	51,538	cubic feet

Controlled by Width (Rows)

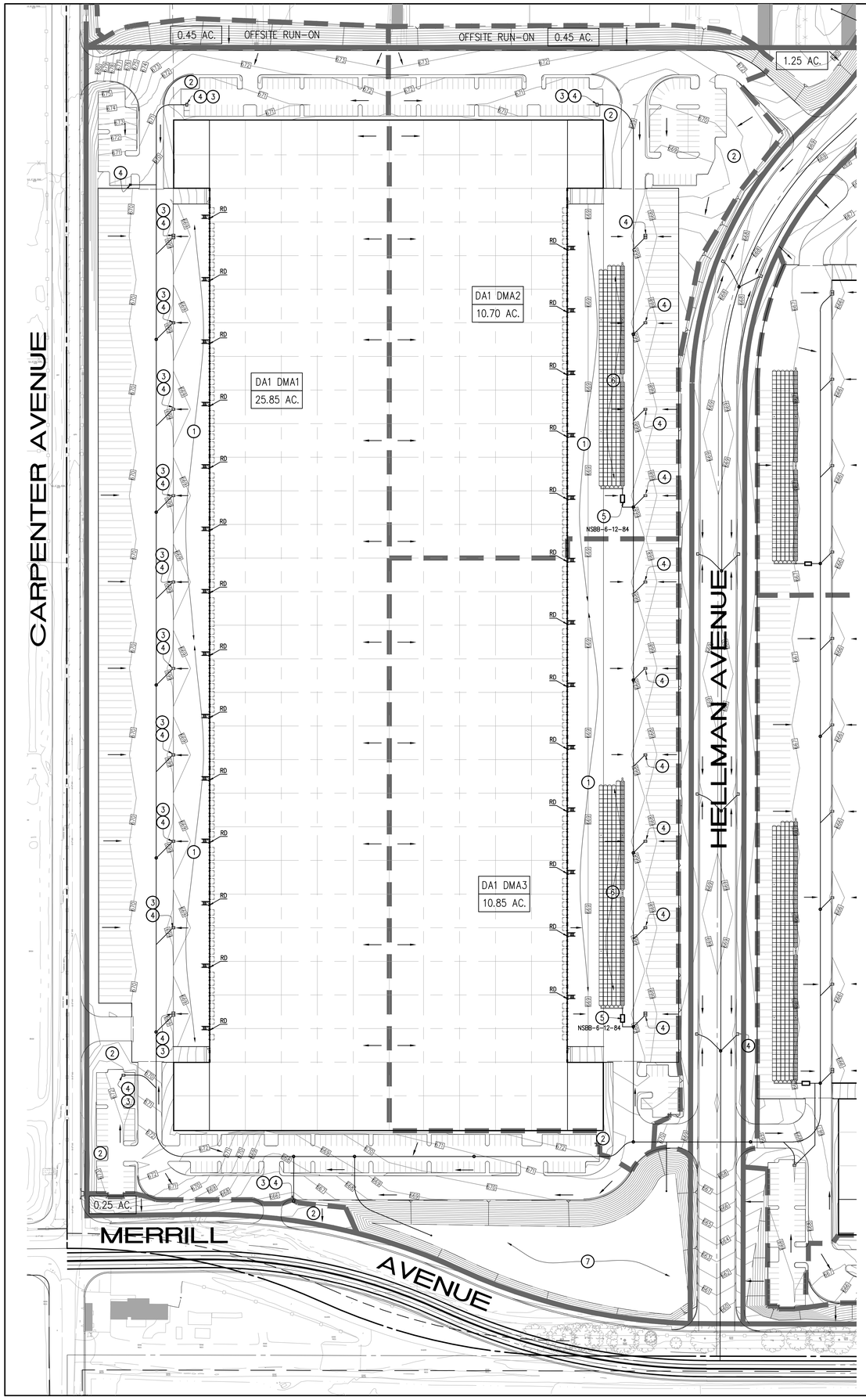
Maximum Width =	50	feet
6 rows of 51 chambers		
Maximum Length =	370.28	feet
Maximum Width =	44.25	feet



*This represents the estimated material and site work costs (US dollars) for the project. Materials excluded from this estimate are conveyance pipe, pavement design, etc. It is always advisable to seek detailed construction costs from local installers. Please contact STORMTECH at 888-892-2694 for additional cost information.

INFILTRATION FEASIBILITY

(PENDING)



SITE SPECIFIC DATA*			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS)			
PEAK FLOW RATE (CFS)			
PEAK STORM DURATION (YEARS)			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
OUTLET PIPE 1			
RIM ELEVATION			
SURFACE LOADING REQUIREMENT			
FRAME AND COVER			#36"
GRADE RING/RECKING			#36"
KNOWN GROUNDWATER ELEVATION			

NOTES:

*PER ENGINEER OF RECORD

NSBB PERFORMANCE DATA	
TREATMENT FLOW RATE (CFS)	3.53
SETTLING AREA (SF)	72
LOADING RATE (GPM/SF)	22.00
SCREEN SYSTEM STORAGE CAPACITY (CF)	41.27
SEDIMENT STORAGE CAPACITY (CF)	203.94
80% TSS REMOVAL @ 75 MICRONS	

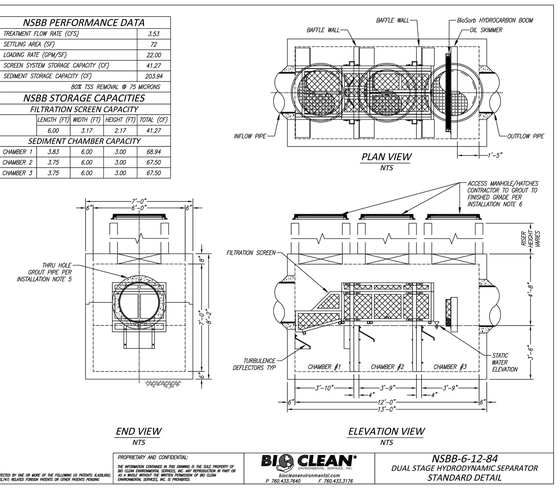
NSBB STORAGE CAPACITIES				
FILTRATION SCREEN CAPACITY				
	LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
	6.00	3.17	2.17	41.27
SEDIMENT CHAMBER CAPACITY				
CHAMBER 1	3.83	6.00	3.00	68.94
CHAMBER 2	3.75	6.00	3.00	67.50
CHAMBER 3	3.75	6.00	3.00	67.50

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
3. SLIDING LIDS FOR SCREEN SYSTEM, SKIMBOSS AND ALTERNATIVE HATCHES AVAILABLE UPON REQUEST.
4. FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF OIL SKIMMER.
5. GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
6. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.



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NSBB-6-12-84
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

StormTech
Detention • Retention • Water Quality

MC-3500 Chamber

StormTech MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.

StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	90" (2286 mm) x 77" (1956 mm) x 45" (1143 mm)
Chamber Storage	109.9 ft³ (3.11 m³)
Min. Installed Storage*	175.9 ft³ (5.06 m³)
Weight	134 lbs (60.8 kg)

* This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below chambers, 9" (229 mm) row spacing, and 40% stone porosity

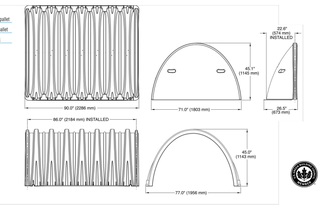
StormTech MC-3500 End Cap (not to scale)

Nominal End Cap Specifications

Size (L x W x H)	36.0" (873 mm) x 77" (1803 mm) x 45.1" (1145 mm)
End Cap Storage	15.6 ft³ (0.44 m³)
Min. Installed Storage*	46.9 ft³ (1.33 m³)
Weight	43 lbs (19.5 kg)

*This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below, 9" (229 mm) row spacing, 9" (152 mm) of stone perimeter, and 40% stone porosity.

Shipping
15 chambers/pallet
16 end caps/pallet
7 pallets/truck



Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)		
	ft³ (m³)	9 (229)	12 (305)	15 (381)	18 (457)
MC-3500 Chamber	109.9 (3.11)	175.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	15.64 (0.44)	46.9 (1.33)	48.6 (1.38)	50.3 (1.43)	52.0 (1.47)

NOTE: Assumes 9" (229 mm) row spacing, 40% stone porosity 12" (305 mm) stone above and includes the bare chamber/end cap volume. End Cap volume assumes 9" (152 mm) stone perimeter.

Volume of Excavation Per Chamber/End Cap in yd³ (m³)

	Stone Foundation Depth in. (mm)			
	9 (229)	12 (305)	15 (381)	18 (457)
MC-3500	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
End Cap	4.1 (3.1)	4.3 (3.3)	4.4 (3.4)	4.6 (3.5)

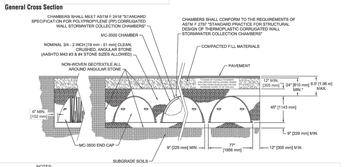
NOTE: Assumes 9" (229 mm) of separation between chamber rows and 24" (610 mm) of cover. The volume of excavation will vary as the depth of cover increases.

Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth			
	9 in.	12 in.	15 in.	18 in.
MC-3500	9.1 (6.4)	9.7 (6.9)	10.4 (7.3)	11.1 (7.8)
End Cap	4.1 (2.8)	4.3 (3.1)	4.6 (3.2)	4.8 (3.4)
METRIC kg (m³)	229 mm	305 mm	381 mm	457 mm
MC-3500	8255 (4.9)	8821 (5.3)	9440 (5.6)	10054 (6.0)
End Cap	3729 (2.2)	3933 (2.3)	4136 (2.5)	4339 (2.6)

NOTE: Assumes 12" (305 mm) of stone above, and 9" (229 mm) between chambers/end caps.

General Cross Section



NOTES:
1. THIS CROSS SECTION PROVIDES GENERAL INFORMATION FOR THE MC-3500 CHAMBER. STORMTECH MC-3500 CHAMBERS MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH THE MC-3500 DESIGN MANUAL AND MC-3500 CONSTRUCTION GUIDE.
2. PROPERLY INSTALLED MC-3500 CHAMBERS PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR EARTH AND LIVE LOADS WITH CONSIDERATION FOR IMPACT AND MULTIPLE PRESENCES.
3. PERIMETER STONE MUST ALWAYS BE BROUGHT UP EVENLY WITH BACKFILL OF BED. PERIMETER STONE MUST EXTEND HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH STRAIGHT OR SLOPED SIDEWALLS.

StormTech
Detention • Retention • Water Quality
A division of ADS
70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067
860.526.8188 | 888.892.2694 | fax 866.328.8401 | fax 860-529-8040 | www.stormtech.com

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S152003 06/12

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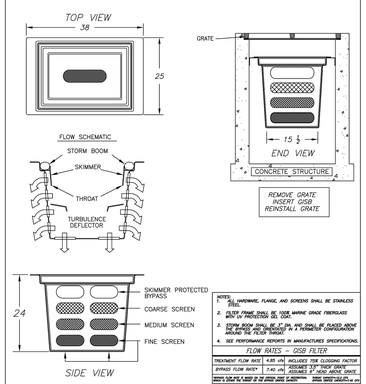
BIO CLEAN MODEL # GISB -25-38-24



NOTES:
1. ALL HARDWARE, FLANGE, AND SCREENS SHALL BE STAINLESS STEEL.
2. FILTER FRAME SHALL BE 100% MARINE GRADE FIBERGLASS WITH UV PROTECTION GEL COAT.
3. STORM BOOM SHALL BE 31 DIA. HDPE SHALL BE PLACED ABOUT 2FT. BELOW THE PIPE OR GRADE IN A PERIMETER CONFIGURATION.
4. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS.

FLOW RATES - GISB FILTER

TREATMENT FLOW RATE	4.81 cfs INCLUDES THE CLOGGING FACTOR
BYPASS FLOW RATE**	7.42 cfs ASSUMES 12" TOGR OPEN ASSUMES 3" HEAD ABOVE GRATE
100% SOLIDS BASED ON THE SIZE AND % OPENING OF THE SCREEN SYSTEM	SIZE OPENING VALUES IN (%)
**FLOW RATES CALCULATED USING THE FOLLOWING EQUATION Q=CCA*sq.rt. of 2gh	CONTRACTED OF = .67 e g = GRAVITY

DRAWING: GRATE INLET SKIMMER BOX (GISB) FILTER DETAILS
MODEL # GISB MEDIA FILTER-25-38-24
WARRANTY: 5 YEAR MANUFACTURERS

BIO CLEAN ENVIRONMENTAL SERVICES, INC.
PO BOX 869 OCEANSIDE, CA 92049
PHONE: 760-433-7640 FAX: 760-433-3176

DATE: 10/5/12 SCALE: 9" = 15
DRAFTER: LA SHEET = INCHES

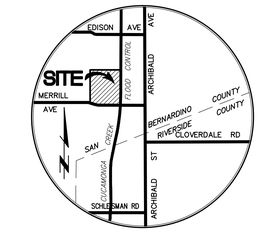
PATENTED

PROJECT:

REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

BIO CLEAN®
WWW.BIOCLEANENVIRONMENTAL.COM

PAGE 1



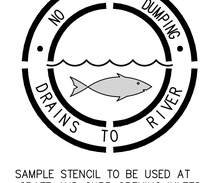
VICINITY MAP
N.T.S.

LEGEND

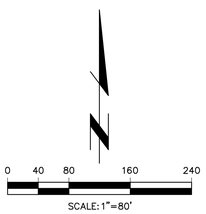
1. ABOVEGROUND LOADING DOCK
2. LANDSCAPE/IRRIGATION
3. DRAIN INSERTS
4. STORM DRAIN SYSTEM SIGNS "NO DUMPING – DRAINS TO RIVER"
5. BIO CLEAN NUTRIENT SEPARATING BAFFLE BOX MODEL # PER PLAN
6. MC-3500 UNDERGROUND CHAMBERS
7. INFILTRATION BASIN
8. NOT USED

NOTES:

RD ROOF DRAIN
BOUNDARY
DRAINAGE AREAS
FLOW DIRECTION



SAMPLE STENCIL TO BE USED AT GRATE AND CURB OPENING INLETS
SAMPLE CATCH BASIN STENCIL



Last Update: 11/28/18
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CITY OF ONTARIO

PUBLIC WORKS DEPARTMENT

WQMP SITE MAP

WEST ONTARIO COMMERCE CENTER
MERRILL AVENUE, CARPENTER AVENUE, AND EUCALYPTUS AVENUE
BUILDING 2

Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director _____ R.C.E. _____
Sheet 1 of 1 Sheets

3290/1 OF 1 SHEET