PRELIMINARY
HYDROLOGY AND HYDRAULIC REPORT

TOMLINSON NORTH PROPERTY
COUNTY OF SAN DIEGO
TM 5573

Prepared for:

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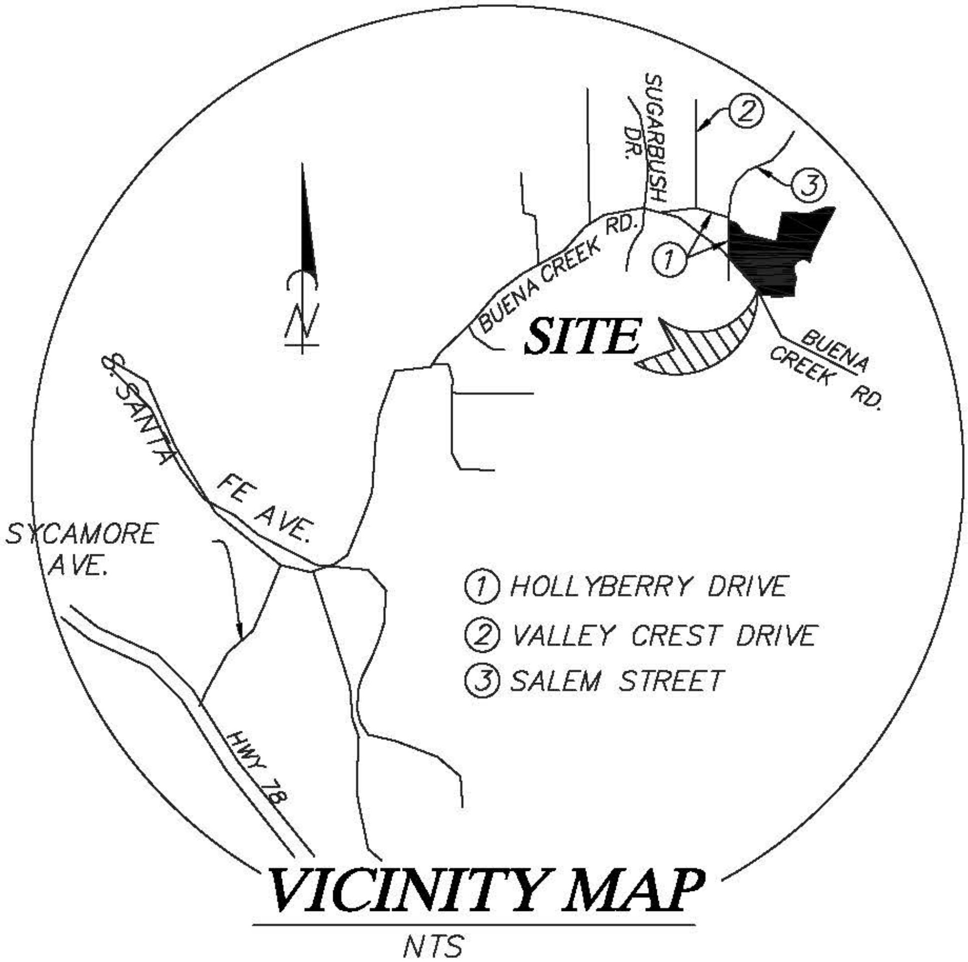
CHAPTER 1 – DISCUSSION



1.2 PURPOSE AND SCOPE

The purpose of this report is to publish the results of hydrology and hydraulic analysis for the proposed Tentative Subdivision Map of Tomlinson North Property TM 5573 in the County of San Diego, CA. The scope of this study is to analyze the results of existing and proposed condition hydrology calculations and provide recommendations as to the design and size of various hydraulic and stormwater conveyance systems. The mitigation measures proposed will include storm drains, curb inlets, catch basins, and brow ditches to route runoff to onsite best management practice (BMP) detention facilities for stormwater treatment. The 100-year storm frequency will be analyzed. Information contained in this report will be referred to for the purpose of sizing treatment and mitigation facilities. An analysis was also prepared to model the stormwater BMPs and prove that post-development peak flow is smaller than pre-development peak flow for the 6-hour 100-year storm event.

1.3 PROJECT DESCRIPTION

The Tomlinson North project site is located in the County of San Diego (APN 181-180-56, 86, 84), northeast of the intersection of Hollyberry Drive and Blue Bird Canyon Road. The property consists of approximately 14.80 acres.

The project site drains to one (1) Point of Compliance located near the northwest corner of the project site.

Since the site lies outside any FEMA floodplain zones, the proposed project is not expected to place structures within a 100-year flood hazard area which would impede or redirect flood flows. Treatment of storm water runoff from the site has been addressed in a separate report- "Priority Development Project (PDP) Storm Water Quality Management Plan (SWQMP) for Tomlinson North Property" by BHA. Hydromodificaiton (HMP) analysis has also been presented within the SWQMP.

Per County of San Diego drainage criteria, the Modified Rational Method should be used to determine peak flowrates when the contributing drainage area is less than 1.0 square mile.

Hydraulic Modified-Puls detention basin routing of the aforementioned modified rational method hydrology was performed using the Army Corps of Engineers HEC-HMS 4.0 software.

1.4 PRE-DEVELOPMENT CONDITIONS

The site has a single family residence located at the north west corner of the property and a nursery located on the remaining portion. The site's topography varies from moderate to steep, with on-site elevations ranging from 710 to 820 feet above mean sea level. The on-site soil classifications is 70% Type-D (Huerhuero loam), 29% Type-C (Escondido very fine sandy loam), and 1% Type-B (Wyman loam) from USDA Web Soil Survey (see References). For the purpose of this study, the entire project site will be modeled with Type-D soils. Existing land use is Low Density Residential (1.0 DU/A).

The project site receives significant storm water run-on from the hillside to the east. The existing hydrology watershed can be divided into two basins, Basin A and Basin B, both draining westerly towards Hollyberry Drive. One discharge point, POC-1, has been identified at an existing 60-inch C.M.P. culvert underneath Hollyberry Drive, as shown on the Existing Condition Hydrology Exhibit. The storm drain pipe outlets on the west side of Hollyberry Drive and runoff drains into a tributary of Buena Vista Creek.

Basin A encompasses run-on that initially flows northwest from the top of the hillside and enters into a natural drainage channel, then flows west to Hollyberry Drive. On-site hydrologic features include a small natural pond area on the east side of Hollyberry Drive, also shown on the Existing Condition Hydrology Exhibit, where flows channel into a small ditch and enter the pond. After ponding, runoff enters an existing culvert underneath Hollyberry Drive and discharges on the west side of Hollyberry Drive and into a tributary of Buena Vista Creek.

Basin B encompasses run-on that initially flows southwest from the top of the hillside located east of the project and enters a natural drainage channel, then flows southwest towards Blue Bird Canyon Road. The drainage channel then flows northwest adjacent to Blue Bird Canyon Road and towards Hollyberry Drive. Flow then enters an existing 12"-dia storm drain pipe that directs runoff underneath the existing driveways located east of Hollyberry Drive and outlets at the small natural pond area on the east side of Hollyberry Drive. After ponding, the runoff enters the existing 60"-dia culvert and discharges into the tributary of Buena Vista Creek.

Pechstein Reservoir, an above ground water storage tank owned and operated by Vista Irrigation District, is located upstream of the drainage channel in Basin B in a south-easterly direction approximately 500 feet off-site. The reservoir was previously an above ground water reservoir but has since been removed. The district no longer intermittently releases water (approx. 1 cfs) downstream during routine maintenance into a rip-rap lined earthen ditch off Blue Bird Canyon Road.

Table 1 summarizes the existing condition runoff information from the site. Please refer to the Existing Condition Hydrology Exhibit for drainage patterns and areas. The hydrologic analysis for the upstream watershed tributary to Buena Creek showing the 100-year flood line is also included in the Exhibit.

TABLE 1—Summary of Existing Condition Peak Flows

Discharge Location	Drainage Area (Ac)	100-Year Peak Flow (cfs)
Basin A	33.5	67.1
Basin B	77.0	136.4
Total at Node 1 (POC 1)	110.5	195.4

1.5 POST-DEVELOPMENT CONDITIONS

The Tomlinson North Project proposes the development of a 13 lot residential subdivision with paved private roads. The project also proposes to the minor widening and improvement of Hollyberry Drive. Proposed land use is Low Density Residential- 2.9 DU/A. Project grading will occur on approximately 8.5 acres of the project, which comprises approximately 57 percent of the total project area.

The graded site will include 13 new residential lots with driveways, private streets, and drainage improvements consisting of storm drain pipes, catch basins, and curb inlets. The project also proposes permeable pavement and biofiltration basins to maintain the pre-developed runoff characteristics. Proposed grading has be minimized as much as possible to maintain existing slope and drainage patterns.

Storm water runoff from the proposed project site is routed to one (1) POC, located at the discharge location to the west of the project site adjacent to Hollyberry Drive.

Prior to discharging from the project site, developed site runoff is intercepted by three (3) onsite receiving BMPs. These BMPs serve to meet water quality, hydromodification, and peak flow reduction requirements for the project site.

Runoff from the proposed roof and driveway areas on Lots 1-13 will be conveyed via surface flow to the front of each lot and onto the proposed cul-de-sacs, “Street A” and “Street B”. “Street A” will intersect Hollyberry Drive and run southeasterly through the center of the project. “Street B” will intersect “Street A” and will run northeasterly through the center of the project. “Street A” and “Street B” will be graded so that runoff flows towards the northern and southern curb and gutter. Runoff that flows onto “Street B” will be directed to “Street A” and will flow via the northern curb and gutter to a proposed curb inlet located north of Lot 1, on the north side of “Street A”. Runoff from Lots 1-6 that flows directly onto “Street A” will flow via the southerly curb and gutter to a proposed curb inlet located north of Lot 1, on the south side of “Street A”. The curb inlets will connect to an 18”-dia PVC storm drain pipe, which will discharge at a proposed biofiltration basin, BMP 1, located west of Lots 12 and 13. The biofiltration basin BMP 1 will provide storm water treatment, hydromodification, and flow detention. Storm water that enters the biofiltration basin will be filtered through the soil media and directed to a perforated underdrain pipe at the bottom of the basin. Discharge from the biofiltration basin will outlet into a bypass storm drain line underneath “Street A”. The storm drain system will be directed northwest to Hollyberry Drive, then directed north to the existing culvert underneath Hollyberry Drive. Runoff will then be released via the culvert on the west side of Hollyberry Drive and flow into a tributary of Buena Vista Creek.

Runoff from “Street A” that falls west of the curb inlets will be conveyed to a permeable pavement BMP. The permeable pavement BMP 3 will cover the entire roadway “bulb” of “Street A”, located just east the intersection of Hollyberry Drive. The permeable pavement will be designed as a retention BMP. A fraction of the permeable pavement will be designed with an open bottom to allow for infiltration into native soils. An underdrain pipe will be provided at the bottom to carry away filtered runoff. The underdrain pipe will direct flow to the proposed storm drain system underneath the private road and Hollyberry Drive.

Runoff that is captured by the brow ditch along the southwestern project boundary will flow to Hollyberry Drive. The street improvement of Hollyberry Drive will propose a curb and gutter on the east side of Hollyberry Drive, which will direct flow to a proposed biofiltration basin at the southeast curb return of Hollyberry Drive and “Street A”. The biofiltration basin BMP 2 will provide storm water treatment, hydromodification, and flow detention. An underdrain pipe will be provided at the bottom to carry away filtered runoff. The underdrain pipe will direct flow to the proposed storm drain system underneath the private road and Hollyberry Drive.

Runoff from the street improvement of Hollyberry Drive that falls north of the biofiltration basin BMP 2 will be directed to tree wells for both pollutant control and flow control. Treated runoff is held in the planting beds until it infiltrates into the ground or evaporates. Excess runoff flows through the system and returns to the curb and gutter downstream. The BMP has been designed per water quality requirements that are not discussed within this Report. For further information in regards to storm water quality requirements for the project, please refer to the site specific SWQMP.

Off-site drainage patterns will mimic existing drainage conditions to the fullest extent possible, and discharge at the historical point of discharge. The Developed Basin A will respect existing drainage courses. The majority of storm water runoff from Developed Basin A will travel through existing natural drainage courses to the existing culvert underneath Hollyberry Drive.

The Developed Basin B will contribute to the bypass storm drain system. Off-site run-on that flows southwest from the top of the hillside located east of the project site will enter the existing natural drainage channel and flow southwest towards Blue Bird Canyon Road, then northwest towards Hollyberry Drive. A rip rap energy dissipater located south of Lot 6 will intercept the runoff from the channel and reduce its velocity before entering a proposed storm drain pipe. The intermittent flow from Pechstein Reservoir will also be intercepted by this storm drain pipe and will be conveyed to a proposed 42"-dia bypass storm drain line underneath the private "Street A."

The Developed Basin B will include the off-site run-on that is collected by the brow ditch along the top of slope of Lot 9. A proposed catch basin near the driveways of Lots 9 and 10 will intercept runoff and convey flow through a proposed 18"-dia storm drain pipe. The storm drain pipe will discharge into a proposed brow ditch along the toe of slope of Lot 12. Flow will then travel via brow ditch along the northerly property boundary line to a proposed catch basin located west of BMP 1. The catch basin will connect to the bypass storm drain system underneath "Street A" and will travel to POC 1. The said brow ditch along the northerly property boundary line is being proposed in order to prevent discharging concentrated flow through the existing development located north of the project site. Consequentially, a smaller discharge area will flow to the existing 12"-dia storm drain pipe located on the east side of Hollyberry Drive. This is beneficial because the existing 12"-dia storm drain pipe was undersized for the existing upstream contributing drainage area and 100-year peak flow. By decreasing the contributing drainage area, the existing pipe is now adequately sized to convey the proposed 100-year peak flow, as shown in the Hydraulic Calculations Section of this report.

Rip rap energy dissipaters are proposed at storm drain outlets to reduce flow velocities. See rip rap energy dissipater calculations in the Hydraulic Elements section of this report. Post-development site flow will mimic existing drainage conditions, and will discharge from the site at below historical flow rates. The Homeowners Association will maintain the private road, storm drain system, permeable pavement, and biofiltration basins.

Per 2003 County of San Diego criteria, runoff coefficients were assumed respectively for the developed project site dependent upon hydrologic soil class and surface land use.

Table 2 summarizes the expected cumulative 100-year peak flow rates from Basin A and B hydrologic subareas.

TABLE 2—SUMMARY OF DEVELOPED CONDITIONS PEAK FLOWS

Discharge Location	Drainage Area (Ac)	Undetained 100-Year Peak Flow (cfs)	Detained 100- Year Peak Flow (cfs)
Basin A	33.2	66.2	66.2
Basin B	77.2	140.9	128.5
Total at Node 1 (POC 1)	110.5	207.1	194.7

Prior to discharging from the site, first flush runoff will be treated via the biofiltration based BMPs in accordance with standards set forth by the Regional Water Quality Control Board and the County of San Diego's BMP Design Manual (see "Storm Water Quality Management Plan (SWQMP) for Tomlinson North Property" by BHA).

Two (2) LID biofiltration basins are located within the project site and are responsible for handling hydromodificaiton requirements for POC-1. In developed conditions, the basins will have surface ponding and a riser spillway structure (see dimensions in Table 3 and 4). Flows will then discharge from the basins via the outlet structure or infiltrate through the bio-filtration layer of the facilities to the receiving amended soil and low flow orifice. The riser structure will act as a spillway such that peak flows can be safely discharged to the receiving storm drain system.

Beneath the basins' invert lies the LID biofiltration portion of the drainage facilities. This portion of the basin is comprised of a 3-inch layer of mulch, an 18-inch layer of amended soil (a highly sandy, organic rich composite with an infiltration capacity of at least 5 inches/hr) and a reservoir layer of gravel for additional detention and to accommodate the French drain system. An underdrain pipe will be provided below the reservoir layer to carry way filtered runoff. The basins will also include 3 inches of saturated storage below the underdrain pipe for partial infiltration of stormwater into native soils. Per the geotechnical study undertaken for the project, the bottom of the basins will be unlined.

One (1) LID permeable pavement BMP is located within the project site and is responsible for handling hydromodification requirements for POC-1. In developed conditions, the permeable pavement will be designed with a uniform structural section and with the surface sloping towards the northwest. Flows will infiltrate through the underground gravel layer of the facility to the low flow orifice. The storm water captured and temporarily stored by the BMP beneath the underdrain prior to infiltration will be limited to a small fraction of the overall area, by incorporating cutoff walls/barriers to increase the effective area.

Beneath the pavement's invert lies the infiltration portion of the drainage facility. This portion of the permeable pavement is comprised on a 2-inch bedding layer, a 2-inch choker layer, and a 6-inch reservoir layer of gravel for additional detention and to accommodate the French drain system. Below the underdrain pipe, the BMP includes a 10-inch infiltration storage layer of gravel for partial infiltration. Flows will discharge from the BMP via low-flow orifice outlet within the gravel layer to the receiving storm drain system. See dimensions in Table 3.

TABLE 3—SUMMARY OF BMP DIMENSIONS

BMP	Tributary Area (Ac)	DIMENSIONS					
		BMP Area(1) (ft^2)	Low Flow Orifice, D (in)	Gravel Depth(2) (in)	Saturated Storage Depth(3) (in)	Depth Riser Invert(4) (ft)	Total Surface Depth(5) (ft)
BMP 1	7.75	14,634	2.30	22	9	1.75-ft	2.5-ft
BMP 2	0.24	877	0.37	28	9	1.0-ft	1.5-ft
BMP 3	0.23	680	0.39	6	6	-	-

Notes: (1): Area of amended soil = area of gravel = area of BMP.
(2): Depth of gravel above underdrain.
(3): Depth of gravel below underdrain for infiltration storage.
(4): Depth of ponding beneath riser structure's surface spillway.
(5): Total surface depth of BMP from top crest elevation to surface invert.

TABLE 4—SUMMARY OF OUTLET DETAILS

BMP	RISER DIMENSIONS			EMERGENCY WEIR	
	Outlet Type(1)	Invert Elevation(2) (ft)	Dimensions (#-size)(3)	Invert Elevation(4) (ft)	Weir Perimeter Length(5) (ft)
BMP 1	Slot Orifice	1.0	2 - 0.25' x 1.5'	1.75	12-ft
BMP 2	Slot Orifice	0.5	2 - 0.25' x 1.5'	1.0	8-ft

Notes: (1): Shape of orifice opening in riser structure.
(2): Depth from bottom of pond to invert of lower orifice or weir.
(3): Number of orifices - dimensions of orifice.
(4): Depth from bottom of pond to invert of emergency overflow weir.
(5): Overflow length, the internal perimeter of the riser is 12 ft (3 ft x 2 ft internal dimensions) for BMP-1 and 8 ft (2 ft x 2 ft internal dimensions) for BMP-2.

The developed condition peak flows calculated using modified rational method were then routed through the detention facility on the project site in HEC-HMS. The HMS Modified-Puls results are summarized in Table 5.

TABLE 5—SUMMARY OF DETENTION BASIN ROUTING

HMP-BMP	100-Year Peak Inflow (cfs)	100-Year Peak Outflow (cfs)	Peak Water Surface Elevation (ft)(1)
BMP 1	17.2	6.9	1.9
BMP 2	1.5	1.3	1.1
BMP 3	0.8	0.0	0.1

Notes: (1): Biofiltration layer included as part of basin depth - volume reduced by voids accordingly

It should be noted that as a conservative design approach, it has been assumed that the 85th percentile water quality event volume was stored in the detention facilities prior to the routing of the 100-year storm event. 85th percentile volumes are provided in Chapter 4 of this report. The volumes are a conservative hydraulic design methodology only – for water quality discussion and BMP sizing analysis, please refer to the site specific SWQMP.

HEC-HMS allows for hydrology input time steps of 1, 2, 3, 4, 5, 10, 15 & 20 minutes. Rational Method analysis input was used to determine an inflow hydrograph using the 2/3's 1/3 distribution as detailed on pages 4-2 and 4-3 of the 2003 County of San Diego Hydrology Manual. The time of concentration (Tc) used for the construction of these hydrographs was rounded to the nearest time interval that HEC-HMS could accept. The peak flow remains as per the modified rational method analysis and is not reduced (or increased) from this hydrograph development accordingly.

Additionally, the detention facilities are multiple purpose water quality and hydromodificaiton BMPs, there is available storage provided in the biofiltration layers of the basin– namely the engineered fill soil layer and the underlying gravel base layer, and enough available storage in the aggregate and infiltration layers of the permeable pavement. As HEC-HMS uses an elevation-storage-discharge function to model the basin volume (stage-storage) and basin discharge (stage-discharge) relationships, the available storage volume provided by these aforementioned sub-layers is accounted for by reducing the total sub-basin volume by the corresponding void ratio for each layer (0.4 for gravel and 0.1 for soil respectively).

Rational method hydrographs, stage-storage, stage-discharge relationships and HEC-HMS model output is provided in Chapter 4 of this report.

1.6 STUDY METHOD

The method of analysis was based on the Rational Method according to the San Diego County Hydrology Manual (SD HM). The Hydrology and Hydraulic Analysis were done on Hydro Soft by Advanced Engineering Software 2013. The study considers the runoff for a 100-year storm frequency.

Methodology used for the computation of design rainfall events, runoff coefficients, and rainfall intensity values are consistent with criteria set forth in the "2003 County of San Diego Drainage Design Manual." A more detailed explanation of methodology used for this analysis is listed in Chapter 6 – References of this report.

Drainage basin areas were determined from the topography and proposed grades shown on the Preliminary Grading Plan and County of San Diego topography sheet 370-1713.

The Rational Method for this project provided the following variable coefficients:

Rainfall Intensity – Initial time of concentration (T_c) values based on Table 3-2 of the SD HM. NOAA Precipitation Frequency Data Server was used to determine P_6 for 100-year storm, see References.

RickRat Hydro was used to perform Rational Method hydrographs. The design storm patter is based on the County of San Diego Intensity-Duration Design Chart. The chart uses the following equation to relate the intensity (I) of the storm to the time of concentration (Tc):

$I = 7.44x(P_6)x(T_c)^{-0.645}$

P_6 for 100-year storm =3.5"
P_6 for 10-year storm =2.4"

Soil Type – The site was modeled with Type-D hydrologic soil as determined from the NRCS Web Soil Survey. Type-D soils have very slow infiltration rates when thoroughly wetted.

Runoff Coefficient—In accordance with the County of San Diego standards, runoff coefficients were based on land use and slope. An appropriate runoff coefficient (C) for each type of land use in the subarea was selected from Table 3-1 of SD HM and multiplied by the percentage of total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient ($\sum[CA]$).

An existing rural runoff coefficient of 0.52 was calculated as a weighted runoff coefficient "C" value over soil Type D. There is an existing commercial nursery to the northeast, as well as Pechstein Reservoir which contribute run-on to the project site. For these areas, 31.4 acres total, the Neighborhood Commercial Runoff Coefficient, C=0.79, was used. All other areas were considered as LDR-1.0 DU/A, C=0.41, to develop the weighted runoff coefficient. These areas are denoted on the Existing Condition Hydrology Exhibit for reference.

For the developed condition, all roofs, streets and driveways were considered 95% impervious and assigned a runoff coefficient of 0.87. Due to the preliminary nature of this report, each lot is considered to include a 3,000-square foot roof area, a 1,000-square foot driveway area plus a

20% contingency of impervious areas for a total of 5,000 square feet. The remaining area is assumed to be landscaped, and assigned a runoff coefficient of 0.35 assuming 0% impervious. At Final Engineering, building footprints and final driveway areas will be calculated and pad areas will be assigned a weighted runoff coefficient accordingly. See Table 6 below for weighted runoff coefficient calculations for the existing and developed hydrology conditions.

TABLE 6—WEIGHTED RUNOFF COEFFICIENT CALCULATIONS BY NODE

Existing Hydrology							
Up Node	Down Node	Total Acreage	C_1	A_1 (acres)	C_2	A_2 (acres)	C_{comp}
-	-	110.50	0.41	77.16	0.79	31.40	0.52
Proposed Hydrology							
Up Node	Down Node	Total Acreage	C_1	A_1 (acres)	C_2	A_2 (acres)	C_{comp}
8	7	0.09	0.35	0.04	0.87	0.05	0.64
7	6	3.35	0.35	2.13	0.87	1.22	0.54
12	11	2.70	0.35	1.89	0.87	0.81	0.51
50	-	0.23	0.35	0.21	0.87	0.02	0.39
51	53	2.05	0.35	1.76	0.87	0.29	0.42
55	57	0.24	0.35	0.09	0.87	0.14	0.67
60	-	0.16	0.35	0.08	0.87	0.08	0.60

Note: C-values taken from Table 3-1 of San Diego County Hydrology Manual, consistent with on-site existing soil types. See References.

The exhibits show the proposed on-site drainage system, subarea, acreage, and nodal points. This study considers the runoff for a 100-year storm frequency and the on-site drainage system shown in the Tentative Subdivision Map is designed for a 100-year storm frequency.

1.7 CONCLUSION

Table 7 below summarizes developed and existing condition drainage areas and resultant 100-year peak flow rates at the POC discharge locations from the Tomlinson North Property.

TABLE 7—SUMMARY OF PEAK FLOWS

	Drainage Area (acres)	100-Year Peak Flow (cfs)
Pre-Developed Condition	110.5	195.4
Post- Developed Undetained Condition	110.5	207.1
Post- Developed Detained Condition	110.5	194.7
DIFFERENCE	0.0	-0.7

As shown in the above table, the development of the proposed Tomlinson North project site will result in a net decrease of peak flow discharged from the project site by approximately 5.8cfs. The proposed drainage basin matches the existing drainage basin in terms of overall area and drainage conditions.

All developed runoff will receive water quality treatment in accordance with the site specific SWQMP. Additionally, POC-1 is HMP compliant as analyzed in the SWQMP.

Peak flow rates listed above were generated based on criteria set forth in "San Diego County Hydrology Manual" (methodology presented in Chapter 6 of this report). Rational method output is located in Chapter 3 and 4. The hydraulic calculations show that the proposed storm drain facilities can sufficiently convey the anticipated Q100 flowrate without any adverse effects. Furthermore, the pipe crossing at Node 1 has the hydraulic capacity to adequately drain the proposed design under a 100-year storm event. Based on this conclusion, runoff released from the proposed project site will be unlikely to cause any adverse impact to downstream water bodies or existing habitat integrity. Sediment will likely be reduced upon site development.

Final storm drain and inlet design details will be provided at the final engineering phase of the development.

1.8 DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the Engineer of Work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

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

12-5-17

Bruce Rice — Date

R.C.E. 60676

REGISTERED PROFESSIONAL ENGINEER
BRUCE L. RICE
C 60676
EXP. 12-31-18
CIVIL
STATE OF CALIFORNIA

CHAPTER 2

EXISTING & DEVELOPED CONDITION HYDROLOGY EXHIBITS

EXISTING CONDITION HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO: TRACT NO. 5573

WEIGHTED RUNOFF COEFFICIENT CALCULATIONS

Existing Hydrology							
Up Node	Down Node	Total Acreage	C_1	A_1 (acres)	C_2	A_2 (acres)	C_{comp}
-	-	110.50	0.41	77.16	0.79	31.40	0.51

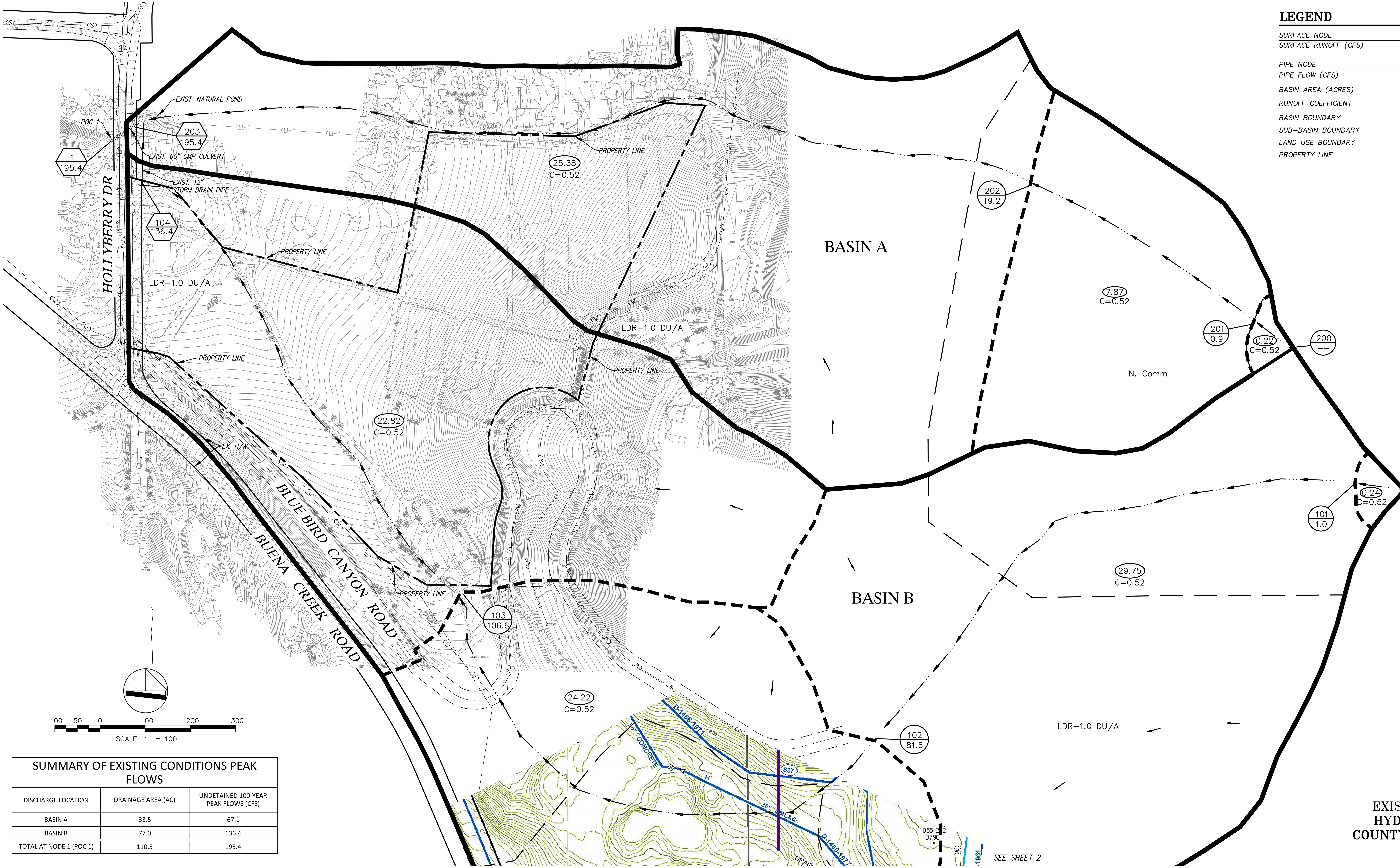
Note: C-values taken from Table 3-1 of San Diego County Hydrology Manual, consistent with on-site existing soil types. See References.

PROJECT CHARACTERISTICS	
PROJECT AREA	14.89 ACRES
APN	181-180-56, 84, 86
SOIL TYPE	D
DEPTH TO GROUNDWATER	> 20 FEET

HYDROLOGIC UNIT CONTRIBUTION (WATERSHED)			
WATERSHED	HYDROLOGIC AREA	HYDROLOGIC SUB-AREA	DOWNSTREAM WATERBODIES
CARLSBAD	904.3 (AGUA HEDIONDA)	904.32 (BUENA)	BUENA VISTA CREEK, BUENA VISTA LAGOON, PACIFIC OCEAN

LEGEND

SURFACE NODE / SURFACE RUNOFF (CFS)	65 / 26.4
PIPE NODE / PIPE FLOW (CFS)	65.1 / 49.3
BASIN AREA (ACRES)	0.3
RUNOFF COEFFICIENT	C=0.52
BASIN BOUNDARY	
SUB-BASIN BOUNDARY	
LAND USE BOUNDARY	
PROPERTY LINE	



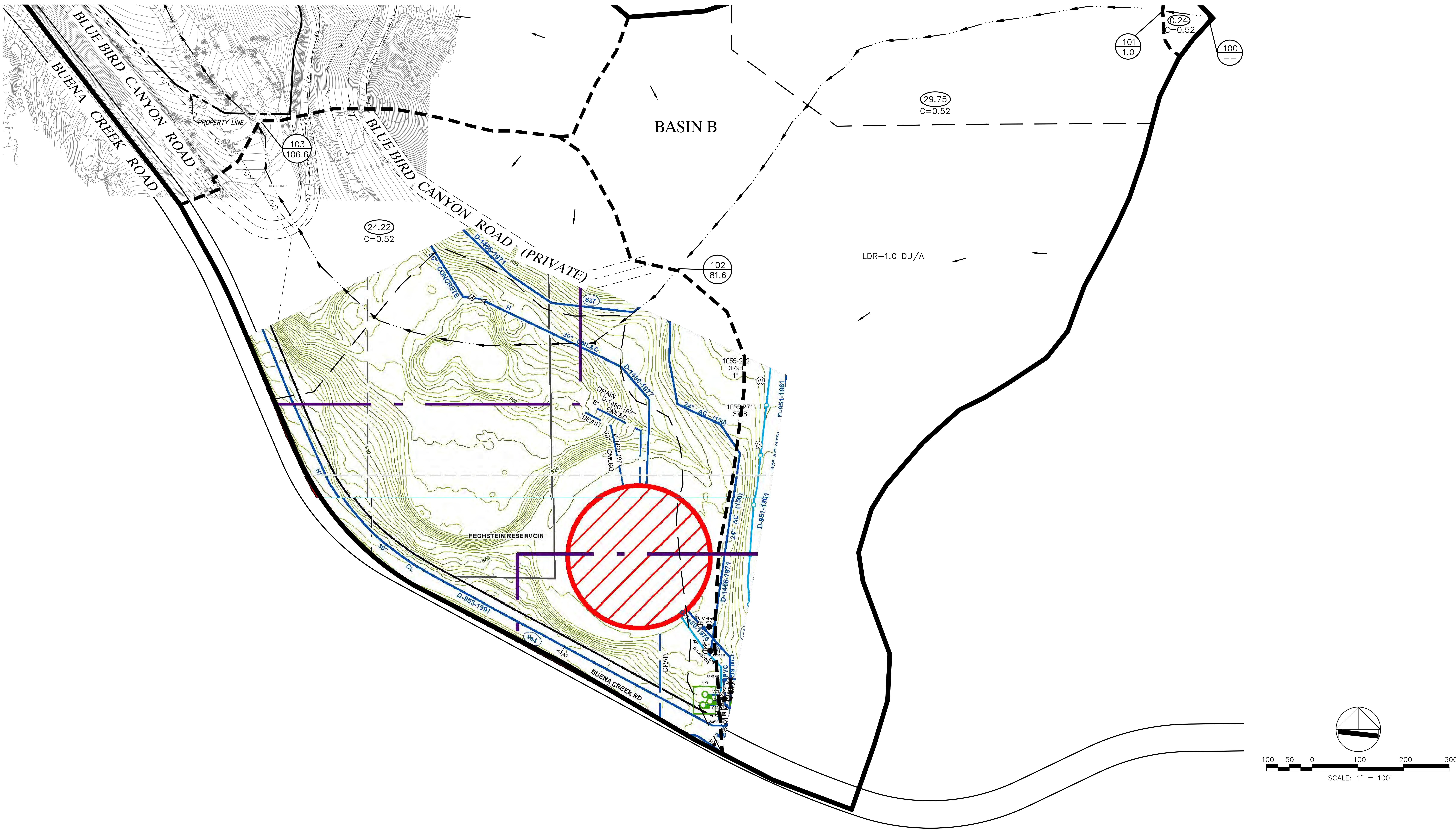
SUMMARY OF EXISTING CONDITIONS PEAK FLOWS

DISCHARGE LOCATION	DRAINAGE AREA (AC)	UNDETAINED 100-YEAR PEAK FLOWS (CFS)
BASIN A	33.5	67.1
BASIN B	77.0	136.4
TOTAL AT NODE 1 (POC 1)	110.5	195.4

EXISTING CONDITION
HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO
TRACT NO. 5573
SHEET 1 OF 2

bHA, Inc. 5115 AVENIDA ENCINAS SUITE L CARLSBAD, CA 92008 (760) 931-8700

EXISTING CONDITION HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO TM 5573



EXISTING CONDITION
HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO
TRACT NO. 5573
SHEET 2 OF 2

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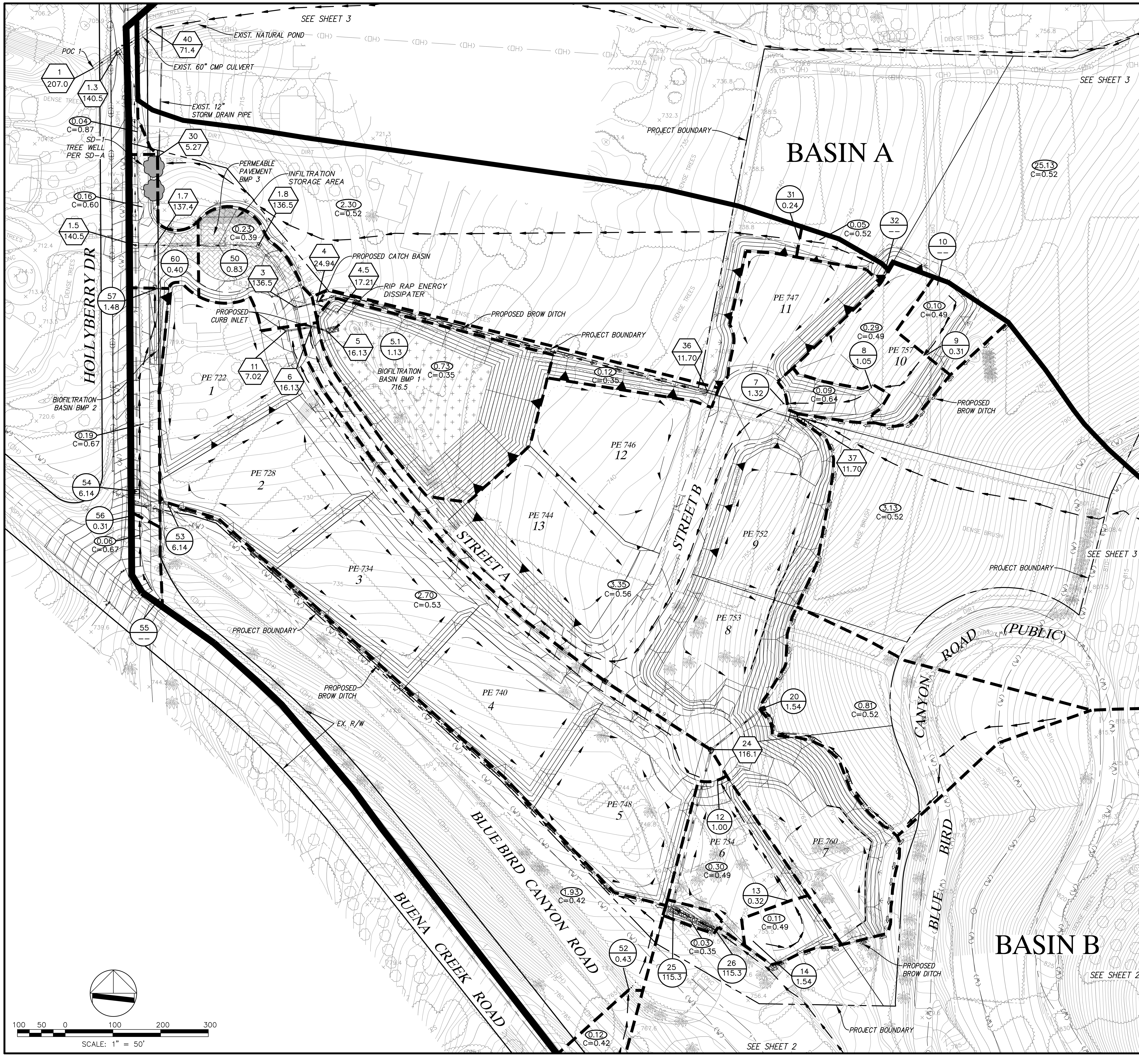
CARLSBAD, CA 92008 (760) 931-8700



DEVELOPED CONDITION HYDROLOGY EXHIBIT

COUNTY OF SAN DIEGO: TM 5573

SHEET 1 OF 3

PROJECT CHARACTERISTICS	
PROJECT AREA	14.89 ACRES
APN	181-180-56, 84, 86
SOIL TYPE	D
DEPTH TO GROUNDWATER	> 20 FEET

HYDROLOGIC UNIT CONTRIBUTION (WATERSHED)			
WATERSHED	HYDROLOGIC AREA	HYDROLOGIC SUB-AREA	DOWNSTREAM WATERBODIES
CARLSBAD	904.3 (AGUA HEDIONDA)	904.32 (BUENA)	BUENA VISTA CREEK, BUENA VISTA LAGOON, PACIFIC OCEAN

LEGEND

- SURFACE NODE / SURFACE RUNOFF (CFS) — 9 / 0.31
- PIPE NODE / PIPE FLOW (CFS) — 4 / 24.94
- BASIN AREA (ACRES) — 0.21
- RUNOFF COEFFICIENT — C=0.49
- FLOWLINE
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- SUBDIVISION BOUNDARY
- LOT LINE
- PROPOSED BROW DITCH
- YARD SWALE
- STREET TREE
- BIOFILTRATION BASIN
- PERMEABLE PAVEMENT WITH IMPERMEABLE LINER
- PERMEABLE PAVEMENT WITH OPEN BOTTOM

WEIGHTED RUNOFF COEFFICIENT CALCULATIONS

Proposed Hydrology							
Up Node	Down Node	Total Acreage	C_1	A_1 (acres)	C_2	A_2 (acres)	C_{comp}
8	7	0.09	0.35	0.04	0.87	0.05	0.64
7	6	3.35	0.35	2.13	0.87	1.22	0.54
12	11	2.70	0.35	1.89	0.87	0.81	0.51
50	-	0.23	0.35	0.21	0.87	0.02	0.39
51	53	2.05	0.35	1.76	0.87	0.29	0.42
55	57	0.24	0.35	0.09	0.87	0.14	0.67
60	-	0.16	0.35	0.08	0.87	0.08	0.60

Note: C-values taken from Table 3-1 of San Diego County Hydrology Manual, consistent with on-site existing soil types. See References.

SUMMARY OF DEVELOPED CONDITIONS PEAK FLOWS			
DISCHARGE LOCATION	DRAINAGE AREA (AC)	UNDETAINED 100-YEAR PEAK FLOWS (CFS)	DETAINED 100-YEAR PEAK FLOWS (CFS)
BASIN A	33.2	66.2	66.2
BASIN B	77.2	140.9	128.5
TOTAL AT NODE 1 (POC 1)	110.5	207.1	194.7

SUMMARY OF PRE VS POST PEAK FLOWS		
	DRAINAGE AREA (AC)	100-YEAR PEAK FLOW (CFS)
PRE-DEVELOPED CONDITION	110.5	195.4
POST-DEVELOPED UNDETAINED CONDITION	110.5	207.1
POST-DEVELOPED DETAINED CONDITION	110.5	194.7
DIFFERENCE	0.00	-0.7

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(760) 931-8700

DEVELOPED CONDITION
HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO
TM 5573
SHEET 1 OF 3

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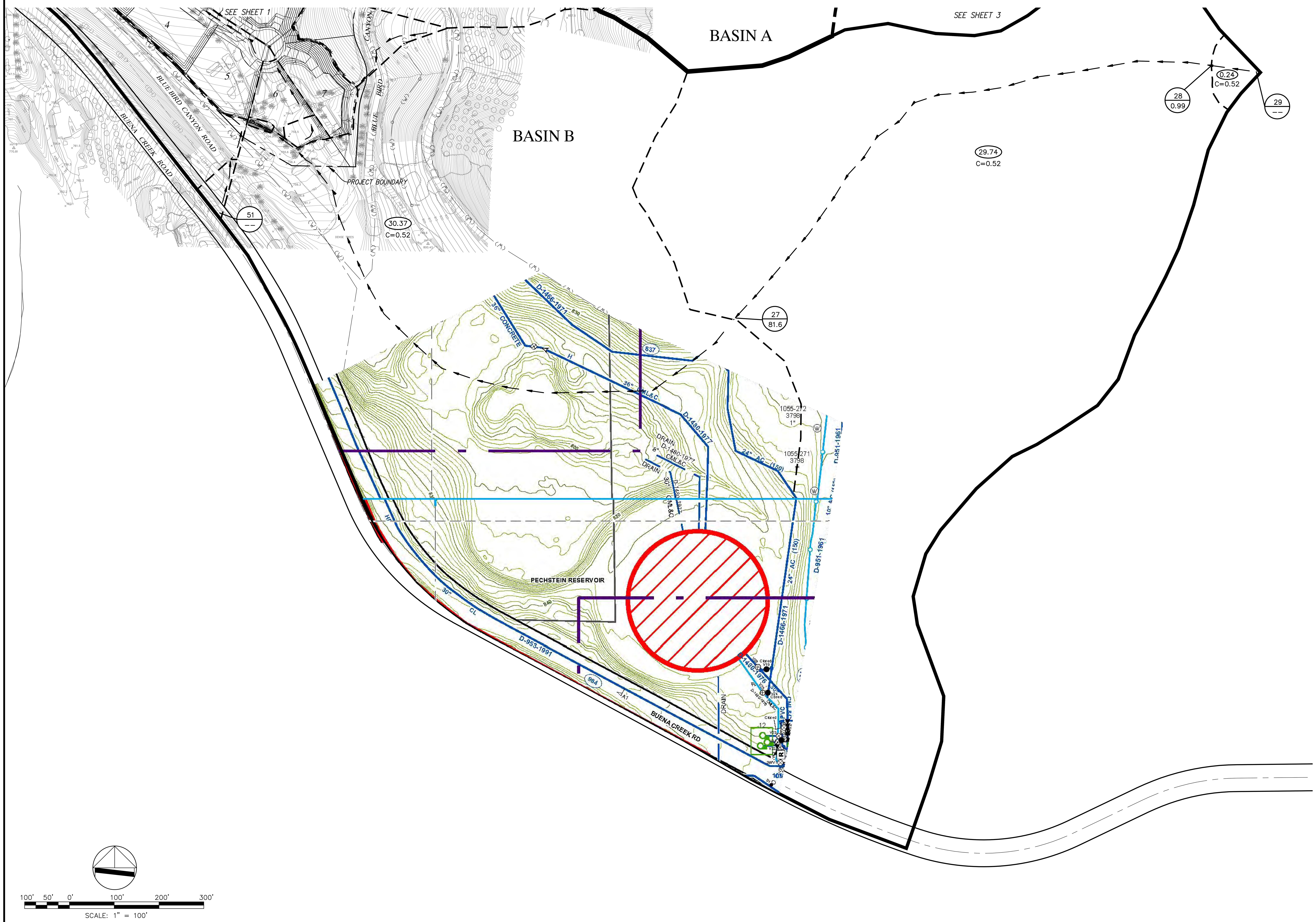
DEVELOPED CONDITION HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO: TM 5573



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DEVELOPED CONDITION
HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO
TM 5573
SHEET 2 OF 3

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DEVELOPED CONDITION HYDROLOGY EXHIBIT

COUNTY OF SAN DIEGO: TM 5573

DEVELOPED CONDITION
HYDROLOGY EXHIBIT
COUNTY OF SAN DIEGO
TM 5573
SHEET 3 OF 3

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CHAPTER 3

CALCULATIONS

3.1 – Existing Condition Hydrology Calculations

100 YEAR STORM

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
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             Ver. 19.0 Release Date: 06/01/2012  License ID 1459

                           Analysis prepared by:

                                  BHA Inc
                       5115 Avenida Encinas, Suite L
                             Carlsbad CA 92008

 ************************** DESCRIPTION OF STUDY **************************
 * 100 Year Storm, Existing Condition Hydrology Analysis                    *
 * Composite C value is 0.52, Type D Soil Considered                        *
 * See Existing Condition Hydrology Map for Node Locations                  *
 **************************************************************************
----------------------------------------------------------------------------
  FILE NAME: 0902E100.DAT
  TIME/DATE OF STUDY: 10:55 02/15/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SPECIFIED CONSTANT RUNOFF COEFFICIENT = 0.520
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======   ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(GLOBAL):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    946.50
  DOWNSTREAM ELEVATION(FEET) =    942.00
  ELEVATION DIFFERENCE(FEET) =      4.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.324
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.925
```

```
  SUBAREA RUNOFF(CFS) =      0.99
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.99

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    942.00  DOWNSTREAM(FEET) =    850.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1308.00   CHANNEL SLOPE =  0.0703
  CHANNEL BASE(FEET) =   40.00   "Z" FACTOR =  12.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.232
  *USER SPECIFIED(GLOBAL):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.17
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.82
  AVERAGE FLOW DEPTH(FEET) =   0.26   TRAVEL TIME(MIN.) =   5.71
  Tc(MIN.) =   12.04
  SUBAREA AREA(ACRES) =    29.75       SUBAREA RUNOFF(CFS) =   80.94
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       30.0         PEAK FLOW RATE(CFS) =      81.60

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.38   FLOW VELOCITY(FEET/SEC.) =   4.84
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    1408.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    850.00  DOWNSTREAM(FEET) =    754.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1252.00   CHANNEL SLOPE =  0.0767
  CHANNEL BASE(FEET) =  300.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.783
  *USER SPECIFIED(GLOBAL):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     105.57
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.65
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   7.87
  Tc(MIN.) =   19.91
  SUBAREA AREA(ACRES) =    24.22       SUBAREA RUNOFF(CFS) =   47.64
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       54.2         PEAK FLOW RATE(CFS) =     106.63

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.13   FLOW VELOCITY(FEET/SEC.) =   2.68
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    2660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    754.00  DOWNSTREAM(FEET) =    708.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1177.00   CHANNEL SLOPE =  0.0387
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  13.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.405
  *USER SPECIFIED(GLOBAL):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     126.83
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.56
  AVERAGE FLOW DEPTH(FEET) =   1.32   TRAVEL TIME(MIN.) =   3.53
  Tc(MIN.) =   23.43
  SUBAREA AREA(ACRES) =    22.82       SUBAREA RUNOFF(CFS) =   40.40
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       77.0         PEAK FLOW RATE(CFS) =     136.38

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.36   FLOW VELOCITY(FEET/SEC.) =   5.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    3837.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    203.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   708.50  DOWNSTREAM(FEET) =   697.25
  FLOW LENGTH(FEET) =   133.90   MANNING'S N =  0.011
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.26
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     136.38
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =   23.56
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    203.00 =    3970.90 FEET.

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

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(GLOBAL):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    934.00
  DOWNSTREAM ELEVATION(FEET) =    929.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.106
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.107
  SUBAREA RUNOFF(CFS) =      0.93
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.93

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

```
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    929.00  DOWNSTREAM(FEET) =    868.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   582.00   CHANNEL SLOPE =  0.1048
  CHANNEL BASE(FEET) =  300.00   "Z" FACTOR =  12.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.574
  *USER SPECIFIED(GLOBAL):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.11
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   8.72
  Tc(MIN.) =   14.83
  SUBAREA AREA(ACRES) =     7.87       SUBAREA RUNOFF(CFS) =   18.72
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =        8.1         PEAK FLOW RATE(CFS) =      19.24

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     682.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    868.00  DOWNSTREAM(FEET) =    697.25
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2040.00   CHANNEL SLOPE =  0.0837
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.857
  *USER SPECIFIED(GLOBAL):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      44.78
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.57
  AVERAGE FLOW DEPTH(FEET) =   1.22   TRAVEL TIME(MIN.) =   4.49
  Tc(MIN.) =   19.32
  SUBAREA AREA(ACRES) =    25.38       SUBAREA RUNOFF(CFS) =   50.90
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       33.5         PEAK FLOW RATE(CFS) =      67.12

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.42   FLOW VELOCITY(FEET/SEC.) =   8.37
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2722.00 FEET.

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

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       67.12    19.32       3.857       33.47
```

```
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2722.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1      136.38    23.56       3.393       77.03
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    203.00 =    3970.90 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1     178.93      19.32        3.857
     2     195.43      23.56        3.393

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     195.43   Tc(MIN.) =   23.56
  TOTAL AREA(ACRES) =      110.5

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE      1.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   697.25  DOWNSTREAM(FEET) =   693.84
  FLOW LENGTH(FEET) =    72.87   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  24.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  25.60
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     195.43
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   23.61
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE      1.00 =    4043.77 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      110.5  TC(MIN.) =     23.61
  PEAK FLOW RATE(CFS)   =     195.43
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 3

CALCULATIONS

3.2 – Developed Condition Hydrology Calculations- Unmitigated

100 YEAR STORM

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2012 Advanced Engineering Software (aes)
             Ver. 19.0 Release Date: 06/01/2012  License ID 1459

                          Analysis prepared by:

                                 BHA Inc
                      5115 Avenida Encinas, Suite L
                            Carlsbad CA 92008

 ************************** DESCRIPTION OF STUDY **************************
* 100 Year Storm Developed Condition Hydrology Analysis- Unmitigated       *
* Type-D Soil, Residential 2.9 DU/A                                        *
* Tomlinson North Property                                                 *
 **************************************************************************
----------------------------------------------------------------------------
  FILE NAME: 0902100P.DAT
  TIME/DATE OF STUDY: 11:23 02/15/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======   ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE      9.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    757.00
  DOWNSTREAM ELEVATION(FEET) =    756.20
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.055
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    71.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.287
 SUBAREA RUNOFF(CFS) =      0.31
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
 FLOW PROCESS FROM NODE      9.00 TO NODE      8.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    756.20  DOWNSTREAM(FEET) =    755.40
 CHANNEL LENGTH THRU SUBAREA(FEET) =    79.00   CHANNEL SLOPE =  0.0101
 CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.512
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .4900
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.70
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.64
 AVERAGE FLOW DEPTH(FEET) =   0.15   TRAVEL TIME(MIN.) =   2.05
 Tc(MIN.) =   11.10
 SUBAREA AREA(ACRES) =     0.29       SUBAREA RUNOFF(CFS) =    0.78
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.490
 TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =       1.05

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   0.72
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE      8.00 =     154.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      7.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    755.40  DOWNSTREAM(FEET) =    745.40
 CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00   CHANNEL SLOPE =  0.1000
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  15.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.291
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6400
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.21
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.30
 AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   0.73
 Tc(MIN.) =   11.83
 SUBAREA AREA(ACRES) =     0.09       SUBAREA RUNOFF(CFS) =    0.30
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.518
 TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       1.32

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   2.51
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE      7.00 =     254.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      6.00 IS CODE =  61
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  745.40  DOWNSTREAM ELEVATION(FEET) =  721.00
  STREET LENGTH(FEET) =   821.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   1.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   11.72
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.35
  STREET FLOW TRAVEL TIME(MIN.) =   3.45   Tc(MIN.) =   15.28
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.486
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.537
  SUBAREA AREA(ACRES) =    3.35      SUBAREA RUNOFF(CFS) =    8.12
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =       9.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  4.02   DEPTH*VELOCITY(FT*FT/SEC.) =   1.39
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      6.00 =    1075.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    94.00
  UPSTREAM ELEVATION(FEET) =    754.00
  DOWNSTREAM ELEVATION(FEET) =    753.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.060
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.96
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.285
  SUBAREA RUNOFF(CFS) =      0.34
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.34
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     12.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    753.00  DOWNSTREAM(FEET) =    751.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   151.00   CHANNEL SLOPE =  0.0099
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.992
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.65
  AVERAGE FLOW DEPTH(FEET) =   0.15   TRAVEL TIME(MIN.) =   3.89
  Tc(MIN.) =   12.95
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.73
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.490
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       1.00

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   0.69
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     12.00 =     245.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     11.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  751.50  DOWNSTREAM ELEVATION(FEET) =  721.00
  STREET LENGTH(FEET) =   669.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   1.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.07
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    9.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.38
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.31
  STREET FLOW TRAVEL TIME(MIN.) =   2.55   Tc(MIN.) =   15.49
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.446
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5100
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.507
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    6.12
  TOTAL AREA(ACRES) =        3.1        PEAK FLOW RATE(CFS) =       7.02

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  11.97
  FLOW VELOCITY(FEET/SEC.) =  4.98   DEPTH*VELOCITY(FT*FT/SEC.) =   1.72
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     11.00 =     914.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE      6.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   716.70  DOWNSTREAM(FEET) =   716.60
  FLOW LENGTH(FEET) =    23.50   MANNING'S N =  0.011
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.51
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.02
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   15.58
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE      6.00 =     937.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        7.02    15.58       4.430        3.11
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE      6.00 =     937.50 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        9.23    15.28       4.486        3.83
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      6.00 =    1075.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      16.11      15.28        4.486
     2      16.13      15.58        4.430

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      16.13   Tc(MIN.) =   15.58
  TOTAL AREA(ACRES) =        6.9

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      5.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   716.60  DOWNSTREAM(FEET) =   716.50
```

```
  FLOW LENGTH(FEET) =    14.50   MANNING'S N =  0.011
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.74
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.13
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   15.62
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      5.00 =    1089.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.10 TO NODE      4.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.423
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5073
  SUBAREA AREA(ACRES) =    0.73   SUBAREA RUNOFF(CFS) =    1.13
  TOTAL AREA(ACRES) =        7.7   TOTAL RUNOFF(CFS) =      17.21
  TC(MIN.) =   15.62

****************************************************************************
  FLOW PROCESS FROM NODE      4.50 TO NODE      4.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   713.50  DOWNSTREAM(FEET) =   710.00
  FLOW LENGTH(FEET) =    22.80   MANNING'S N =  0.011
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.33
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.21
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =   15.64
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      4.00 =    1112.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     39.00 TO NODE     38.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    896.00
  DOWNSTREAM ELEVATION(FEET) =    883.00
  ELEVATION DIFFERENCE(FEET) =     13.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.846
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
```

```
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE     38.00 TO NODE     37.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    883.00  DOWNSTREAM(FEET) =    745.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   659.00   CHANNEL SLOPE =  0.2091
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.076
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.13
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.08
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   2.69
  Tc(MIN.) =    7.54
  SUBAREA AREA(ACRES) =     3.13       SUBAREA RUNOFF(CFS) =   11.52
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =        3.2         PEAK FLOW RATE(CFS) =      11.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   5.06
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE     37.00 =     759.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     37.00 TO NODE     36.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   745.20  DOWNSTREAM(FEET) =   742.00
  FLOW LENGTH(FEET) =    97.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.63
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.70
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    7.67
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE     36.00 =     856.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     36.00 TO NODE      4.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    742.00  DOWNSTREAM(FEET) =    710.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   423.00   CHANNEL SLOPE =  0.0757
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.685
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.84
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  12.45
  AVERAGE FLOW DEPTH(FEET) =   0.69   TRAVEL TIME(MIN.) =   0.57
```

```
  Tc(MIN.) =    8.23
  SUBAREA AREA(ACRES) =     0.12       SUBAREA RUNOFF(CFS) =    0.28
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.514
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =      11.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.69   FLOW VELOCITY(FEET/SEC.) =  12.31
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      4.00 =    1279.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        11.70     8.23       6.685        3.30
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      4.00 =    1279.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        17.21    15.64       4.420        7.67
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      4.00 =    1112.30 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      20.76       8.23        6.685
     2      24.94      15.64        4.420

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      24.94   Tc(MIN.) =   15.64
  TOTAL AREA(ACRES) =       11.0

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      3.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  7110.00  DOWNSTREAM(FEET) =   708.80
  FLOW LENGTH(FEET) =    19.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   1.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) = 441.96
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.94
  PIPE TRAVEL TIME(MIN.) =   0.00    Tc(MIN.) =   15.64
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      3.00 =    1298.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
```

```
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     29.00 TO NODE     28.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    946.50
  DOWNSTREAM ELEVATION(FEET) =    942.00
  ELEVATION DIFFERENCE(FEET) =      4.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.324
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.925
  SUBAREA RUNOFF(CFS) =      0.99
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.99

****************************************************************************
  FLOW PROCESS FROM NODE     28.00 TO NODE     27.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    942.00  DOWNSTREAM(FEET) =    850.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1308.00   CHANNEL SLOPE =  0.0703
  CHANNEL BASE(FEET) =   40.00   "Z" FACTOR =  12.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.232
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.81
  AVERAGE FLOW DEPTH(FEET) =   0.26   TRAVEL TIME(MIN.) =   5.72
  Tc(MIN.) =   12.04
  SUBAREA AREA(ACRES) =    29.74       SUBAREA RUNOFF(CFS) =   80.91
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       30.0         PEAK FLOW RATE(CFS) =      81.56

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.38   FLOW VELOCITY(FEET/SEC.) =   4.84
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     27.00 =    1408.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     27.00 TO NODE     26.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    850.00  DOWNSTREAM(FEET) =    754.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1389.00   CHANNEL SLOPE =  0.0688
  CHANNEL BASE(FEET) =  300.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.673
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     110.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.63
  AVERAGE FLOW DEPTH(FEET) =   0.14   TRAVEL TIME(MIN.) =   8.79
```

```
  Tc(MIN.) =   20.83
  SUBAREA AREA(ACRES) =    30.37       SUBAREA RUNOFF(CFS) =   58.01
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       60.3         PEAK FLOW RATE(CFS) =     115.28

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.14   FLOW VELOCITY(FEET/SEC.) =   2.70
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     26.00 =    2797.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     26.00 TO NODE     25.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    754.50  DOWNSTREAM(FEET) =    747.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    53.00   CHANNEL SLOPE =  0.1415
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   1.500
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =     115.28
  FLOW VELOCITY(FEET/SEC.) =   9.45   FLOW DEPTH(FEET) =   0.58
  TRAVEL TIME(MIN.) =   0.09   Tc(MIN.) =   20.92
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     25.00 =    2850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     25.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.663
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5199
  SUBAREA AREA(ACRES) =    0.03   SUBAREA RUNOFF(CFS) =    0.04
  TOTAL AREA(ACRES) =       60.4   TOTAL RUNOFF(CFS) =     115.28
  TC(MIN.) =   20.92
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     24.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   747.00  DOWNSTREAM(FEET) =   739.30
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  25.32
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     115.28
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   21.04
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     24.00 =    3018.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     24.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.650
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5199
  SUBAREA AREA(ACRES) =    0.81   SUBAREA RUNOFF(CFS) =    1.54
  TOTAL AREA(ACRES) =       61.2   TOTAL RUNOFF(CFS) =     116.13
  TC(MIN.) =   21.04

****************************************************************************
  FLOW PROCESS FROM NODE     24.00 TO NODE      3.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   739.30  DOWNSTREAM(FEET) =   708.80
  FLOW LENGTH(FEET) =   651.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  25.57
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     116.13
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =   21.46
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      3.00 =    3669.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1      116.13    21.46       3.604       61.19
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      3.00 =    3669.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       24.94    15.64       4.420       10.97
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      3.00 =    1298.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1     109.58      15.64        4.420
     2     136.47      21.46        3.604

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     136.47   Tc(MIN.) =   21.46
  TOTAL AREA(ACRES) =       72.2

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      1.80 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   708.80  DOWNSTREAM(FEET) =   707.50
  FLOW LENGTH(FEET) =    96.00   MANNING'S N =  0.011
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.98
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =     136.47
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   21.56
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.80 =    3765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.80 TO NODE      1.70 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   707.50  DOWNSTREAM(FEET) =   699.50
  FLOW LENGTH(FEET) =   109.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  19.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  31.49
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     136.47
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   21.62
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.70 =    3874.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.70 TO NODE      1.70 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     55.00 TO NODE     56.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6700
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    744.00
  DOWNSTREAM ELEVATION(FEET) =    733.00
  ELEVATION DIFFERENCE(FEET) =     11.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.593
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
  FLOW PROCESS FROM NODE     56.00 TO NODE     57.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    733.00  DOWNSTREAM(FEET) =    716.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   236.00   CHANNEL SLOPE =  0.0720
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.022   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6700
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.90
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.73
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   1.06
```

```
  Tc(MIN.) =    4.65
  SUBAREA AREA(ACRES) =     0.19       SUBAREA RUNOFF(CFS) =    1.17
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.670
  TOTAL AREA(ACRES) =        0.2         PEAK FLOW RATE(CFS) =       1.48

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.14   FLOW VELOCITY(FEET/SEC.) =   4.37
  LONGEST FLOWPATH FROM NODE     55.00 TO NODE     57.00 =     336.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     57.00 TO NODE      1.70 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   710.00  DOWNSTREAM(FEET) =   699.50
  FLOW LENGTH(FEET) =    44.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.18
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.48
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    4.70
  LONGEST FLOWPATH FROM NODE     55.00 TO NODE      1.70 =     380.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     50.00 TO NODE      1.70 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3900
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5330
  SUBAREA AREA(ACRES) =    0.23   SUBAREA RUNOFF(CFS) =    0.83
  TOTAL AREA(ACRES) =        0.5   TOTAL RUNOFF(CFS) =       2.31
  TC(MIN.) =    4.70

****************************************************************************
  FLOW PROCESS FROM NODE      1.70 TO NODE      1.70 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        2.31     4.70       9.222        0.47
  LONGEST FLOWPATH FROM NODE     55.00 TO NODE      1.70 =     380.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1      136.47    21.62       3.587       72.16
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.70 =    3874.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      31.98       4.70        9.222
     2     137.37      21.62        3.587
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     137.37   Tc(MIN.) =   21.62
  TOTAL AREA(ACRES) =       72.6

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      1.70 TO NODE      1.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   699.50  DOWNSTREAM(FEET) =   699.00
  FLOW LENGTH(FEET) =    20.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  27.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.90
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     137.37
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =   21.63
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.50 =    3894.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.50 TO NODE      1.50 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    802.00
  DOWNSTREAM ELEVATION(FEET) =    762.00
  ELEVATION DIFFERENCE(FEET) =     40.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.682
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.492
  SUBAREA RUNOFF(CFS) =      0.43
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.43

****************************************************************************
  FLOW PROCESS FROM NODE     52.00 TO NODE     53.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    762.00  DOWNSTREAM(FEET) =    730.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   770.00   CHANNEL SLOPE =  0.0416
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.136
  *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .4200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.30
  AVERAGE FLOW DEPTH(FEET) =   0.48   TRAVEL TIME(MIN.) =   1.76
  Tc(MIN.) =    7.44
  SUBAREA AREA(ACRES) =     1.93       SUBAREA RUNOFF(CFS) =    5.78
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.420
  TOTAL AREA(ACRES) =        2.0         PEAK FLOW RATE(CFS) =       6.14

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =   8.38
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE     53.00 =     870.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     53.00 TO NODE     54.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   725.00  DOWNSTREAM(FEET) =   724.00
  FLOW LENGTH(FEET) =    34.25   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.07
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.14
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    7.50
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE     54.00 =     904.25 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     54.00 TO NODE      1.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   724.00  DOWNSTREAM(FEET) =   699.00
  FLOW LENGTH(FEET) =   253.16   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.22
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.14
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    7.76
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE      1.50 =    1157.41 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.50 TO NODE      1.50 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        6.14     7.76       6.947        2.05
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE      1.50 =    1157.41 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1      137.37    21.63       3.585       72.63
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.50 =    3894.00 FEET.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      55.40       7.76        6.947
      2     140.54      21.63        3.585

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     140.54   Tc(MIN.) =   21.63
  TOTAL AREA(ACRES) =       74.7

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      1.50 TO NODE      1.30 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   699.00  DOWNSTREAM(FEET) =   695.30
  FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  27.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.61
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     140.54
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   21.82
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.30 =    4102.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.30 TO NODE      1.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   695.30  DOWNSTREAM(FEET) =   693.84
  FLOW LENGTH(FEET) =    31.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  20.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.45
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     140.54
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =   21.84
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.00 =    4133.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     32.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    757.00
```

```
  DOWNSTREAM ELEVATION(FEET) =    742.00
  ELEVATION DIFFERENCE(FEET) =     15.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.846
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     30.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    742.00  DOWNSTREAM(FEET) =    708.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   699.00   CHANNEL SLOPE =  0.0479
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.024
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.94
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.88
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =  13.24
  Tc(MIN.) =   18.08
  SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =    4.81
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       4.92

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   1.01
  LONGEST FLOWPATH FROM NODE     32.00 TO NODE     30.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     60.00 TO NODE     30.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.024
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5251
  SUBAREA AREA(ACRES) =    0.16   SUBAREA RUNOFF(CFS) =    0.39
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =       5.30
  TC(MIN.) =   18.08

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     40.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   708.50  DOWNSTREAM(FEET) =   697.25
  FLOW LENGTH(FEET) =   133.90   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.72
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.30
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   18.24
```

```
  LONGEST FLOWPATH FROM NODE     32.00 TO NODE     40.00 =     932.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     40.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.003
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5305
  SUBAREA AREA(ACRES) =    0.04   SUBAREA RUNOFF(CFS) =    0.14
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =       5.41
  TC(MIN.) =   18.24

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     40.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     43.00 TO NODE     42.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    934.00
  DOWNSTREAM ELEVATION(FEET) =    929.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.106
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.107
  SUBAREA RUNOFF(CFS) =      0.93
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.93

****************************************************************************
  FLOW PROCESS FROM NODE     42.00 TO NODE     41.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    929.00  DOWNSTREAM(FEET) =    868.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   582.00   CHANNEL SLOPE =  0.1048
  CHANNEL BASE(FEET) =  300.00   "Z" FACTOR =  12.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.574
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.11
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   8.72
  Tc(MIN.) =   14.83
  SUBAREA AREA(ACRES) =     7.87       SUBAREA RUNOFF(CFS) =   18.72
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =        8.1         PEAK FLOW RATE(CFS) =      19.24

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE     41.00 =     682.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     41.00 TO NODE     40.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    868.00  DOWNSTREAM(FEET) =    697.25
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2100.00   CHANNEL SLOPE =  0.0813
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.832
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      44.35
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.48
  AVERAGE FLOW DEPTH(FEET) =   1.22   TRAVEL TIME(MIN.) =   4.68
  Tc(MIN.) =   19.51
  SUBAREA AREA(ACRES) =    25.13       SUBAREA RUNOFF(CFS) =   50.08
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       33.2         PEAK FLOW RATE(CFS) =      66.20

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.42   FLOW VELOCITY(FEET/SEC.) =   8.25
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE     40.00 =    2782.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     40.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       66.20    19.51       3.832       33.22
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE     40.00 =    2782.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        5.41    18.24       4.003        2.55
  LONGEST FLOWPATH FROM NODE     32.00 TO NODE     40.00 =     932.90 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      67.29      18.24        4.003
     2      71.38      19.51        3.832

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      71.38   Tc(MIN.) =   19.51
  TOTAL AREA(ACRES) =       35.8

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE      1.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
```

Post-Dev Unmitigated – 100-Year Storm

```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   697.25  DOWNSTREAM(FEET) =   693.84
  FLOW LENGTH(FEET) =    72.87   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  14.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.30
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      71.38
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   19.57
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE      1.00 =    2854.87 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       71.38    19.57       3.824       35.77
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE      1.00 =    2854.87 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1      140.54    21.84       3.563       74.68
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.00 =    4133.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1     197.32      19.57        3.824
     2     207.05      21.84        3.563

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     207.05   Tc(MIN.) =   21.84
  TOTAL AREA(ACRES) =      110.4
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      110.4  TC(MIN.) =     21.84
  PEAK FLOW RATE(CFS)   =     207.05
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

10 YEAR STORM

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                       2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2012 Advanced Engineering Software (aes)
             Ver. 19.0 Release Date: 06/01/2012  License ID 1459

                          Analysis prepared by:

                                 BHA Inc
                      5115 Avenida Encinas, Suite L
                            Carlsbad CA 92008

 ************************** DESCRIPTION OF STUDY **************************
* 10 Year Storm Developed Condition Hydrology Analysis- Unmitigated        *
* Type-D Soil, Residential 2.9 DU/A                                        *
* Tomlinson North Property                                                 *
 **************************************************************************

-----------------------------------------------------------------------------
  FILE NAME: 0902100P.DAT
  TIME/DATE OF STUDY: 15:43 02/22/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.400
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE      9.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    757.00
  DOWNSTREAM ELEVATION(FEET) =    756.20
```

```
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.055
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    71.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.311
  SUBAREA RUNOFF(CFS) =      0.21
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.21

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE      8.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    756.20  DOWNSTREAM(FEET) =    755.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =    79.00   CHANNEL SLOPE =  0.0101
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.742
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.48
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.59
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   2.22
  Tc(MIN.) =   11.28
  SUBAREA AREA(ACRES) =     0.29       SUBAREA RUNOFF(CFS) =    0.53
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.490
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       0.72

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.15   FLOW VELOCITY(FEET/SEC.) =   0.65
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      8.00 =     154.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      7.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    755.40  DOWNSTREAM(FEET) =    745.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00   CHANNEL SLOPE =  0.1000
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  15.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.591
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6400
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.82
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.23
  AVERAGE FLOW DEPTH(FEET) =   0.02   TRAVEL TIME(MIN.) =   0.75
  Tc(MIN.) =   12.02
  SUBAREA AREA(ACRES) =     0.09       SUBAREA RUNOFF(CFS) =    0.21
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.518
  TOTAL AREA(ACRES) =        0.5         PEAK FLOW RATE(CFS) =       0.89

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.02   FLOW VELOCITY(FEET/SEC.) =   2.20
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      7.00 =     254.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      6.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  745.40  DOWNSTREAM ELEVATION(FEET) =  721.00
  STREET LENGTH(FEET) =   821.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   1.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.62
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.85
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.65
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.12
  STREET FLOW TRAVEL TIME(MIN.) =   3.75   Tc(MIN.) =   15.78
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.014
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.537
  SUBAREA AREA(ACRES) =    3.35      SUBAREA RUNOFF(CFS) =    5.45
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =       6.20

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  4.02   DEPTH*VELOCITY(FT*FT/SEC.) =   1.39
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      6.00 =    1075.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    94.00
  UPSTREAM ELEVATION(FEET) =    754.00
  DOWNSTREAM ELEVATION(FEET) =    753.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.060
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.96
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
```

```
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.309
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.23

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     12.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    753.00  DOWNSTREAM(FEET) =    751.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   151.00   CHANNEL SLOPE =  0.0099
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.369
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.48
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.60
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   4.21
  Tc(MIN.) =   13.27
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.50
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.490
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       0.68

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.15   FLOW VELOCITY(FEET/SEC.) =   0.62
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     12.00 =     245.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     11.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  751.50  DOWNSTREAM ELEVATION(FEET) =  721.00
  STREET LENGTH(FEET) =   669.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   1.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.73
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.85
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.05
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.10
  STREET FLOW TRAVEL TIME(MIN.) =   2.75   Tc(MIN.) =   16.02
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.983
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5100
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.507
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    4.11
```

```
  TOTAL AREA(ACRES) =       3.1       PEAK FLOW RATE(CFS) =      4.71

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.07
  FLOW VELOCITY(FEET/SEC.) =  4.56   DEPTH*VELOCITY(FT*FT/SEC.) =   1.41
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     11.00 =     914.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE      6.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   716.70  DOWNSTREAM(FEET) =   716.60
  FLOW LENGTH(FEET) =    23.50   MANNING'S N =  0.011
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.51
  GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.71
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   16.11
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE      6.00 =     937.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        4.71    16.11       2.973        3.11
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE      6.00 =     937.50 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        6.20    15.78       3.014        3.83
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      6.00 =    1075.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      10.81      15.78       3.014
     2      10.82      16.11       2.973

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.82   Tc(MIN.) =   16.11
  TOTAL AREA(ACRES) =       6.9

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

CHAPTER 3

CALCULATIONS

3.3 – Developed Condition Hydrology Calculations- Mitigated

100 YEAR STORM

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2012 Advanced Engineering Software (aes)
             Ver. 19.0 Release Date: 06/01/2012  License ID 1459

                           Analysis prepared by:

                                  BHA Inc
                      5115 Avenida Encinas, Suite L
                            Carlsbad CA 92008

 ************************** DESCRIPTION OF STUDY **************************
 * 100 Year Storm Developed Condition Hydrology Analysis- Mitigated         *
 * Type-D Soil, Residential 2.9 DU/A                                        *
 * Tomlinson North Property                                                 *
 **************************************************************************
----------------------------------------------------------------------------
  FILE NAME: 0902100P.DAT
  TIME/DATE OF STUDY: 11:50 02/15/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE      9.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    757.00
  DOWNSTREAM ELEVATION(FEET) =    756.20
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.055
```

```
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    71.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.287
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE      8.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    756.20  DOWNSTREAM(FEET) =    755.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =    79.00   CHANNEL SLOPE =  0.0101
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.512
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.70
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.64
  AVERAGE FLOW DEPTH(FEET) =   0.15   TRAVEL TIME(MIN.) =   2.05
  Tc(MIN.) =   11.10
  SUBAREA AREA(ACRES) =     0.29       SUBAREA RUNOFF(CFS) =    0.78
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.490
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       1.05

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   0.72
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      8.00 =     154.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      7.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    755.40  DOWNSTREAM(FEET) =    745.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00   CHANNEL SLOPE =  0.1000
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  15.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.291
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6400
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.21
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.30
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   0.73
  Tc(MIN.) =   11.83
  SUBAREA AREA(ACRES) =     0.09       SUBAREA RUNOFF(CFS) =    0.30
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.518
  TOTAL AREA(ACRES) =        0.5         PEAK FLOW RATE(CFS) =       1.32

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   2.51
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      7.00 =     254.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      6.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  745.40  DOWNSTREAM ELEVATION(FEET) =  721.00
  STREET LENGTH(FEET) =   821.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   1.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   11.72
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.35
  STREET FLOW TRAVEL TIME(MIN.) =   3.45   Tc(MIN.) =   15.28
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.486
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5400
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.537
  SUBAREA AREA(ACRES) =    3.35      SUBAREA RUNOFF(CFS) =    8.12
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =       9.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  4.02   DEPTH*VELOCITY(FT*FT/SEC.) =   1.39
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      6.00 =    1075.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    94.00
  UPSTREAM ELEVATION(FEET) =    754.00
  DOWNSTREAM ELEVATION(FEET) =    753.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.060
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.96
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.285
  SUBAREA RUNOFF(CFS) =      0.34
```

```
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.34

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     12.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    753.00  DOWNSTREAM(FEET) =    751.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   151.00   CHANNEL SLOPE =  0.0099
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.992
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4900
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.65
  AVERAGE FLOW DEPTH(FEET) =   0.15   TRAVEL TIME(MIN.) =   3.89
  Tc(MIN.) =   12.95
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.73
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.490
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       1.00

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   0.69
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     12.00 =     245.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     11.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  751.50  DOWNSTREAM ELEVATION(FEET) =  721.00
  STREET LENGTH(FEET) =   669.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   1.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.07
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    9.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.38
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.31
  STREET FLOW TRAVEL TIME(MIN.) =   2.55   Tc(MIN.) =   15.49
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.446
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5100
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.507
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    6.12
  TOTAL AREA(ACRES) =        3.1        PEAK FLOW RATE(CFS) =       7.02
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  11.97
  FLOW VELOCITY(FEET/SEC.) =  4.98   DEPTH*VELOCITY(FT*FT/SEC.) =   1.72
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     11.00 =     914.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE      6.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   716.70  DOWNSTREAM(FEET) =   716.60
  FLOW LENGTH(FEET) =    23.50   MANNING'S N =  0.011
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.51
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.02
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   15.58
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE      6.00 =     937.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        7.02    15.58       4.430        3.11
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE      6.00 =     937.50 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        9.23    15.28       4.486        3.83
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      6.00 =    1075.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      16.11      15.28        4.486
     2      16.13      15.58        4.430

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      16.13   Tc(MIN.) =   15.58
  TOTAL AREA(ACRES) =        6.9

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      5.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   716.60  DOWNSTREAM(FEET) =   716.50
  FLOW LENGTH(FEET) =    14.50   MANNING'S N =  0.011
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.74
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.13
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   15.62
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      5.00 =    1089.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.10 TO NODE      4.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.423
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5073
  SUBAREA AREA(ACRES) =    0.73   SUBAREA RUNOFF(CFS) =    1.13
  TOTAL AREA(ACRES) =        7.7   TOTAL RUNOFF(CFS) =      17.21
  TC(MIN.) =   15.62

****************************************************************************
  FLOW PROCESS FROM NODE      4.50 TO NODE      4.50 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  20.05   RAIN INTENSITY(INCH/HOUR) =  3.77
  TOTAL AREA(ACRES) =     7.67   TOTAL RUNOFF(CFS) =      6.90

****************************************************************************
  FLOW PROCESS FROM NODE      4.50 TO NODE      4.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   713.50  DOWNSTREAM(FEET) =   710.00
  FLOW LENGTH(FEET) =    22.80   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.69
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.90
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =   20.07
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      4.00 =    1112.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     39.00 TO NODE     38.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    896.00
  DOWNSTREAM ELEVATION(FEET) =    883.00
  ELEVATION DIFFERENCE(FEET) =     13.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.846
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE     38.00 TO NODE     37.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    883.00  DOWNSTREAM(FEET) =    745.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   659.00   CHANNEL SLOPE =  0.2091
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.076
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.13
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.08
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   2.69
  Tc(MIN.) =    7.54
  SUBAREA AREA(ACRES) =     3.13       SUBAREA RUNOFF(CFS) =   11.52
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =        3.2         PEAK FLOW RATE(CFS) =      11.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   5.06
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE     37.00 =     759.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     37.00 TO NODE     36.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   745.20  DOWNSTREAM(FEET) =   742.00
  FLOW LENGTH(FEET) =    97.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.63
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.70
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    7.67
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE     36.00 =     856.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     36.00 TO NODE      4.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    742.00  DOWNSTREAM(FEET) =    710.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   423.00   CHANNEL SLOPE =  0.0757
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   2.000
```

```
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.685
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.84
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  12.45
  AVERAGE FLOW DEPTH(FEET) =   0.69   TRAVEL TIME(MIN.) =   0.57
  Tc(MIN.) =    8.23
  SUBAREA AREA(ACRES) =     0.12       SUBAREA RUNOFF(CFS) =    0.28
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.514
  TOTAL AREA(ACRES) =        3.3         PEAK FLOW RATE(CFS) =      11.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.69   FLOW VELOCITY(FEET/SEC.) =  12.31
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      4.00 =    1279.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       11.70     8.23       6.685        3.30
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      4.00 =    1279.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        6.90    20.07       3.763        7.67
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      4.00 =    1112.30 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      14.53       8.23        6.685
      2      13.49      20.07        3.763

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      14.53   Tc(MIN.) =    8.23
  TOTAL AREA(ACRES) =       11.0

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      3.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  7110.00  DOWNSTREAM(FEET) =   708.80
  FLOW LENGTH(FEET) =    19.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   1.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) = 375.77
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =      14.53
  PIPE TRAVEL TIME(MIN.) =   0.00    Tc(MIN.) =    8.23
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      3.00 =    1298.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     29.00 TO NODE     28.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    946.50
  DOWNSTREAM ELEVATION(FEET) =    942.00
  ELEVATION DIFFERENCE(FEET) =      4.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.324
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.925
  SUBAREA RUNOFF(CFS) =      0.99
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.99

****************************************************************************
  FLOW PROCESS FROM NODE     28.00 TO NODE     27.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    942.00  DOWNSTREAM(FEET) =    850.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1308.00   CHANNEL SLOPE =  0.0703
  CHANNEL BASE(FEET) =   40.00   "Z" FACTOR =  12.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.232
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.81
  AVERAGE FLOW DEPTH(FEET) =   0.26   TRAVEL TIME(MIN.) =   5.72
  Tc(MIN.) =   12.04
  SUBAREA AREA(ACRES) =    29.74       SUBAREA RUNOFF(CFS) =   80.91
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       30.0         PEAK FLOW RATE(CFS) =      81.56

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.38   FLOW VELOCITY(FEET/SEC.) =   4.84
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     27.00 =    1408.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     27.00 TO NODE     26.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    850.00  DOWNSTREAM(FEET) =    754.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1389.00   CHANNEL SLOPE =  0.0688
  CHANNEL BASE(FEET) =  300.00   "Z" FACTOR =   2.000
```

```
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.673
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     110.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.63
  AVERAGE FLOW DEPTH(FEET) =   0.14   TRAVEL TIME(MIN.) =   8.79
  Tc(MIN.) =   20.83
  SUBAREA AREA(ACRES) =    30.37       SUBAREA RUNOFF(CFS) =   58.01
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       60.3         PEAK FLOW RATE(CFS) =     115.28

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.14   FLOW VELOCITY(FEET/SEC.) =   2.70
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     26.00 =    2797.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     26.00 TO NODE     25.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    754.50  DOWNSTREAM(FEET) =    747.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    53.00   CHANNEL SLOPE =  0.1415
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   1.500
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =     115.28
  FLOW VELOCITY(FEET/SEC.) =   9.45   FLOW DEPTH(FEET) =   0.58
  TRAVEL TIME(MIN.) =   0.09   Tc(MIN.) =   20.92
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     25.00 =    2850.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     25.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.663
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5199
  SUBAREA AREA(ACRES) =    0.03   SUBAREA RUNOFF(CFS) =    0.04
  TOTAL AREA(ACRES) =       60.4   TOTAL RUNOFF(CFS) =     115.28
  TC(MIN.) =   20.92
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     24.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   747.00  DOWNSTREAM(FEET) =   739.30
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  25.32
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     115.28
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   21.04
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE     24.00 =    3018.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     24.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.650
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5199
  SUBAREA AREA(ACRES) =    0.81   SUBAREA RUNOFF(CFS) =    1.54
  TOTAL AREA(ACRES) =       61.2   TOTAL RUNOFF(CFS) =     116.13
  TC(MIN.) =   21.04

****************************************************************************
  FLOW PROCESS FROM NODE     24.00 TO NODE      3.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   739.30  DOWNSTREAM(FEET) =   708.80
  FLOW LENGTH(FEET) =   651.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  25.57
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     116.13
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =   21.46
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      3.00 =    3669.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1      116.13    21.46       3.604       61.19
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      3.00 =    3669.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       14.53     8.23       6.685       10.97
  LONGEST FLOWPATH FROM NODE     39.00 TO NODE      3.00 =    1298.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      59.09       8.23        6.685
     2     123.97      21.46        3.604

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     123.97   Tc(MIN.) =   21.46
  TOTAL AREA(ACRES) =       72.2

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      1.80 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   708.80  DOWNSTREAM(FEET) =   707.50
  FLOW LENGTH(FEET) =    96.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.90
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     123.97
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   21.56
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.80 =    3765.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE      1.80 TO NODE      1.70 IS CODE =  41
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   707.50  DOWNSTREAM(FEET) =   699.50
  FLOW LENGTH(FEET) =   109.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  18.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  30.71
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     123.97
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   21.62
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.70 =    3874.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE      1.70 TO NODE      1.70 IS CODE =  10
--------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
==========================================================================

**************************************************************************
  FLOW PROCESS FROM NODE     55.00 TO NODE     56.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6700
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    744.00
  DOWNSTREAM ELEVATION(FEET) =    733.00
  ELEVATION DIFFERENCE(FEET) =     11.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.593
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.31

**************************************************************************
  FLOW PROCESS FROM NODE     56.00 TO NODE     57.00 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    733.00  DOWNSTREAM(FEET) =    716.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   236.00   CHANNEL SLOPE =  0.0720
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.022   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
```

```
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6700
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.90
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.73
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   1.06
  Tc(MIN.) =    4.65
  SUBAREA AREA(ACRES) =     0.19       SUBAREA RUNOFF(CFS) =    1.17
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.670
  TOTAL AREA(ACRES) =        0.2         PEAK FLOW RATE(CFS) =       1.48

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.14   FLOW VELOCITY(FEET/SEC.) =   4.37
  LONGEST FLOWPATH FROM NODE     55.00 TO NODE     57.00 =     336.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     57.00 TO NODE     57.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   9.10   RAIN INTENSITY(INCH/HOUR) =  6.27
  TOTAL AREA(ACRES) =     0.25   TOTAL RUNOFF(CFS) =      1.30

****************************************************************************
  FLOW PROCESS FROM NODE     57.00 TO NODE      1.70 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   710.00  DOWNSTREAM(FEET) =   699.50
  FLOW LENGTH(FEET) =    44.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.60
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.30
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    9.15
  LONGEST FLOWPATH FROM NODE     55.00 TO NODE      1.70 =     380.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     50.00 TO NODE      1.70 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.243
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3900
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6190
  SUBAREA AREA(ACRES) =    0.23   SUBAREA RUNOFF(CFS) =    0.56
  TOTAL AREA(ACRES) =        0.5   TOTAL RUNOFF(CFS) =       1.86
  TC(MIN.) =    9.15

****************************************************************************
  FLOW PROCESS FROM NODE      1.70 TO NODE      1.70 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

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

```
    1        1.86     9.15       6.243        0.48
  LONGEST FLOWPATH FROM NODE     55.00 TO NODE      1.70 =     380.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1      123.97    21.62       3.586       72.16
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.70 =    3874.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
    1      54.34       9.15        6.243
    2     125.03      21.62        3.586

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     125.03   Tc(MIN.) =   21.62
  TOTAL AREA(ACRES) =       72.6

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      1.70 TO NODE      1.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   699.50  DOWNSTREAM(FEET) =   699.00
  FLOW LENGTH(FEET) =    20.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  25.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.49
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     125.03
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =   21.64
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.50 =    3894.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.50 TO NODE      1.50 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    802.00
  DOWNSTREAM ELEVATION(FEET) =    762.00
  ELEVATION DIFFERENCE(FEET) =     40.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.682
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.492
  SUBAREA RUNOFF(CFS) =      0.43
```

```
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.43

****************************************************************************
  FLOW PROCESS FROM NODE     52.00 TO NODE     53.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    762.00  DOWNSTREAM(FEET) =    730.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   770.00   CHANNEL SLOPE =  0.0416
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.136
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.30
  AVERAGE FLOW DEPTH(FEET) =   0.48   TRAVEL TIME(MIN.) =   1.76
  Tc(MIN.) =    7.44
  SUBAREA AREA(ACRES) =     1.93       SUBAREA RUNOFF(CFS) =    5.78
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.420
  TOTAL AREA(ACRES) =        2.0         PEAK FLOW RATE(CFS) =       6.14

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =   8.38
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE     53.00 =     870.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     53.00 TO NODE     54.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   725.00  DOWNSTREAM(FEET) =   724.00
  FLOW LENGTH(FEET) =    34.25   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.07
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.14
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    7.50
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE     54.00 =     904.25 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     54.00 TO NODE      1.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   724.00  DOWNSTREAM(FEET) =   699.00
  FLOW LENGTH(FEET) =   253.16   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.22
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.14
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    7.76
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE      1.50 =    1157.41 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.50 TO NODE      1.50 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
```

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

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        6.14     7.76       6.947        2.05
  LONGEST FLOWPATH FROM NODE     51.00 TO NODE      1.50 =    1157.41 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1      125.03    21.64       3.585       72.64
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.50 =    3894.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      50.97       7.76        6.947
     2     128.20      21.64        3.585

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     128.20   Tc(MIN.) =   21.64
  TOTAL AREA(ACRES) =       74.7

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      1.50 TO NODE      1.30 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   699.00  DOWNSTREAM(FEET) =   695.30
  FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  26.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.22
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     128.20
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   21.83
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.30 =    4102.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.30 TO NODE      1.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   695.30  DOWNSTREAM(FEET) =   693.84
  FLOW LENGTH(FEET) =    31.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  19.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.86
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     128.20
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =   21.85
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.00 =    4133.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  10
```

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

****************************************************************************
  FLOW PROCESS FROM NODE     32.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    757.00
  DOWNSTREAM ELEVATION(FEET) =    742.00
  ELEVATION DIFFERENCE(FEET) =     15.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.846
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  9.222
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     30.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    742.00  DOWNSTREAM(FEET) =    708.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   699.00   CHANNEL SLOPE =  0.0479
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.024
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.94
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.88
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =  13.24
  Tc(MIN.) =   18.08
  SUBAREA AREA(ACRES) =     2.30       SUBAREA RUNOFF(CFS) =    4.81
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       4.92

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   1.01
  LONGEST FLOWPATH FROM NODE     32.00 TO NODE     30.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     60.00 TO NODE     30.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.024
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5251
  SUBAREA AREA(ACRES) =    0.16   SUBAREA RUNOFF(CFS) =    0.39
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =       5.30
  TC(MIN.) =   18.08
```

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```
****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     40.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   708.50  DOWNSTREAM(FEET) =   697.25
  FLOW LENGTH(FEET) =   133.90   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.72
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.30
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   18.24
  LONGEST FLOWPATH FROM NODE     32.00 TO NODE     40.00 =     932.90 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     40.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.003
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5305
  SUBAREA AREA(ACRES) =    0.04   SUBAREA RUNOFF(CFS) =    0.14
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =       5.41
  TC(MIN.) =   18.24

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     40.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     43.00 TO NODE     42.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    934.00
  DOWNSTREAM ELEVATION(FEET) =    929.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.106
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.107
  SUBAREA RUNOFF(CFS) =      0.93
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.93

****************************************************************************
  FLOW PROCESS FROM NODE     42.00 TO NODE     41.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    929.00  DOWNSTREAM(FEET) =    868.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   582.00   CHANNEL SLOPE =  0.1048
  CHANNEL BASE(FEET) =  300.00   "Z" FACTOR =  12.000
```

```
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.574
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.11
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   8.72
  Tc(MIN.) =   14.83
  SUBAREA AREA(ACRES) =     7.87       SUBAREA RUNOFF(CFS) =   18.72
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =        8.1         PEAK FLOW RATE(CFS) =      19.24

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE     41.00 =     682.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     41.00 TO NODE     40.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    868.00  DOWNSTREAM(FEET) =    697.25
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2100.00   CHANNEL SLOPE =  0.0813
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   4.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.832
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      44.35
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.48
  AVERAGE FLOW DEPTH(FEET) =   1.22   TRAVEL TIME(MIN.) =   4.68
  Tc(MIN.) =   19.51
  SUBAREA AREA(ACRES) =    25.13       SUBAREA RUNOFF(CFS) =   50.08
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.520
  TOTAL AREA(ACRES) =       33.2         PEAK FLOW RATE(CFS) =      66.20

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.42   FLOW VELOCITY(FEET/SEC.) =   8.25
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE     40.00 =    2782.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     40.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       66.20    19.51       3.832       33.22
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE     40.00 =    2782.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        5.41    18.24       4.003        2.55
  LONGEST FLOWPATH FROM NODE     32.00 TO NODE     40.00 =     932.90 FEET.

  ** PEAK FLOW RATE TABLE **
```

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```
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      67.29      18.24        4.003
      2      71.38      19.51        3.832

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      71.38   Tc(MIN.) =   19.51
  TOTAL AREA(ACRES) =       35.8

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE      1.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   697.25  DOWNSTREAM(FEET) =   693.84
  FLOW LENGTH(FEET) =    72.87   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  14.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.30
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      71.38
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   19.57
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE      1.00 =    2854.87 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       71.38    19.57       3.824       35.77
  LONGEST FLOWPATH FROM NODE     43.00 TO NODE      1.00 =    2854.87 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      128.20    21.85       3.562       74.69
  LONGEST FLOWPATH FROM NODE     29.00 TO NODE      1.00 =    4133.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     186.23      19.57        3.824
      2     194.69      21.85        3.562

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     194.69   Tc(MIN.) =   21.85
  TOTAL AREA(ACRES) =      110.5
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      110.5  TC(MIN.) =     21.85
  PEAK FLOW RATE(CFS)   =     194.69
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
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CHAPTER 4

MODIFIED-PULS DETENTION ROUTING

4.1 – Rational Method Hydrographs

Rational Method Hydrograph

for

BMP 1 Tomlinson North Property, San Diego, CA

RATIONAL METHOD HYDROGRAPH PROGRAM
COPYRIGHT 1992, 2001 RICK ENGINEERING COMPANY

RUN DATE 2/9/2017
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 15 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 7.67 ACRES
RUNOFF COEFFICIENT 0.5073
PEAK DISCHARGE 17.21 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 15	DISCHARGE (CFS) = 0.8
TIME (MIN) = 30	DISCHARGE (CFS) = 0.8
TIME (MIN) = 45	DISCHARGE (CFS) = 0.9
TIME (MIN) = 60	DISCHARGE (CFS) = 0.9
TIME (MIN) = 75	DISCHARGE (CFS) = 1
TIME (MIN) = 90	DISCHARGE (CFS) = 1
TIME (MIN) = 105	DISCHARGE (CFS) = 1.1
TIME (MIN) = 120	DISCHARGE (CFS) = 1.2
TIME (MIN) = 135	DISCHARGE (CFS) = 1.3
TIME (MIN) = 150	DISCHARGE (CFS) = 1.4
TIME (MIN) = 165	DISCHARGE (CFS) = 1.6
TIME (MIN) = 180	DISCHARGE (CFS) = 1.7
TIME (MIN) = 195	DISCHARGE (CFS) = 2.1
TIME (MIN) = 210	DISCHARGE (CFS) = 2.4
TIME (MIN) = 225	DISCHARGE (CFS) = 3.5
TIME (MIN) = 240	DISCHARGE (CFS) = 5.4
TIME (MIN) = 255	DISCHARGE (CFS) = 17.21
TIME (MIN) = 270	DISCHARGE (CFS) = 2.8
TIME (MIN) = 285	DISCHARGE (CFS) = 1.9
TIME (MIN) = 300	DISCHARGE (CFS) = 1.5
TIME (MIN) = 315	DISCHARGE (CFS) = 1.2
TIME (MIN) = 330	DISCHARGE (CFS) = 1.1
TIME (MIN) = 345	DISCHARGE (CFS) = 1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.9
TIME (MIN) = 375	DISCHARGE (CFS) = 0

Rational Method Hydrograph

for

BMP 2 Tomlinson North Property, San Diego, CA

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 2/9/2017
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 0.24 ACRES
RUNOFF COEFFICIENT 0.67
PEAK DISCHARGE 1.48 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
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TIME (MIN) = 15	DISCHARGE (CFS) = 0
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TIME (MIN) = 160	DISCHARGE (CFS) = 0.1
TIME (MIN) = 165	DISCHARGE (CFS) = 0.1
TIME (MIN) = 170	DISCHARGE (CFS) = 0.1
TIME (MIN) = 175	DISCHARGE (CFS) = 0.1
TIME (MIN) = 180	DISCHARGE (CFS) = 0.1
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TIME (MIN) = 190	DISCHARGE (CFS) = 0.1
TIME (MIN) = 195	DISCHARGE (CFS) = 0.1
TIME (MIN) = 200	DISCHARGE (CFS) = 0.1
TIME (MIN) = 205	DISCHARGE (CFS) = 0.1
TIME (MIN) = 210	DISCHARGE (CFS) = 0.1
TIME (MIN) = 215	DISCHARGE (CFS) = 0.1
TIME (MIN) = 220	DISCHARGE (CFS) = 0.1
TIME (MIN) = 225	DISCHARGE (CFS) = 0.2
TIME (MIN) = 230	DISCHARGE (CFS) = 0.2
TIME (MIN) = 235	DISCHARGE (CFS) = 0.3
TIME (MIN) = 240	DISCHARGE (CFS) = 0.4

TIME (MIN) = 245	DISCHARGE (CFS) = 1.48
TIME (MIN) = 250	DISCHARGE (CFS) = 0.2
TIME (MIN) = 255	DISCHARGE (CFS) = 0.2
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TIME (MIN) = 270	DISCHARGE (CFS) = 0.1
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TIME (MIN) = 285	DISCHARGE (CFS) = 0.1
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TIME (MIN) = 315	DISCHARGE (CFS) = 0
TIME (MIN) = 320	DISCHARGE (CFS) = 0
TIME (MIN) = 325	DISCHARGE (CFS) = 0
TIME (MIN) = 330	DISCHARGE (CFS) = 0
TIME (MIN) = 335	DISCHARGE (CFS) = 0
TIME (MIN) = 340	DISCHARGE (CFS) = 0
TIME (MIN) = 345	DISCHARGE (CFS) = 0
TIME (MIN) = 350	DISCHARGE (CFS) = 0
TIME (MIN) = 355	DISCHARGE (CFS) = 0
TIME (MIN) = 360	DISCHARGE (CFS) = 0
TIME (MIN) = 365	DISCHARGE (CFS) = 0

Rational Method Hydrograph
for
BMP 3 Tomlinson North Property, San Diego, CA

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 2/9/2017
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 0.23 ACRES
RUNOFF COEFFICIENT 0.39
PEAK DISCHARGE 0.83 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 0
TIME (MIN) = 15	DISCHARGE (CFS) = 0
TIME (MIN) = 20	DISCHARGE (CFS) = 0
TIME (MIN) = 25	DISCHARGE (CFS) = 0
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TIME (MIN) = 95	DISCHARGE (CFS) = 0
TIME (MIN) = 100	DISCHARGE (CFS) = 0
TIME (MIN) = 105	DISCHARGE (CFS) = 0
TIME (MIN) = 110	DISCHARGE (CFS) = 0
TIME (MIN) = 115	DISCHARGE (CFS) = 0
TIME (MIN) = 120	DISCHARGE (CFS) = 0
TIME (MIN) = 125	DISCHARGE (CFS) = 0
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TIME (MIN) = 185	DISCHARGE (CFS) = 0
TIME (MIN) = 190	DISCHARGE (CFS) = 0
TIME (MIN) = 195	DISCHARGE (CFS) = 0.1
TIME (MIN) = 200	DISCHARGE (CFS) = 0.1
TIME (MIN) = 205	DISCHARGE (CFS) = 0.1
TIME (MIN) = 210	DISCHARGE (CFS) = 0.1
TIME (MIN) = 215	DISCHARGE (CFS) = 0.1
TIME (MIN) = 220	DISCHARGE (CFS) = 0.1
TIME (MIN) = 225	DISCHARGE (CFS) = 0.1
TIME (MIN) = 230	DISCHARGE (CFS) = 0.1
TIME (MIN) = 235	DISCHARGE (CFS) = 0.2
TIME (MIN) = 240	DISCHARGE (CFS) = 0.2

TIME (MIN) = 245	DISCHARGE (CFS) = 0.83
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TIME (MIN) = 255	DISCHARGE (CFS) = 0.1
TIME (MIN) = 260	DISCHARGE (CFS) = 0.1
TIME (MIN) = 265	DISCHARGE (CFS) = 0.1
TIME (MIN) = 270	DISCHARGE (CFS) = 0.1
TIME (MIN) = 275	DISCHARGE (CFS) = 0
TIME (MIN) = 280	DISCHARGE (CFS) = 0
TIME (MIN) = 285	DISCHARGE (CFS) = 0
TIME (MIN) = 290	DISCHARGE (CFS) = 0
TIME (MIN) = 295	DISCHARGE (CFS) = 0
TIME (MIN) = 300	DISCHARGE (CFS) = 0
TIME (MIN) = 305	DISCHARGE (CFS) = 0
TIME (MIN) = 310	DISCHARGE (CFS) = 0
TIME (MIN) = 315	DISCHARGE (CFS) = 0
TIME (MIN) = 320	DISCHARGE (CFS) = 0
TIME (MIN) = 325	DISCHARGE (CFS) = 0
TIME (MIN) = 330	DISCHARGE (CFS) = 0
TIME (MIN) = 335	DISCHARGE (CFS) = 0
TIME (MIN) = 340	DISCHARGE (CFS) = 0
TIME (MIN) = 345	DISCHARGE (CFS) = 0
TIME (MIN) = 350	DISCHARGE (CFS) = 0
TIME (MIN) = 355	DISCHARGE (CFS) = 0
TIME (MIN) = 360	DISCHARGE (CFS) = 0
TIME (MIN) = 365	DISCHARGE (CFS) = 0

CHAPTER 4

MODIFIED-PULS DETENTION ROUTING

4.2 – STAGE-STORAGE & STAGE-DISCHARGE RELATIONSHIPS

DISCHARGE EQUATIONS

1) Weir:
$Q_W = C_W * L * H^{3/2}$ (1)

2) Slot:

As an orifice: $Q_S = B_S * h_S * c_g * \sqrt{2g(H - \frac{h_S}{2})}$ (2.a)

As a weir: $Q_S = C_W * B_S * H^{3/2}$ (2.b)

For $H > h_S$ slot works as weir until orifice equation provides a smaller discharge. The elevation such that equation (2.a) = equation (2.b) is the elevation at which the behavior changes from weir to orifice.

3) Vertical Orifices

As an orifice: $Q_O = 0.25 * \pi D^2 * c_g * \sqrt{2g(H - \frac{D}{2})}$ (3.a)

As a weir: Critical depth and geometric family of circular sector must be solved to determine Q as a function of H:

$$\frac{Q_O^2}{g} = \frac{A_{cr}^3}{T_{cr}}; H = y_{cr} + \frac{A_{cr}}{2*T_{cr}}; T_{cr} = 2\sqrt{y_{cr}(D - y_{cr})}; A_{cr} = \frac{D^2}{8}[a_{cr} - \sin(a_{cr})];$$
$$y_{cr} = \frac{D}{2}[1 - \sin(0.5 * a_{cr})]$$ (3.b.1, 3.b.2, 3.b.3, 3.b.4 and 3.b.5)

There is a value of H (approximately H=110%D) from which orifices no longer work as weirs as critical depth is not possible at the entrance of the orifice. This value of H is obtained equaling the discharge using critical equations and equations (3.b).

A mathematical model is prepared with the previous equations depending on the type of discharge.

The following are the variables used above:

Q_W, Q_s, Q_o = Discharge of weir, slot or orifice (cfs)

C_W, c_g: Coefficients of discharge of weir (typically 3.1) and orifice (0.61 to 0.62)

L, B_s, D, h_s: Length of weir, width of slot, diameter of orifice and height of slot, respectively; (ft)

H: Level of water in the pond over the invert of slot, weir or orifice (ft)

$A_{cr}, T_{cr}, y_{cr}, a_{cr}$: Critical variables for circular sector: area (sq-ft), top width (ft), critical depth (ft), and angle to the center, respectively.

BASIN STORAGE AND DISCHARGE TABLES

BMP 1

Detention Flow Results Summary

BMP	Q_{IN}	Q_{OUT}	ΔQ	Max Depth (ft)	WSE
BMP 1	17.2	6.9	10.30	1.90	718.40

Capacity of 2.30"-dia Draindown Orifice at Base of Baffle

Basin Elev.	Basin Depth (ft)	Orifice Size Dia.(ft)	(Diameter) Area (sf)	Coefficient	Head (ft)	Q discharge (cfs)
716.5	0.00	0.19167	0.02885	0.603	3.5	0.261
716.7	0.20	0.19167	0.02885	0.603	3.7	0.269
716.9	0.40	0.19167	0.02885	0.603	3.9	0.276
717.1	0.60	0.19167	0.02885	0.603	4.1	0.283
717.3	0.80	0.19167	0.02885	0.603	4.3	0.290
717.5	1.00	0.19167	0.02885	0.603	4.5	0.296
717.7	1.20	0.19167	0.02885	0.603	4.7	0.303
717.9	1.40	0.19167	0.02885	0.603	4.9	0.309
718.1	1.60	0.19167	0.02885	0.603	5.1	0.315
718.3	1.80	0.19167	0.02885	0.603	5.3	0.321
718.5	2.00	0.19167	0.02885	0.603	5.5	0.327
718.7	2.20	0.19167	0.02885	0.603	5.7	0.333
718.9	2.40	0.19167	0.02885	0.603	5.9	0.339
719.0	2.50	0.19167	0.02885	0.603	6.0	0.342

Capacity of 3"x18" Slot Orifice

Using General Orifice Flow equation

where (H-Hd) equals available Head, g = 32.2 ft/s^2, D is the orifice diameter, and Cg is the orifice discharge coefficient.

Basin Depth (ft)	Orifice Size Area (ft^2)	Cg (considering	Head (ft)	Q discharge (cfs)	X 2 total slots
1.00	0.375	0.75	0	0.0000	0.000
1.20	0.375	0.75	0.2	1.0094	2.019
1.40	0.375	0.75	0.4	1.4275	2.855
1.60	0.375	0.75	0.6	1.7483	3.497
1.80	0.375	0.75	0.8	2.0187	4.037
2.00	0.375	0.75	1	2.2570	4.514
2.20	0.375	0.75	1.2	2.4724	4.945
2.40	0.375	0.75	1.4	2.6705	5.341
2.50	0.375	0.75	1.5	2.7643	5.529

Capacity of Overflow Weir- Top of Baffle

Using Sharp Crested Weir Formula equation (5-10) $Q=CLH^{1.5}$ where Coefficient C is 3.3 (Brater and King)

Basin Elev.	Basin Depth (ft)	Coefficient	Weir Length (ft)	Head (ft)	Q (cfs)	
718.3	1.8	3.3	12	0.05	0.44	
718.5	2.0	3.3	12	0.25	4.95	
718.7	2.2	3.3	12	0.45	11.95	
718.9	2.4	3.3	12	0.65	20.75	> 16.55 cfs Q_{IN} ✓
719.0	2.5	3.3	12	0.75	25.72	

Depth vs. Storage and Discharge Information

Bottom Basin Area (sf) = 14,634

Basin Elev.	Volume (ft^3)	Depth (ft)	Volume (acre-ft)	Outflow (cfs)
716.5	12926.70	0.0	0.297	0.261
716.7	15873.90	0.2	0.364	0.269
716.9	18861.90	0.4	0.433	0.276
717.1	21890.70	0.6	0.503	0.283
717.3	24960.30	0.8	0.573	0.290
717.5	28070.70	1.0	0.644	0.296
717.7	31221.90	1.2	0.717	2.321
717.9	34413.90	1.4	0.790	3.164
718.1	37646.70	1.6	0.864	3.812
718.3	40920.30	1.8	0.939	4.802
718.5	44234.70	2.0	1.015	9.791
718.7	47589.90	2.2	1.093	17.232
718.9	50985.90	2.4	1.170	26.432
719.0	52699.20	2.5	1.210	31.591

***assuming 40% Void Ratio in Gravel Layer and 10% Void Ratio in Engineered Soil Layer (typical value)

Drawdown calculator:

Flow through orifice plate governs drain-down flow:

14634	Basin Bottom Area (sf):
28071	Basin Volume @ 12" Depth (cf):
0.296	Q of 2.30" orifice plate at 12" Basin Depth (cfs)
26.33	Drawdown Time (hrs) < 96 hrs ✓

BMP 2

Detention Flow Results Summary

Basin	Q_{IN}	Q_{OUT}	ΔQ	Max Depth (ft)
BMP 2	1.5	1.3	0.2	1.1

Capacity of 0.37"-dia Draindown Orifice at Base of Baffle

Basin Depth (ft)	Orifice Size Dia.(ft)	(Diameter) Area (sf)	Coefficient	Head (ft)	Q discharge (cfs)
0.00	0.03083	0.00075	0.603	4.0	0.007
0.10	0.03083	0.00075	0.603	4.1	0.007
0.20	0.03083	0.00075	0.603	4.2	0.007
0.30	0.03083	0.00075	0.603	4.3	0.007
0.40	0.03083	0.00075	0.603	4.4	0.008
0.50	0.03083	0.00075	0.603	4.5	0.008
0.60	0.03083	0.00075	0.603	4.6	0.008
0.70	0.03083	0.00075	0.603	4.7	0.008
0.80	0.03083	0.00075	0.603	4.8	0.008
0.90	0.03083	0.00075	0.603	4.9	0.008
1.00	0.03083	0.00075	0.603	5.0	0.008
1.10	0.03083	0.00075	0.603	5.1	0.008
1.20	0.03083	0.00075	0.603	5.2	0.008
1.30	0.03083	0.00075	0.603	5.3	0.008
1.40	0.03083	0.00075	0.603	5.4	0.008
1.50	0.03083	0.00075	0.603	5.5	0.008

Capacity of 3"x18" Slot Orifice

Using General Orifice Flow equation:

where (H-Hd) equals available Head, $g = 32.2\ ft/s^2$, D is the orifice diameter, and Cg is the orifice discharge coefficient.

Basin Depth (ft)	Orifice Size Area (ft^2)	Cg (considering	Head (ft)	Q discharge (cfs)	X 2 total slots
0.50	0.375	0.75	0.067	0.5842	1.168
0.60	0.375	0.75	0.167	0.9223	1.845
0.70	0.375	0.75	0.267	1.1662	2.332
0.80	0.375	0.75	0.367	1.3673	2.735
0.90	0.375	0.75	0.467	1.5424	3.085
1.00	0.375	0.75	0.567	1.6995	3.399
1.10	0.375	0.75	0.667	1.8433	3.687
1.20	0.375	0.75	0.767	1.9767	3.953
1.30	0.375	0.75	0.867	2.1016	4.203
1.40	0.375	0.75	0.967	2.2195	4.439
1.50	0.375	0.75	1.067	2.3314	4.663

Capacity of Overflow Weir- Top of Baffle

Using Sharp Crested Weir Formula equation (5-10) $Q=CLH^{1.5}$ where Coefficient C is 3.3 (Brater and King)

Basin Depth (ft)	Coefficient	Weir Length (ft)	Head (ft)	Q (cfs)	
1.00	3.3	8	0	0.00	
1.10	3.3	8	0.1	0.83	
1.20	3.3	8	0.2	2.36	> 1.48 cfs Q_{IN} ✓
1.30	3.3	8	0.3	4.34	
1.40	3.3	8	0.4	6.68	
1.50	3.3	8	0.5	9.33	

Depth vs. Storage and Discharge Information

Bottom Basin Area (sf) = 877

Volume (ft^3)	Basin Depth (ft)	Volume (acre-ft)	Outflow (cfs)
950.08	0.0	0.022	0.0072
1039.58	0.1	0.024	0.0073
1132.68	0.2	0.026	0.0074
1229.38	0.3	0.028	0.0075
1329.68	0.4	0.031	0.0076
1433.58	0.5	0.033	1.1761
1541.08	0.6	0.035	1.8524
1652.18	0.7	0.038	2.3403
1766.88	0.8	0.041	2.7425
1885.18	0.9	0.043	3.0928
2007.08	1.0	0.046	3.4071
2132.58	1.1	0.049	4.5296
2261.68	1.2	0.052	6.3229
2394.38	1.3	0.055	8.5494
2530.68	1.4	0.058	11.1261
2670.58	1.5	0.061	14.0051

***assuming 40% Void Ratio in Gravel Layer and 10% Void Ratio in Engineered Soil Layer (typical value)

Drawdown calculator:

Flow through orifice plate governs drain-down flow:

877	Basin Bottom Area (sf):
1434	Basin Volume @ 6" Depth (cf):
0.008	Q of 0.37" orifice plate at 6" Basin Depth (cfs)
51.95	Drawdown Time (hrs) < 96 hrs ✓

BMP 3

Detention Flow Results Summary

Basin	Q_{IN}	Q_{OUT}	ΔQ	Max Depth (ft)
BMP 3	0.8	0.0	0.8	0.1

Capacity of 0.39"-dia Draindown Orifice at Base of Baffle

Basin Depth (ft)	Orifice Size Dia.(ft)	(Diameter) Area (sf)	Coefficient	Head (ft)	Q discharge (cfs)
0.00	0.03250	0.00083	0.603	1.1	0.004
0.10	0.03250	0.00083	0.603	1.2	0.004
0.20	0.03250	0.00083	0.603	1.3	0.005
0.30	0.03250	0.00083	0.603	1.4	0.005
0.40	0.03250	0.00083	0.603	1.5	0.005
0.50	0.03250	0.00083	0.603	1.6	0.005

Depth vs. Storage and Discharge Information

Bottom Basin Area (sf) = 6,191

Volume (ft^3)	Basin Depth (ft)	Volume (acre-ft)	Outflow (cfs)
1238.20	0.0	0.028	0.0042
1860.59	0.1	0.043	0.0044
2489.56	0.2	0.057	0.0045
3125.11	0.3	0.072	0.0047
3767.24	0.4	0.086	0.0049
4415.95	0.5	0.101	0.0051

***assuming 40% Void Ratio in Gravel Layer (typical value)

Drawdown calculator:

Using design infiltration rate to calculate drawdown time of effective permeable pavement area:

680	Basin Bottom Area (sf)
2.4	Effective Depth of Gravel Storage (in)
0.624	Design Infiltration Rate
3.85	Drawdown Time (hrs) < 36 hrs ✓

CHAPTER 4

MODIFIED-PULS DETENTION ROUTING

4.3 – BMP Outlet Details

TABLE 3—SUMMARY OF BMP DIMENSIONS

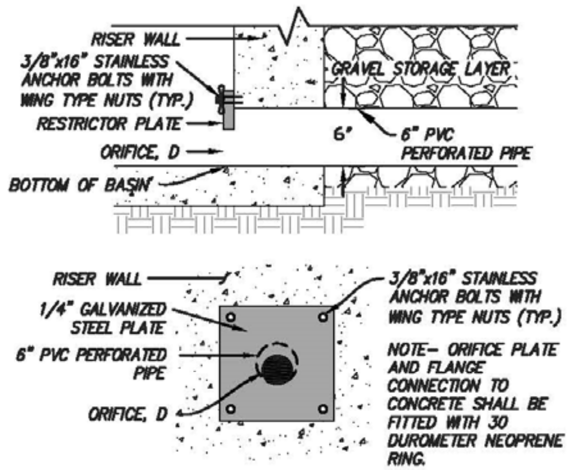
BMP	Tributary Area (Ac)	DIMENSIONS					
		BMP Area(1) (ft^2)	Low Flow Orifice, D (in)	Gravel Depth(2) (in)	Saturated Storage Depth(3) (in)	Depth Riser Invert(4) (ft)	Total Surface Depth(5) (ft)
BMP 1	7.75	14,634	2.30	22	3	1.75-ft	2.5-ft
BMP 2	0.24	877	0.37	28	3	1.0-ft	1.5-ft
BMP 3	0.23	800	0.39	6	10	-	-

Notes: (1): Area of amended soil = area of gravel = area of BMP.
(2): Depth of gravel above underdrain.
(3): Depth of gravel below underdrain for infiltration storage.
(4): Depth of ponding beneath riser structure's surface spillway.
(5): Total surface depth of BMP from top crest elevation to surface invert.

TABLE 4—SUMMARY OF BMP DIMENSIONS

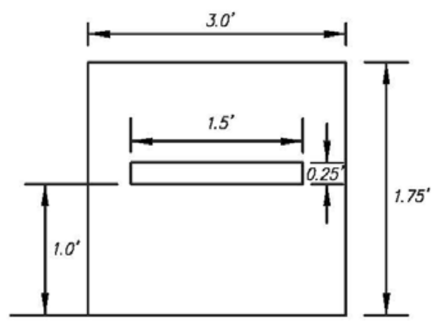
BMP	RISER DIMENSIONS		EMERGENCY WEIR		
	Outlet Type(1)	Invert Elevation(2) (ft)	Dimensions (#-size)(3)	Invert Elevation(4) (ft)	Weir Perimeter Length(5) (ft)
BMP 1	Slot Orifice	1.0	2 - 0.25' x 1.5'	1.75	12-ft
BMP 2	Slot Orifice	0.5	2 - 0.25' x 1.5'	1.0	8-ft

Notes: (1): Shape of orifice opening in riser structure.
(2): Depth from bottom of pond to invert of lower orifice or weir.
(3): Number of orifices - dimensions of orifice.
(4): Depth from bottom of pond to invert of emergency overflow weir.
(5): Overflow length, the internal perimeter of the riser is 12 ft (3 ft x 2 ft internal dimensions) for BMP 1 and 8 ft (2 ft x 2 ft internal dimensions) for BMP 2.



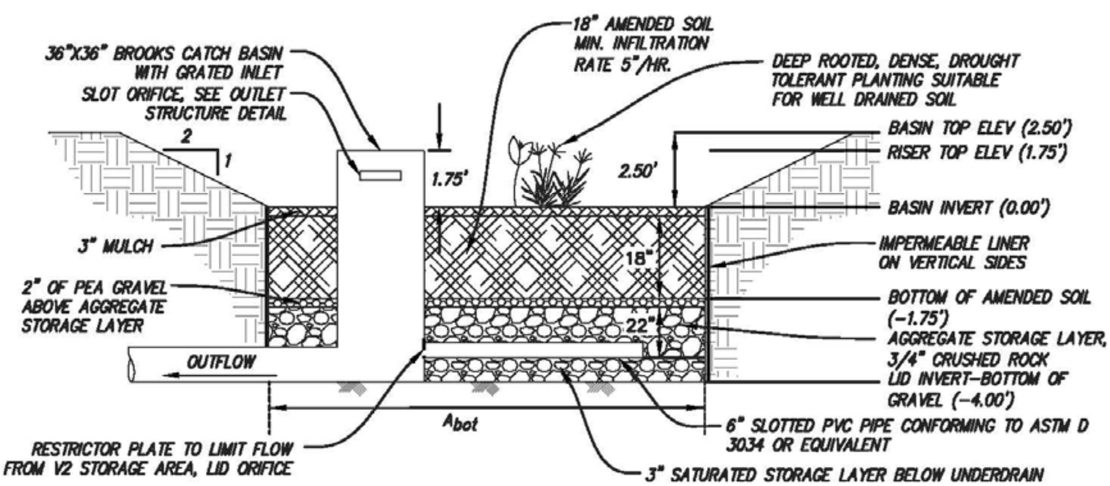
RESTRICTOR PLATE, BMP 1 & BMP 2 DETAIL

NOT TO SCALE



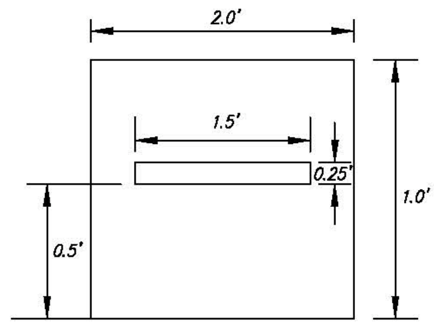
OUTLET STRUCTURE, BMP 1 DETAIL

NOT TO SCALE



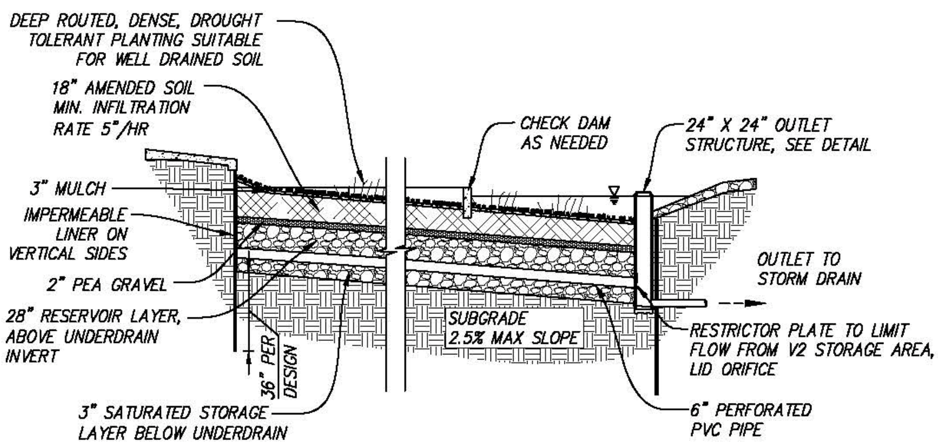
BIOFILTRATION BASIN, BMP 1 DETAIL

NOT TO SCALE



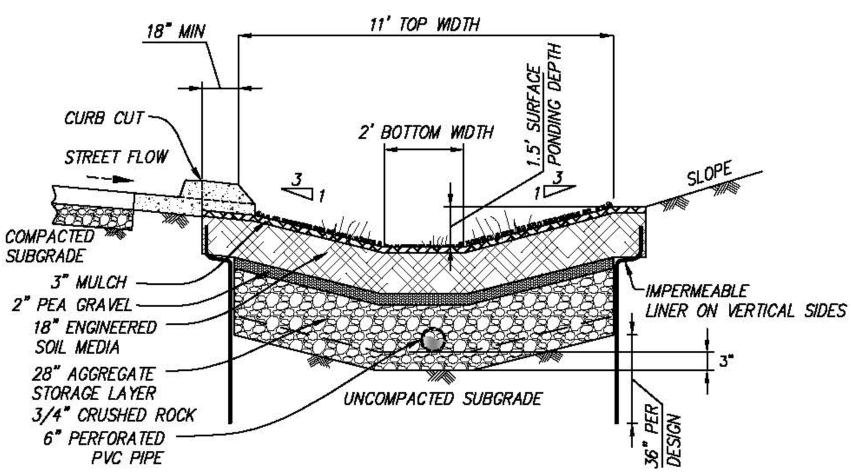
OUTLET STRUCTURE, BMP 2 DETAIL

NOT TO SCALE



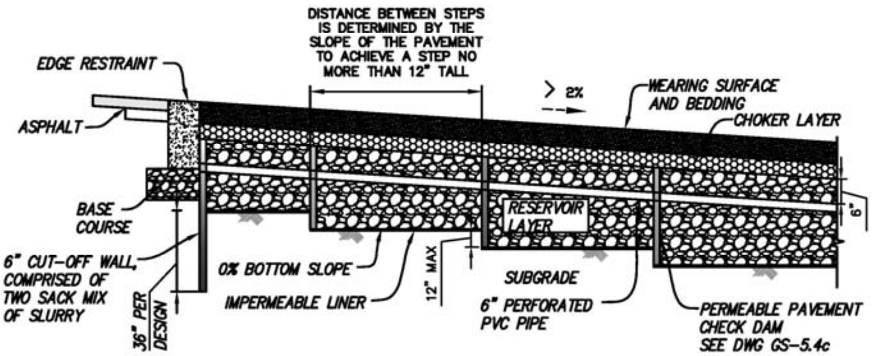
BIOFILTRATION BASIN, BMP 2 PROFILE

NOT TO SCALE



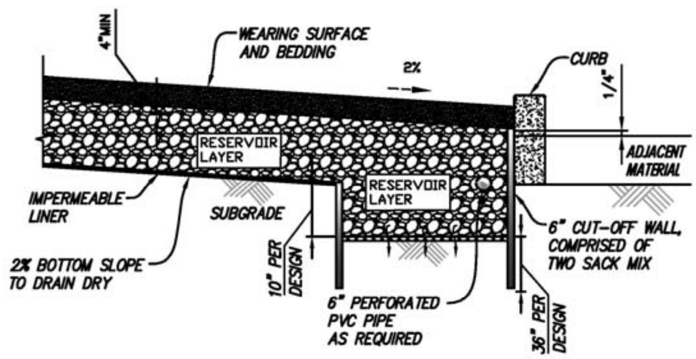
BIOFILTRATION BASIN, BMP 2 SECTION

NOT TO SCALE



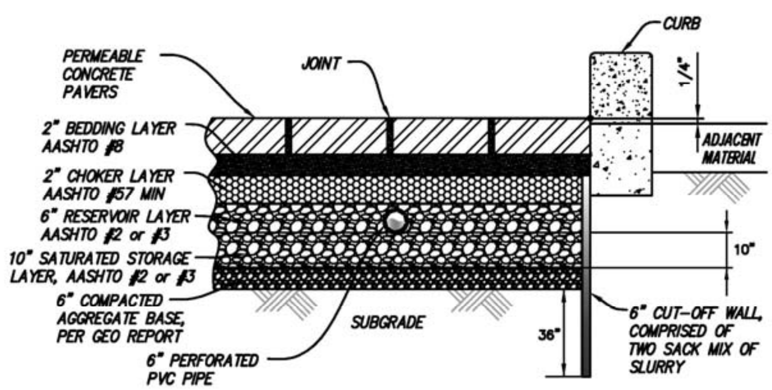
PERMEABLE PAVEMENT, BMP 3 DETAIL

LONGITUDINAL/TERRACED SLOPE
NOT TO SCALE



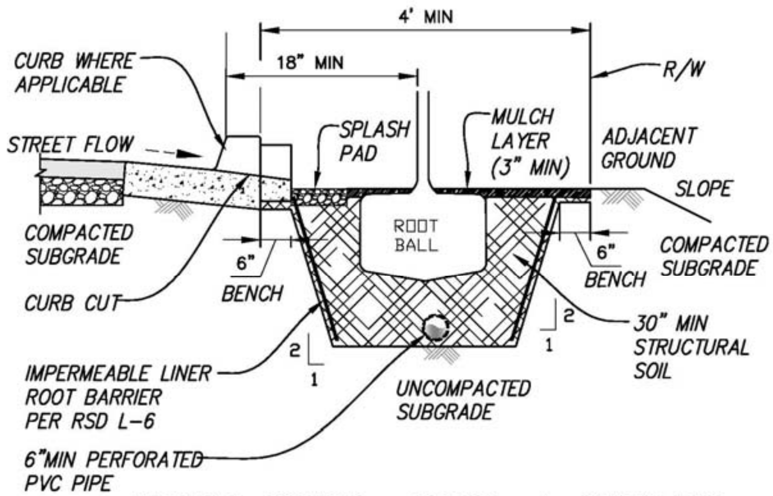
PERMEABLE PAVEMENT, BMP 3 DETAIL

CROSS SLOPE
NOT TO SCALE



PERMEABLE PAVEMENT, BMP 3 DETAIL

NOT TO SCALE



TREE WELL, BMP 4 DETAIL

NOT TO SCALE

CHAPTER 4

MODIFIED-PULS DETENTION ROUTING

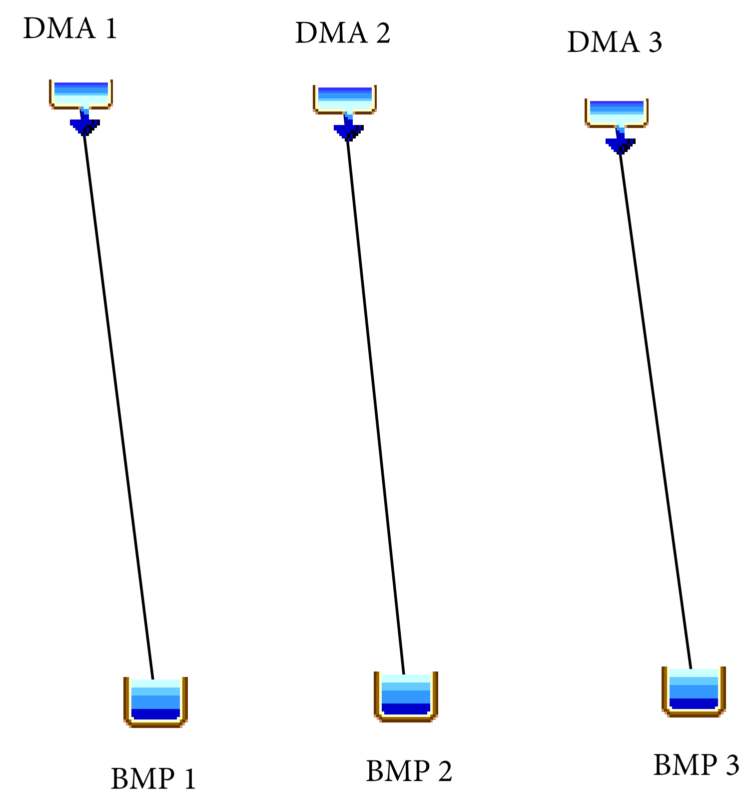
4.4 – HEC-HMS Modified-Puls Routing Results

HEC-HMS

Project : Tomlinson North Property

Basin Model : Post_Dev

Feb 16 15:22:05 PST 2017

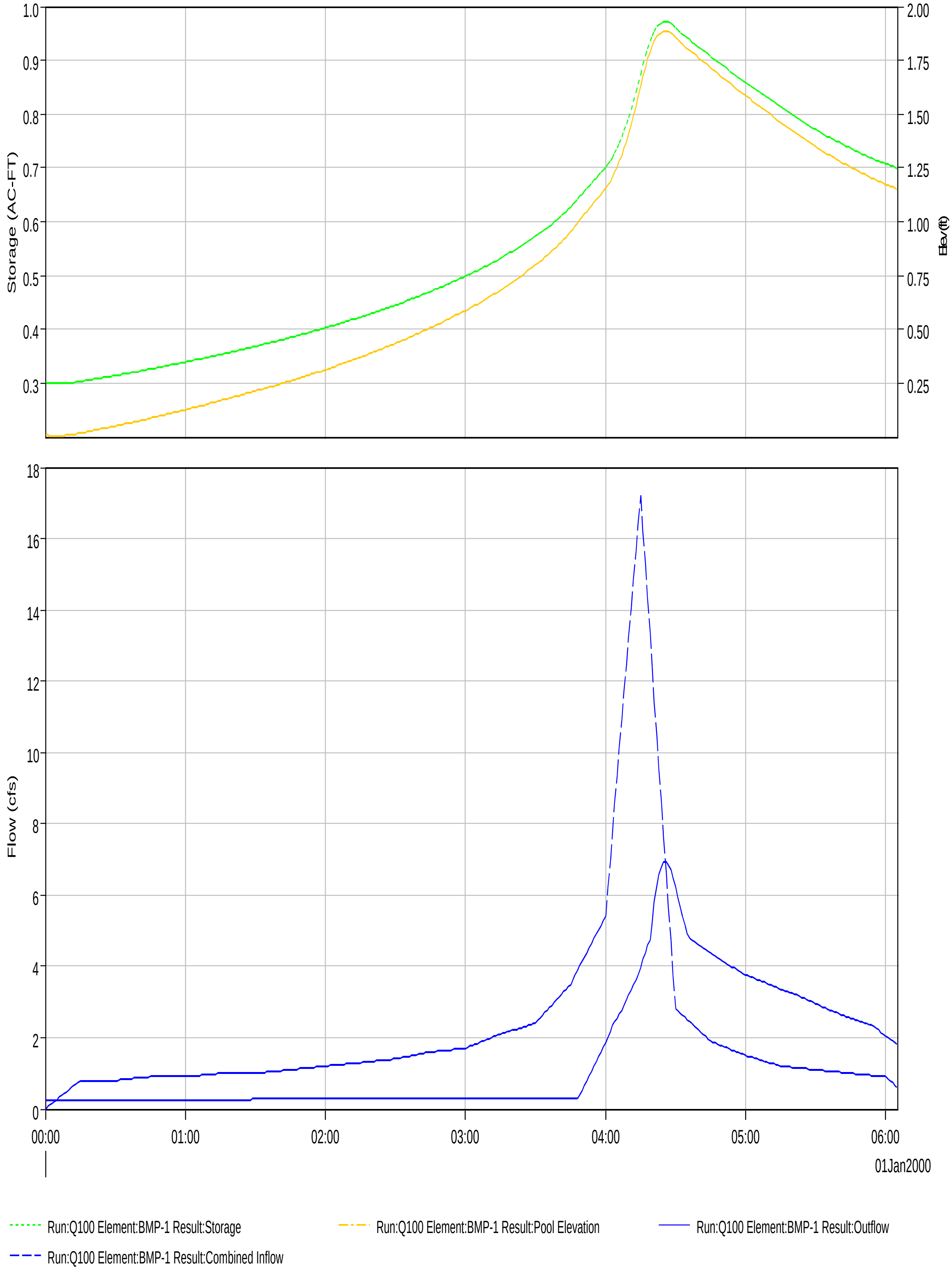


Project: Tomlinson North Property Simulation Run: Q100

Start of Run:	01Jan2000, 00:00	Basin Model:	Post_Dev
End of Run:	01Jan2000, 06:05	Meteorologic Model:	Met 1
Compute Time:	15Feb2017, 11:45:17	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DMA 3	Not Specified	0.8	01Jan2000, 04:05	0.0
BMP-3	Not Specified	0.0	01Jan2000, 04:35	0.0
DMA 1	Not Specified	17.2	01Jan2000, 04:15	1.1
BMP-1	Not Specified	6.9	01Jan2000, 04:26	0.7
DMA 2	Not Specified	1.5	01Jan2000, 04:05	0.0
BMP-2	Not Specified	1.3	01Jan2000, 04:06	0.0

Reservoir "BMP-1" Results for Run "Q100"



Project: Tomlinson North Property   Simulation Run: Q100
Reservoir: BMP-1

Start of Run:	01Jan2000, 00:00	Basin Model:	Post_Dev
End of Run:	01Jan2000, 06:05	Meteorologic Model:	Met 1
Compute Time:	15Feb2017, 11:45:17	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow:	17.2 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 04:15
Peak Discharge:	6.9 (CFS)	Date/Time of Peak Discharge	01Jan2000, 04:26
Inflow Volume:	n/a	Peak Storage:	1.0 (AC-FT)
Discharge Volume	n/a	Peak Elevation:	1.9 (FT)

Project: Tomlinson North Property Simulation Run: Q100
Reservoir: BMP-1

Start of Run: 01Jan2000, 00:00 Basin Model: Post_Dev
End of Run: 01Jan2000, 06:05 Meteorologic Model: Met 1
Compute Time: 15Feb2017, 11:45:17 Control Specifications: Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:00	0.0	0.3	0.0	0.3
01Jan2000	00:01	0.1	0.3	0.0	0.3
01Jan2000	00:02	0.1	0.3	0.0	0.3
01Jan2000	00:03	0.2	0.3	0.0	0.3
01Jan2000	00:04	0.2	0.3	0.0	0.3
01Jan2000	00:05	0.3	0.3	0.0	0.3
01Jan2000	00:06	0.3	0.3	0.0	0.3
01Jan2000	00:07	0.4	0.3	0.0	0.3
01Jan2000	00:08	0.4	0.3	0.0	0.3
01Jan2000	00:09	0.5	0.3	0.0	0.3
01Jan2000	00:10	0.5	0.3	0.0	0.3
01Jan2000	00:11	0.6	0.3	0.0	0.3
01Jan2000	00:12	0.6	0.3	0.0	0.3
01Jan2000	00:13	0.7	0.3	0.0	0.3
01Jan2000	00:14	0.7	0.3	0.0	0.3
01Jan2000	00:15	0.8	0.3	0.0	0.3
01Jan2000	00:16	0.8	0.3	0.0	0.3
01Jan2000	00:17	0.8	0.3	0.0	0.3
01Jan2000	00:18	0.8	0.3	0.0	0.3
01Jan2000	00:19	0.8	0.3	0.0	0.3
01Jan2000	00:20	0.8	0.3	0.0	0.3
01Jan2000	00:21	0.8	0.3	0.0	0.3
01Jan2000	00:22	0.8	0.3	0.0	0.3
01Jan2000	00:23	0.8	0.3	0.0	0.3
01Jan2000	00:24	0.8	0.3	0.0	0.3
01Jan2000	00:25	0.8	0.3	0.0	0.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:26	0.8	0.3	0.0	0.3
01Jan2000	00:27	0.8	0.3	0.0	0.3
01Jan2000	00:28	0.8	0.3	0.0	0.3
01Jan2000	00:29	0.8	0.3	0.0	0.3
01Jan2000	00:30	0.8	0.3	0.1	0.3
01Jan2000	00:31	0.8	0.3	0.1	0.3
01Jan2000	00:32	0.8	0.3	0.1	0.3
01Jan2000	00:33	0.8	0.3	0.1	0.3
01Jan2000	00:34	0.8	0.3	0.1	0.3
01Jan2000	00:35	0.8	0.3	0.1	0.3
01Jan2000	00:36	0.8	0.3	0.1	0.3
01Jan2000	00:37	0.8	0.3	0.1	0.3
01Jan2000	00:38	0.9	0.3	0.1	0.3
01Jan2000	00:39	0.9	0.3	0.1	0.3
01Jan2000	00:40	0.9	0.3	0.1	0.3
01Jan2000	00:41	0.9	0.3	0.1	0.3
01Jan2000	00:42	0.9	0.3	0.1	0.3
01Jan2000	00:43	0.9	0.3	0.1	0.3
01Jan2000	00:44	0.9	0.3	0.1	0.3
01Jan2000	00:45	0.9	0.3	0.1	0.3
01Jan2000	00:46	0.9	0.3	0.1	0.3
01Jan2000	00:47	0.9	0.3	0.1	0.3
01Jan2000	00:48	0.9	0.3	0.1	0.3
01Jan2000	00:49	0.9	0.3	0.1	0.3
01Jan2000	00:50	0.9	0.3	0.1	0.3
01Jan2000	00:51	0.9	0.3	0.1	0.3
01Jan2000	00:52	0.9	0.3	0.1	0.3
01Jan2000	00:53	0.9	0.3	0.1	0.3
01Jan2000	00:54	0.9	0.3	0.1	0.3
01Jan2000	00:55	0.9	0.3	0.1	0.3
01Jan2000	00:56	0.9	0.3	0.1	0.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:57	0.9	0.3	0.1	0.3
01Jan2000	00:58	0.9	0.3	0.1	0.3
01Jan2000	00:59	0.9	0.3	0.1	0.3
01Jan2000	01:00	0.9	0.3	0.1	0.3
01Jan2000	01:01	0.9	0.3	0.1	0.3
01Jan2000	01:02	0.9	0.3	0.1	0.3
01Jan2000	01:03	0.9	0.3	0.1	0.3
01Jan2000	01:04	0.9	0.3	0.1	0.3
01Jan2000	01:05	0.9	0.3	0.1	0.3
01Jan2000	01:06	0.9	0.3	0.1	0.3
01Jan2000	01:07	0.9	0.3	0.1	0.3
01Jan2000	01:08	1.0	0.3	0.1	0.3
01Jan2000	01:09	1.0	0.3	0.2	0.3
01Jan2000	01:10	1.0	0.3	0.2	0.3
01Jan2000	01:11	1.0	0.3	0.2	0.3
01Jan2000	01:12	1.0	0.4	0.2	0.3
01Jan2000	01:13	1.0	0.4	0.2	0.3
01Jan2000	01:14	1.0	0.4	0.2	0.3
01Jan2000	01:15	1.0	0.4	0.2	0.3
01Jan2000	01:16	1.0	0.4	0.2	0.3
01Jan2000	01:17	1.0	0.4	0.2	0.3
01Jan2000	01:18	1.0	0.4	0.2	0.3
01Jan2000	01:19	1.0	0.4	0.2	0.3
01Jan2000	01:20	1.0	0.4	0.2	0.3
01Jan2000	01:21	1.0	0.4	0.2	0.3
01Jan2000	01:22	1.0	0.4	0.2	0.3
01Jan2000	01:23	1.0	0.4	0.2	0.3
01Jan2000	01:24	1.0	0.4	0.2	0.3
01Jan2000	01:25	1.0	0.4	0.2	0.3
01Jan2000	01:26	1.0	0.4	0.2	0.3
01Jan2000	01:27	1.0	0.4	0.2	0.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:28	1.0	0.4	0.2	0.3
01Jan2000	01:29	1.0	0.4	0.2	0.3
01Jan2000	01:30	1.0	0.4	0.2	0.3
01Jan2000	01:31	1.0	0.4	0.2	0.3
01Jan2000	01:32	1.0	0.4	0.2	0.3
01Jan2000	01:33	1.0	0.4	0.2	0.3
01Jan2000	01:34	1.0	0.4	0.2	0.3
01Jan2000	01:35	1.0	0.4	0.2	0.3
01Jan2000	01:36	1.0	0.4	0.2	0.3
01Jan2000	01:37	1.0	0.4	0.2	0.3
01Jan2000	01:38	1.1	0.4	0.2	0.3
01Jan2000	01:39	1.1	0.4	0.2	0.3
01Jan2000	01:40	1.1	0.4	0.2	0.3
01Jan2000	01:41	1.1	0.4	0.2	0.3
01Jan2000	01:42	1.1	0.4	0.2	0.3
01Jan2000	01:43	1.1	0.4	0.3	0.3
01Jan2000	01:44	1.1	0.4	0.3	0.3
01Jan2000	01:45	1.1	0.4	0.3	0.3
01Jan2000	01:46	1.1	0.4	0.3	0.3
01Jan2000	01:47	1.1	0.4	0.3	0.3
01Jan2000	01:48	1.1	0.4	0.3	0.3
01Jan2000	01:49	1.1	0.4	0.3	0.3
01Jan2000	01:50	1.1	0.4	0.3	0.3
01Jan2000	01:51	1.1	0.4	0.3	0.3
01Jan2000	01:52	1.1	0.4	0.3	0.3
01Jan2000	01:53	1.2	0.4	0.3	0.3
01Jan2000	01:54	1.2	0.4	0.3	0.3
01Jan2000	01:55	1.2	0.4	0.3	0.3
01Jan2000	01:56	1.2	0.4	0.3	0.3
01Jan2000	01:57	1.2	0.4	0.3	0.3
01Jan2000	01:58	1.2	0.4	0.3	0.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:59	1.2	0.4	0.3	0.3
01Jan2000	02:00	1.2	0.4	0.3	0.3
01Jan2000	02:01	1.2	0.4	0.3	0.3
01Jan2000	02:02	1.2	0.4	0.3	0.3
01Jan2000	02:03	1.2	0.4	0.3	0.3
01Jan2000	02:04	1.2	0.4	0.3	0.3
01Jan2000	02:05	1.2	0.4	0.3	0.3
01Jan2000	02:06	1.2	0.4	0.3	0.3
01Jan2000	02:07	1.2	0.4	0.3	0.3
01Jan2000	02:08	1.3	0.4	0.3	0.3
01Jan2000	02:09	1.3	0.4	0.3	0.3
01Jan2000	02:10	1.3	0.4	0.4	0.3
01Jan2000	02:11	1.3	0.4	0.4	0.3
01Jan2000	02:12	1.3	0.4	0.4	0.3
01Jan2000	02:13	1.3	0.4	0.4	0.3
01Jan2000	02:14	1.3	0.4	0.4	0.3
01Jan2000	02:15	1.3	0.4	0.4	0.3
01Jan2000	02:16	1.3	0.4	0.4	0.3
01Jan2000	02:17	1.3	0.4	0.4	0.3
01Jan2000	02:18	1.3	0.4	0.4	0.3
01Jan2000	02:19	1.3	0.4	0.4	0.3
01Jan2000	02:20	1.3	0.4	0.4	0.3
01Jan2000	02:21	1.3	0.4	0.4	0.3
01Jan2000	02:22	1.3	0.4	0.4	0.3
01Jan2000	02:23	1.4	0.4	0.4	0.3
01Jan2000	02:24	1.4	0.4	0.4	0.3
01Jan2000	02:25	1.4	0.4	0.4	0.3
01Jan2000	02:26	1.4	0.4	0.4	0.3
01Jan2000	02:27	1.4	0.4	0.4	0.3
01Jan2000	02:28	1.4	0.4	0.4	0.3
01Jan2000	02:29	1.4	0.4	0.4	0.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	02:30	1.4	0.4	0.4	0.3
01Jan2000	02:31	1.4	0.4	0.4	0.3
01Jan2000	02:32	1.4	0.4	0.4	0.3
01Jan2000	02:33	1.4	0.4	0.4	0.3
01Jan2000	02:34	1.5	0.5	0.5	0.3
01Jan2000	02:35	1.5	0.5	0.5	0.3
01Jan2000	02:36	1.5	0.5	0.5	0.3
01Jan2000	02:37	1.5	0.5	0.5	0.3
01Jan2000	02:38	1.5	0.5	0.5	0.3
01Jan2000	02:39	1.5	0.5	0.5	0.3
01Jan2000	02:40	1.5	0.5	0.5	0.3
01Jan2000	02:41	1.5	0.5	0.5	0.3
01Jan2000	02:42	1.6	0.5	0.5	0.3
01Jan2000	02:43	1.6	0.5	0.5	0.3
01Jan2000	02:44	1.6	0.5	0.5	0.3
01Jan2000	02:45	1.6	0.5	0.5	0.3
01Jan2000	02:46	1.6	0.5	0.5	0.3
01Jan2000	02:47	1.6	0.5	0.5	0.3
01Jan2000	02:48	1.6	0.5	0.5	0.3
01Jan2000	02:49	1.6	0.5	0.5	0.3
01Jan2000	02:50	1.6	0.5	0.5	0.3
01Jan2000	02:51	1.6	0.5	0.5	0.3
01Jan2000	02:52	1.6	0.5	0.5	0.3
01Jan2000	02:53	1.7	0.5	0.5	0.3
01Jan2000	02:54	1.7	0.5	0.6	0.3
01Jan2000	02:55	1.7	0.5	0.6	0.3
01Jan2000	02:56	1.7	0.5	0.6	0.3
01Jan2000	02:57	1.7	0.5	0.6	0.3
01Jan2000	02:58	1.7	0.5	0.6	0.3
01Jan2000	02:59	1.7	0.5	0.6	0.3
01Jan2000	03:00	1.7	0.5	0.6	0.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:01	1.7	0.5	0.6	0.3
01Jan2000	03:02	1.8	0.5	0.6	0.3
01Jan2000	03:03	1.8	0.5	0.6	0.3
01Jan2000	03:04	1.8	0.5	0.6	0.3
01Jan2000	03:05	1.8	0.5	0.6	0.3
01Jan2000	03:06	1.9	0.5	0.6	0.3
01Jan2000	03:07	1.9	0.5	0.6	0.3
01Jan2000	03:08	1.9	0.5	0.6	0.3
01Jan2000	03:09	1.9	0.5	0.6	0.3
01Jan2000	03:10	2.0	0.5	0.6	0.3
01Jan2000	03:11	2.0	0.5	0.7	0.3
01Jan2000	03:12	2.0	0.5	0.7	0.3
01Jan2000	03:13	2.0	0.5	0.7	0.3
01Jan2000	03:14	2.1	0.5	0.7	0.3
01Jan2000	03:15	2.1	0.5	0.7	0.3
01Jan2000	03:16	2.1	0.5	0.7	0.3
01Jan2000	03:17	2.1	0.5	0.7	0.3
01Jan2000	03:18	2.2	0.5	0.7	0.3
01Jan2000	03:19	2.2	0.5	0.7	0.3
01Jan2000	03:20	2.2	0.5	0.7	0.3
01Jan2000	03:21	2.2	0.5	0.7	0.3
01Jan2000	03:22	2.2	0.6	0.7	0.3
01Jan2000	03:23	2.3	0.6	0.7	0.3
01Jan2000	03:24	2.3	0.6	0.8	0.3
01Jan2000	03:25	2.3	0.6	0.8	0.3
01Jan2000	03:26	2.3	0.6	0.8	0.3
01Jan2000	03:27	2.3	0.6	0.8	0.3
01Jan2000	03:28	2.4	0.6	0.8	0.3
01Jan2000	03:29	2.4	0.6	0.8	0.3
01Jan2000	03:30	2.4	0.6	0.8	0.3
01Jan2000	03:31	2.5	0.6	0.8	0.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:32	2.5	0.6	0.8	0.3
01Jan2000	03:33	2.6	0.6	0.8	0.3
01Jan2000	03:34	2.7	0.6	0.8	0.3
01Jan2000	03:35	2.8	0.6	0.8	0.3
01Jan2000	03:36	2.8	0.6	0.9	0.3
01Jan2000	03:37	2.9	0.6	0.9	0.3
01Jan2000	03:38	3.0	0.6	0.9	0.3
01Jan2000	03:39	3.1	0.6	0.9	0.3
01Jan2000	03:40	3.1	0.6	0.9	0.3
01Jan2000	03:41	3.2	0.6	0.9	0.3
01Jan2000	03:42	3.3	0.6	0.9	0.3
01Jan2000	03:43	3.4	0.6	0.9	0.3
01Jan2000	03:44	3.4	0.6	0.9	0.3
01Jan2000	03:45	3.5	0.6	1.0	0.3
01Jan2000	03:46	3.6	0.6	1.0	0.3
01Jan2000	03:47	3.8	0.6	1.0	0.3
01Jan2000	03:48	3.9	0.6	1.0	0.3
01Jan2000	03:49	4.0	0.6	1.0	0.4
01Jan2000	03:50	4.1	0.7	1.0	0.5
01Jan2000	03:51	4.3	0.7	1.0	0.6
01Jan2000	03:52	4.4	0.7	1.0	0.8
01Jan2000	03:53	4.5	0.7	1.1	0.9
01Jan2000	03:54	4.6	0.7	1.1	1.1
01Jan2000	03:55	4.8	0.7	1.1	1.2
01Jan2000	03:56	4.9	0.7	1.1	1.3
01Jan2000	03:57	5.0	0.7	1.1	1.5
01Jan2000	03:58	5.1	0.7	1.1	1.6
01Jan2000	03:59	5.3	0.7	1.1	1.7
01Jan2000	04:00	5.4	0.7	1.2	1.9
01Jan2000	04:01	6.2	0.7	1.2	2.0
01Jan2000	04:02	7.0	0.7	1.2	2.2

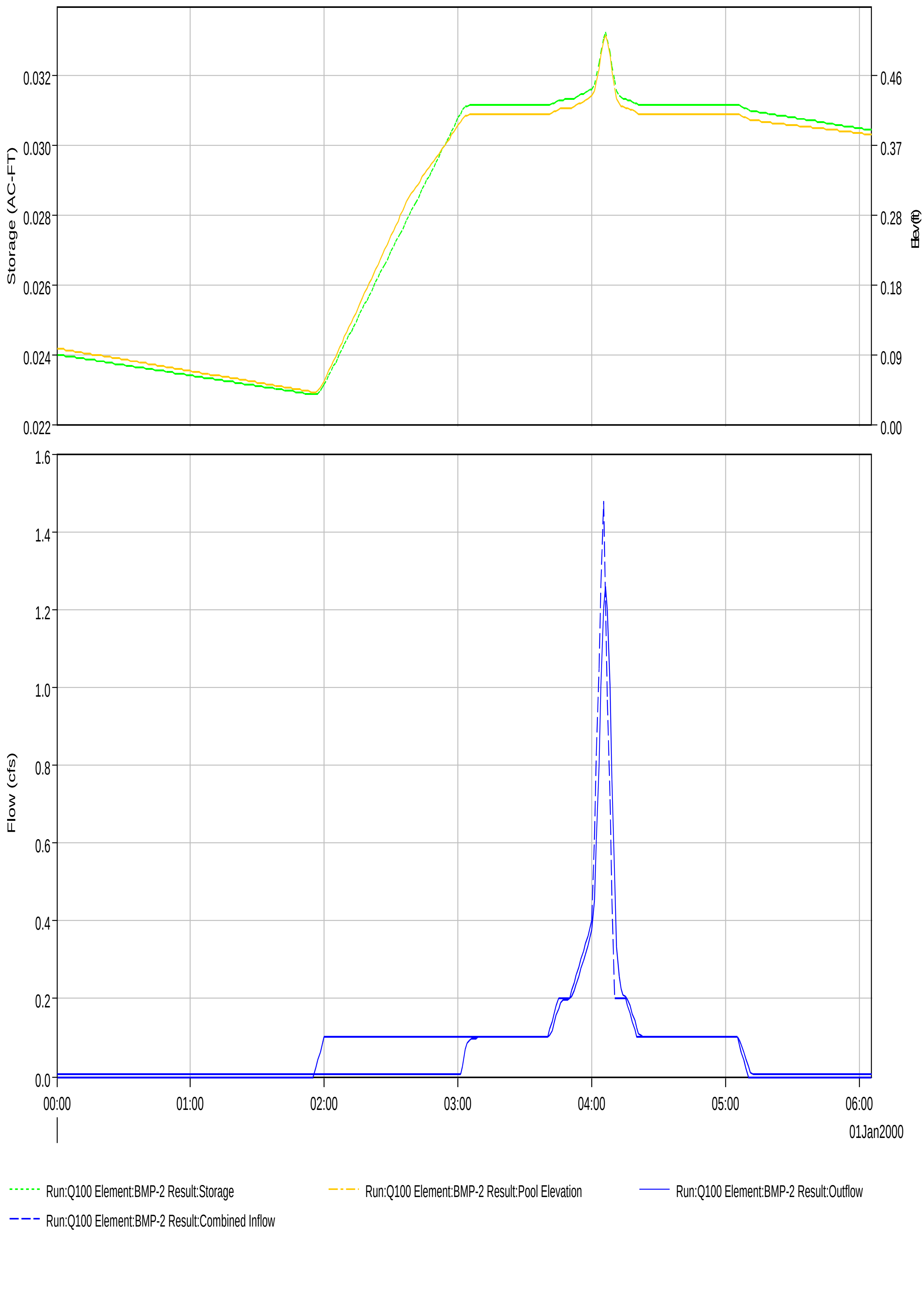
Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:03	7.8	0.7	1.2	2.3
01Jan2000	04:04	8.5	0.7	1.2	2.4
01Jan2000	04:05	9.3	0.7	1.3	2.5
01Jan2000	04:06	10.1	0.7	1.3	2.7
01Jan2000	04:07	10.9	0.8	1.3	2.8
01Jan2000	04:08	11.7	0.8	1.3	2.9
01Jan2000	04:09	12.5	0.8	1.4	3.1
01Jan2000	04:10	13.3	0.8	1.4	3.2
01Jan2000	04:11	14.1	0.8	1.5	3.3
01Jan2000	04:12	14.8	0.8	1.5	3.5
01Jan2000	04:13	15.6	0.8	1.5	3.6
01Jan2000	04:14	16.4	0.9	1.6	3.8
01Jan2000	04:15	17.2	0.9	1.6	4.0
01Jan2000	04:16	16.2	0.9	1.7	4.2
01Jan2000	04:17	15.3	0.9	1.7	4.4
01Jan2000	04:18	14.3	0.9	1.8	4.6
01Jan2000	04:19	13.4	0.9	1.8	4.7
01Jan2000	04:20	12.4	0.9	1.8	5.2
01Jan2000	04:21	11.4	1.0	1.8	5.8
01Jan2000	04:22	10.5	1.0	1.9	6.3
01Jan2000	04:23	9.5	1.0	1.9	6.6
01Jan2000	04:24	8.6	1.0	1.9	6.8
01Jan2000	04:25	7.6	1.0	1.9	6.9
01Jan2000	04:26	6.6	1.0	1.9	6.9
01Jan2000	04:27	5.7	1.0	1.9	6.9
01Jan2000	04:28	4.7	1.0	1.9	6.7
01Jan2000	04:29	3.8	1.0	1.9	6.5
01Jan2000	04:30	2.8	1.0	1.9	6.2
01Jan2000	04:31	2.7	1.0	1.8	5.9
01Jan2000	04:32	2.7	1.0	1.8	5.7
01Jan2000	04:33	2.6	0.9	1.8	5.4

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:34	2.6	0.9	1.8	5.1
01Jan2000	04:35	2.5	0.9	1.8	4.9
01Jan2000	04:36	2.4	0.9	1.8	4.8
01Jan2000	04:37	2.4	0.9	1.8	4.7
01Jan2000	04:38	2.3	0.9	1.8	4.7
01Jan2000	04:39	2.3	0.9	1.8	4.7
01Jan2000	04:40	2.2	0.9	1.8	4.6
01Jan2000	04:41	2.1	0.9	1.8	4.6
01Jan2000	04:42	2.1	0.9	1.7	4.5
01Jan2000	04:43	2.0	0.9	1.7	4.5
01Jan2000	04:44	2.0	0.9	1.7	4.4
01Jan2000	04:45	1.9	0.9	1.7	4.4
01Jan2000	04:46	1.9	0.9	1.7	4.3
01Jan2000	04:47	1.8	0.9	1.7	4.3
01Jan2000	04:48	1.8	0.9	1.7	4.3
01Jan2000	04:49	1.8	0.9	1.7	4.2
01Jan2000	04:50	1.8	0.9	1.7	4.2
01Jan2000	04:51	1.7	0.9	1.7	4.1
01Jan2000	04:52	1.7	0.9	1.7	4.1
01Jan2000	04:53	1.7	0.9	1.6	4.0
01Jan2000	04:54	1.7	0.9	1.6	4.0
01Jan2000	04:55	1.6	0.9	1.6	4.0
01Jan2000	04:56	1.6	0.9	1.6	3.9
01Jan2000	04:57	1.6	0.9	1.6	3.9
01Jan2000	04:58	1.6	0.9	1.6	3.8
01Jan2000	04:59	1.5	0.9	1.6	3.8
01Jan2000	05:00	1.5	0.9	1.6	3.8
01Jan2000	05:01	1.5	0.9	1.6	3.7
01Jan2000	05:02	1.5	0.9	1.6	3.7
01Jan2000	05:03	1.4	0.8	1.6	3.7
01Jan2000	05:04	1.4	0.8	1.6	3.7

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:05	1.4	0.8	1.5	3.6
01Jan2000	05:06	1.4	0.8	1.5	3.6
01Jan2000	05:07	1.4	0.8	1.5	3.6
01Jan2000	05:08	1.3	0.8	1.5	3.6
01Jan2000	05:09	1.3	0.8	1.5	3.5
01Jan2000	05:10	1.3	0.8	1.5	3.5
01Jan2000	05:11	1.3	0.8	1.5	3.5
01Jan2000	05:12	1.3	0.8	1.5	3.4
01Jan2000	05:13	1.2	0.8	1.5	3.4
01Jan2000	05:14	1.2	0.8	1.5	3.4
01Jan2000	05:15	1.2	0.8	1.5	3.4
01Jan2000	05:16	1.2	0.8	1.5	3.3
01Jan2000	05:17	1.2	0.8	1.4	3.3
01Jan2000	05:18	1.2	0.8	1.4	3.3
01Jan2000	05:19	1.2	0.8	1.4	3.3
01Jan2000	05:20	1.2	0.8	1.4	3.2
01Jan2000	05:21	1.2	0.8	1.4	3.2
01Jan2000	05:22	1.2	0.8	1.4	3.2
01Jan2000	05:23	1.1	0.8	1.4	3.2
01Jan2000	05:24	1.1	0.8	1.4	3.1
01Jan2000	05:25	1.1	0.8	1.4	3.1
01Jan2000	05:26	1.1	0.8	1.4	3.1
01Jan2000	05:27	1.1	0.8	1.4	3.0
01Jan2000	05:28	1.1	0.8	1.4	3.0
01Jan2000	05:29	1.1	0.8	1.4	3.0
01Jan2000	05:30	1.1	0.8	1.3	2.9
01Jan2000	05:31	1.1	0.8	1.3	2.9
01Jan2000	05:32	1.1	0.8	1.3	2.9
01Jan2000	05:33	1.1	0.8	1.3	2.9
01Jan2000	05:34	1.1	0.8	1.3	2.8
01Jan2000	05:35	1.1	0.8	1.3	2.8

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:36	1.1	0.8	1.3	2.8
01Jan2000	05:37	1.1	0.8	1.3	2.8
01Jan2000	05:38	1.0	0.8	1.3	2.7
01Jan2000	05:39	1.0	0.7	1.3	2.7
01Jan2000	05:40	1.0	0.7	1.3	2.7
01Jan2000	05:41	1.0	0.7	1.3	2.6
01Jan2000	05:42	1.0	0.7	1.3	2.6
01Jan2000	05:43	1.0	0.7	1.3	2.6
01Jan2000	05:44	1.0	0.7	1.3	2.6
01Jan2000	05:45	1.0	0.7	1.3	2.5
01Jan2000	05:46	1.0	0.7	1.2	2.5
01Jan2000	05:47	1.0	0.7	1.2	2.5
01Jan2000	05:48	1.0	0.7	1.2	2.5
01Jan2000	05:49	1.0	0.7	1.2	2.4
01Jan2000	05:50	1.0	0.7	1.2	2.4
01Jan2000	05:51	1.0	0.7	1.2	2.4
01Jan2000	05:52	1.0	0.7	1.2	2.4
01Jan2000	05:53	0.9	0.7	1.2	2.4
01Jan2000	05:54	0.9	0.7	1.2	2.3
01Jan2000	05:55	0.9	0.7	1.2	2.3
01Jan2000	05:56	0.9	0.7	1.2	2.3
01Jan2000	05:57	0.9	0.7	1.2	2.2
01Jan2000	05:58	0.9	0.7	1.2	2.2
01Jan2000	05:59	0.9	0.7	1.2	2.1
01Jan2000	06:00	0.9	0.7	1.2	2.1
01Jan2000	06:01	0.8	0.7	1.2	2.0
01Jan2000	06:02	0.8	0.7	1.2	2.0
01Jan2000	06:03	0.7	0.7	1.2	1.9
01Jan2000	06:04	0.7	0.7	1.2	1.9
01Jan2000	06:05	0.6	0.7	1.2	1.8

Reservoir "BMP-2" Results for Run "Q100"



Project: Tomlinson North Property Simulation Run: Q100

Reservoir: BMP-2

Start of Run:	01Jan2000, 00:00	Basin Model:	Post_Dev
End of Run:	01Jan2000, 06:05	Meteorologic Model:	Met 1
Compute Time:	15Feb2017, 11:45:17	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow:	1.5 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 04:05
Peak Discharge:	1.3 (CFS)	Date/Time of Peak Discharge	01Jan2000, 04:06
Inflow Volume:	n/a	Peak Storage:	0.0 (AC-FT)
Discharge Volume	n/a	Peak Elevation:	0.5 (FT)

Project: Tomlinson North Property Simulation Run: Q100
Reservoir: BMP-2

Start of Run: 01Jan2000, 00:00 Basin Model: Post_Dev
End of Run: 01Jan2000, 06:05 Meteorologic Model: Met 1
Compute Time: 15Feb2017, 11:45:17 Control Specifications: Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:00	0.0	0.0	0.1	0.0
01Jan2000	00:01	0.0	0.0	0.1	0.0
01Jan2000	00:02	0.0	0.0	0.1	0.0
01Jan2000	00:03	0.0	0.0	0.1	0.0
01Jan2000	00:04	0.0	0.0	0.1	0.0
01Jan2000	00:05	0.0	0.0	0.1	0.0
01Jan2000	00:06	0.0	0.0	0.1	0.0
01Jan2000	00:07	0.0	0.0	0.1	0.0
01Jan2000	00:08	0.0	0.0	0.1	0.0
01Jan2000	00:09	0.0	0.0	0.1	0.0
01Jan2000	00:10	0.0	0.0	0.1	0.0
01Jan2000	00:11	0.0	0.0	0.1	0.0
01Jan2000	00:12	0.0	0.0	0.1	0.0
01Jan2000	00:13	0.0	0.0	0.1	0.0
01Jan2000	00:14	0.0	0.0	0.1	0.0
01Jan2000	00:15	0.0	0.0	0.1	0.0
01Jan2000	00:16	0.0	0.0	0.1	0.0
01Jan2000	00:17	0.0	0.0	0.1	0.0
01Jan2000	00:18	0.0	0.0	0.1	0.0
01Jan2000	00:19	0.0	0.0	0.1	0.0
01Jan2000	00:20	0.0	0.0	0.1	0.0
01Jan2000	00:21	0.0	0.0	0.1	0.0
01Jan2000	00:22	0.0	0.0	0.1	0.0
01Jan2000	00:23	0.0	0.0	0.1	0.0
01Jan2000	00:24	0.0	0.0	0.1	0.0
01Jan2000	00:25	0.0	0.0	0.1	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:26	0.0	0.0	0.1	0.0
01Jan2000	00:27	0.0	0.0	0.1	0.0
01Jan2000	00:28	0.0	0.0	0.1	0.0
01Jan2000	00:29	0.0	0.0	0.1	0.0
01Jan2000	00:30	0.0	0.0	0.1	0.0
01Jan2000	00:31	0.0	0.0	0.1	0.0
01Jan2000	00:32	0.0	0.0	0.1	0.0
01Jan2000	00:33	0.0	0.0	0.1	0.0
01Jan2000	00:34	0.0	0.0	0.1	0.0
01Jan2000	00:35	0.0	0.0	0.1	0.0
01Jan2000	00:36	0.0	0.0	0.1	0.0
01Jan2000	00:37	0.0	0.0	0.1	0.0
01Jan2000	00:38	0.0	0.0	0.1	0.0
01Jan2000	00:39	0.0	0.0	0.1	0.0
01Jan2000	00:40	0.0	0.0	0.1	0.0
01Jan2000	00:41	0.0	0.0	0.1	0.0
01Jan2000	00:42	0.0	0.0	0.1	0.0
01Jan2000	00:43	0.0	0.0	0.1	0.0
01Jan2000	00:44	0.0	0.0	0.1	0.0
01Jan2000	00:45	0.0	0.0	0.1	0.0
01Jan2000	00:46	0.0	0.0	0.1	0.0
01Jan2000	00:47	0.0	0.0	0.1	0.0
01Jan2000	00:48	0.0	0.0	0.1	0.0
01Jan2000	00:49	0.0	0.0	0.1	0.0
01Jan2000	00:50	0.0	0.0	0.1	0.0
01Jan2000	00:51	0.0	0.0	0.1	0.0
01Jan2000	00:52	0.0	0.0	0.1	0.0
01Jan2000	00:53	0.0	0.0	0.1	0.0
01Jan2000	00:54	0.0	0.0	0.1	0.0
01Jan2000	00:55	0.0	0.0	0.1	0.0
01Jan2000	00:56	0.0	0.0	0.1	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:57	0.0	0.0	0.1	0.0
01Jan2000	00:58	0.0	0.0	0.1	0.0
01Jan2000	00:59	0.0	0.0	0.1	0.0
01Jan2000	01:00	0.0	0.0	0.1	0.0
01Jan2000	01:01	0.0	0.0	0.1	0.0
01Jan2000	01:02	0.0	0.0	0.1	0.0
01Jan2000	01:03	0.0	0.0	0.1	0.0
01Jan2000	01:04	0.0	0.0	0.1	0.0
01Jan2000	01:05	0.0	0.0	0.1	0.0
01Jan2000	01:06	0.0	0.0	0.1	0.0
01Jan2000	01:07	0.0	0.0	0.1	0.0
01Jan2000	01:08	0.0	0.0	0.1	0.0
01Jan2000	01:09	0.0	0.0	0.1	0.0
01Jan2000	01:10	0.0	0.0	0.1	0.0
01Jan2000	01:11	0.0	0.0	0.1	0.0
01Jan2000	01:12	0.0	0.0	0.1	0.0
01Jan2000	01:13	0.0	0.0	0.1	0.0
01Jan2000	01:14	0.0	0.0	0.1	0.0
01Jan2000	01:15	0.0	0.0	0.1	0.0
01Jan2000	01:16	0.0	0.0	0.1	0.0
01Jan2000	01:17	0.0	0.0	0.1	0.0
01Jan2000	01:18	0.0	0.0	0.1	0.0
01Jan2000	01:19	0.0	0.0	0.1	0.0
01Jan2000	01:20	0.0	0.0	0.1	0.0
01Jan2000	01:21	0.0	0.0	0.1	0.0
01Jan2000	01:22	0.0	0.0	0.1	0.0
01Jan2000	01:23	0.0	0.0	0.1	0.0
01Jan2000	01:24	0.0	0.0	0.1	0.0
01Jan2000	01:25	0.0	0.0	0.1	0.0
01Jan2000	01:26	0.0	0.0	0.1	0.0
01Jan2000	01:27	0.0	0.0	0.1	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:28	0.0	0.0	0.1	0.0
01Jan2000	01:29	0.0	0.0	0.1	0.0
01Jan2000	01:30	0.0	0.0	0.1	0.0
01Jan2000	01:31	0.0	0.0	0.1	0.0
01Jan2000	01:32	0.0	0.0	0.1	0.0
01Jan2000	01:33	0.0	0.0	0.1	0.0
01Jan2000	01:34	0.0	0.0	0.1	0.0
01Jan2000	01:35	0.0	0.0	0.1	0.0
01Jan2000	01:36	0.0	0.0	0.1	0.0
01Jan2000	01:37	0.0	0.0	0.1	0.0
01Jan2000	01:38	0.0	0.0	0.1	0.0
01Jan2000	01:39	0.0	0.0	0.1	0.0
01Jan2000	01:40	0.0	0.0	0.0	0.0
01Jan2000	01:41	0.0	0.0	0.0	0.0
01Jan2000	01:42	0.0	0.0	0.0	0.0
01Jan2000	01:43	0.0	0.0	0.0	0.0
01Jan2000	01:44	0.0	0.0	0.0	0.0
01Jan2000	01:45	0.0	0.0	0.0	0.0
01Jan2000	01:46	0.0	0.0	0.0	0.0
01Jan2000	01:47	0.0	0.0	0.0	0.0
01Jan2000	01:48	0.0	0.0	0.0	0.0
01Jan2000	01:49	0.0	0.0	0.0	0.0
01Jan2000	01:50	0.0	0.0	0.0	0.0
01Jan2000	01:51	0.0	0.0	0.0	0.0
01Jan2000	01:52	0.0	0.0	0.0	0.0
01Jan2000	01:53	0.0	0.0	0.0	0.0
01Jan2000	01:54	0.0	0.0	0.0	0.0
01Jan2000	01:55	0.0	0.0	0.0	0.0
01Jan2000	01:56	0.0	0.0	0.0	0.0
01Jan2000	01:57	0.0	0.0	0.0	0.0
01Jan2000	01:58	0.1	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:59	0.1	0.0	0.1	0.0
01Jan2000	02:00	0.1	0.0	0.1	0.0
01Jan2000	02:01	0.1	0.0	0.1	0.0
01Jan2000	02:02	0.1	0.0	0.1	0.0
01Jan2000	02:03	0.1	0.0	0.1	0.0
01Jan2000	02:04	0.1	0.0	0.1	0.0
01Jan2000	02:05	0.1	0.0	0.1	0.0
01Jan2000	02:06	0.1	0.0	0.1	0.0
01Jan2000	02:07	0.1	0.0	0.1	0.0
01Jan2000	02:08	0.1	0.0	0.1	0.0
01Jan2000	02:09	0.1	0.0	0.1	0.0
01Jan2000	02:10	0.1	0.0	0.1	0.0
01Jan2000	02:11	0.1	0.0	0.1	0.0
01Jan2000	02:12	0.1	0.0	0.1	0.0
01Jan2000	02:13	0.1	0.0	0.1	0.0
01Jan2000	02:14	0.1	0.0	0.1	0.0
01Jan2000	02:15	0.1	0.0	0.2	0.0
01Jan2000	02:16	0.1	0.0	0.2	0.0
01Jan2000	02:17	0.1	0.0	0.2	0.0
01Jan2000	02:18	0.1	0.0	0.2	0.0
01Jan2000	02:19	0.1	0.0	0.2	0.0
01Jan2000	02:20	0.1	0.0	0.2	0.0
01Jan2000	02:21	0.1	0.0	0.2	0.0
01Jan2000	02:22	0.1	0.0	0.2	0.0
01Jan2000	02:23	0.1	0.0	0.2	0.0
01Jan2000	02:24	0.1	0.0	0.2	0.0
01Jan2000	02:25	0.1	0.0	0.2	0.0
01Jan2000	02:26	0.1	0.0	0.2	0.0
01Jan2000	02:27	0.1	0.0	0.2	0.0
01Jan2000	02:28	0.1	0.0	0.2	0.0
01Jan2000	02:29	0.1	0.0	0.2	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	02:30	0.1	0.0	0.2	0.0
01Jan2000	02:31	0.1	0.0	0.3	0.0
01Jan2000	02:32	0.1	0.0	0.3	0.0
01Jan2000	02:33	0.1	0.0	0.3	0.0
01Jan2000	02:34	0.1	0.0	0.3	0.0
01Jan2000	02:35	0.1	0.0	0.3	0.0
01Jan2000	02:36	0.1	0.0	0.3	0.0
01Jan2000	02:37	0.1	0.0	0.3	0.0
01Jan2000	02:38	0.1	0.0	0.3	0.0
01Jan2000	02:39	0.1	0.0	0.3	0.0
01Jan2000	02:40	0.1	0.0	0.3	0.0
01Jan2000	02:41	0.1	0.0	0.3	0.0
01Jan2000	02:42	0.1	0.0	0.3	0.0
01Jan2000	02:43	0.1	0.0	0.3	0.0
01Jan2000	02:44	0.1	0.0	0.3	0.0
01Jan2000	02:45	0.1	0.0	0.3	0.0
01Jan2000	02:46	0.1	0.0	0.3	0.0
01Jan2000	02:47	0.1	0.0	0.3	0.0
01Jan2000	02:48	0.1	0.0	0.3	0.0
01Jan2000	02:49	0.1	0.0	0.3	0.0
01Jan2000	02:50	0.1	0.0	0.4	0.0
01Jan2000	02:51	0.1	0.0	0.4	0.0
01Jan2000	02:52	0.1	0.0	0.4	0.0
01Jan2000	02:53	0.1	0.0	0.4	0.0
01Jan2000	02:54	0.1	0.0	0.4	0.0
01Jan2000	02:55	0.1	0.0	0.4	0.0
01Jan2000	02:56	0.1	0.0	0.4	0.0
01Jan2000	02:57	0.1	0.0	0.4	0.0
01Jan2000	02:58	0.1	0.0	0.4	0.0
01Jan2000	02:59	0.1	0.0	0.4	0.0
01Jan2000	03:00	0.1	0.0	0.4	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:01	0.1	0.0	0.4	0.0
01Jan2000	03:02	0.1	0.0	0.4	0.0
01Jan2000	03:03	0.1	0.0	0.4	0.1
01Jan2000	03:04	0.1	0.0	0.4	0.1
01Jan2000	03:05	0.1	0.0	0.4	0.1
01Jan2000	03:06	0.1	0.0	0.4	0.1
01Jan2000	03:07	0.1	0.0	0.4	0.1
01Jan2000	03:08	0.1	0.0	0.4	0.1
01Jan2000	03:09	0.1	0.0	0.4	0.1
01Jan2000	03:10	0.1	0.0	0.4	0.1
01Jan2000	03:11	0.1	0.0	0.4	0.1
01Jan2000	03:12	0.1	0.0	0.4	0.1
01Jan2000	03:13	0.1	0.0	0.4	0.1
01Jan2000	03:14	0.1	0.0	0.4	0.1
01Jan2000	03:15	0.1	0.0	0.4	0.1
01Jan2000	03:16	0.1	0.0	0.4	0.1
01Jan2000	03:17	0.1	0.0	0.4	0.1
01Jan2000	03:18	0.1	0.0	0.4	0.1
01Jan2000	03:19	0.1	0.0	0.4	0.1
01Jan2000	03:20	0.1	0.0	0.4	0.1
01Jan2000	03:21	0.1	0.0	0.4	0.1
01Jan2000	03:22	0.1	0.0	0.4	0.1
01Jan2000	03:23	0.1	0.0	0.4	0.1
01Jan2000	03:24	0.1	0.0	0.4	0.1
01Jan2000	03:25	0.1	0.0	0.4	0.1
01Jan2000	03:26	0.1	0.0	0.4	0.1
01Jan2000	03:27	0.1	0.0	0.4	0.1
01Jan2000	03:28	0.1	0.0	0.4	0.1
01Jan2000	03:29	0.1	0.0	0.4	0.1
01Jan2000	03:30	0.1	0.0	0.4	0.1
01Jan2000	03:31	0.1	0.0	0.4	0.1

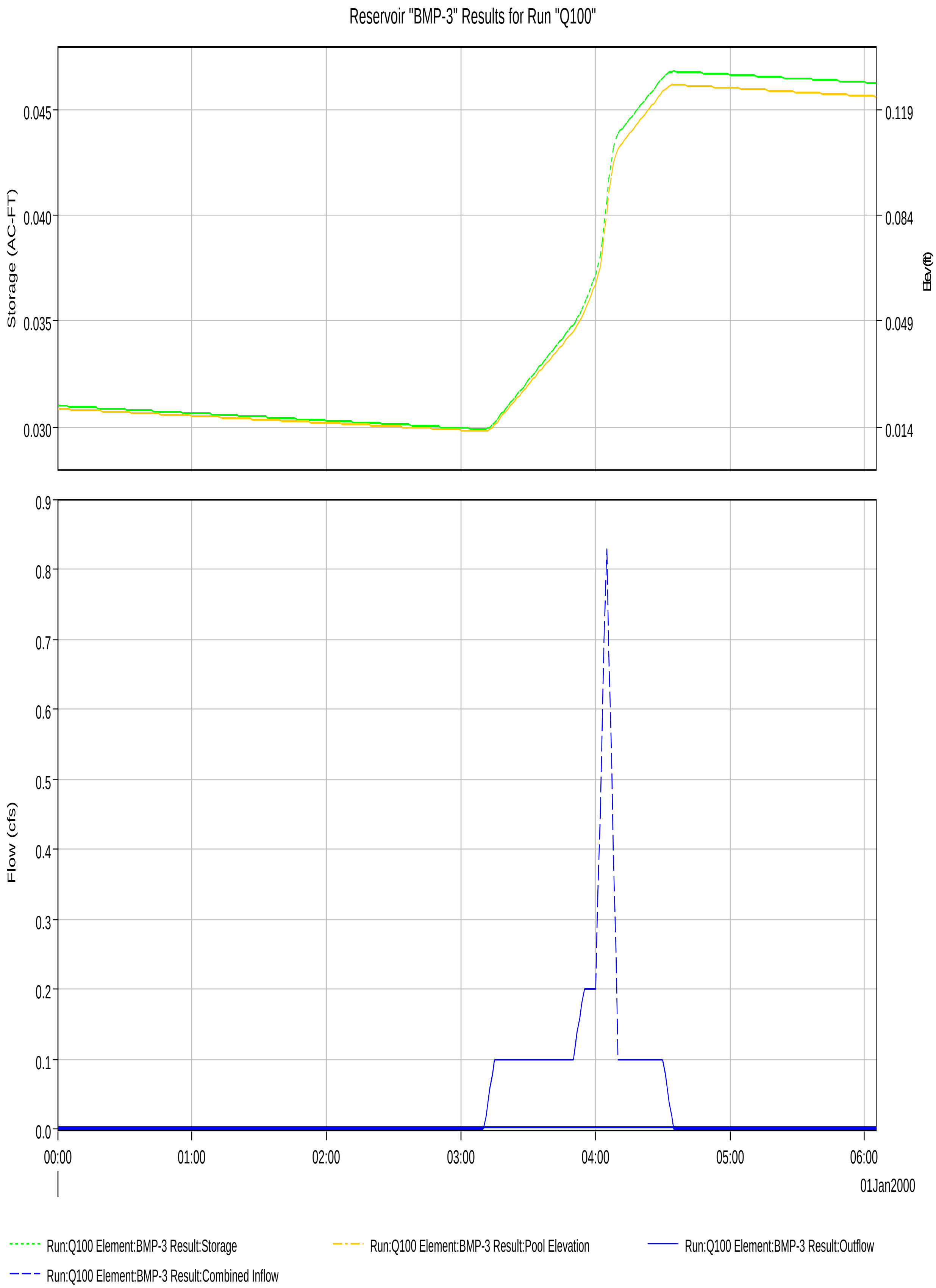
Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:32	0.1	0.0	0.4	0.1
01Jan2000	03:33	0.1	0.0	0.4	0.1
01Jan2000	03:34	0.1	0.0	0.4	0.1
01Jan2000	03:35	0.1	0.0	0.4	0.1
01Jan2000	03:36	0.1	0.0	0.4	0.1
01Jan2000	03:37	0.1	0.0	0.4	0.1
01Jan2000	03:38	0.1	0.0	0.4	0.1
01Jan2000	03:39	0.1	0.0	0.4	0.1
01Jan2000	03:40	0.1	0.0	0.4	0.1
01Jan2000	03:41	0.1	0.0	0.4	0.1
01Jan2000	03:42	0.1	0.0	0.4	0.1
01Jan2000	03:43	0.2	0.0	0.4	0.1
01Jan2000	03:44	0.2	0.0	0.4	0.2
01Jan2000	03:45	0.2	0.0	0.4	0.2
01Jan2000	03:46	0.2	0.0	0.4	0.2
01Jan2000	03:47	0.2	0.0	0.4	0.2
01Jan2000	03:48	0.2	0.0	0.4	0.2
01Jan2000	03:49	0.2	0.0	0.4	0.2
01Jan2000	03:50	0.2	0.0	0.4	0.2
01Jan2000	03:51	0.2	0.0	0.4	0.2
01Jan2000	03:52	0.2	0.0	0.4	0.2
01Jan2000	03:53	0.3	0.0	0.4	0.2
01Jan2000	03:54	0.3	0.0	0.4	0.3
01Jan2000	03:55	0.3	0.0	0.4	0.3
01Jan2000	03:56	0.3	0.0	0.4	0.3
01Jan2000	03:57	0.3	0.0	0.4	0.3
01Jan2000	03:58	0.4	0.0	0.4	0.3
01Jan2000	03:59	0.4	0.0	0.4	0.4
01Jan2000	04:00	0.4	0.0	0.4	0.4
01Jan2000	04:01	0.6	0.0	0.4	0.5
01Jan2000	04:02	0.8	0.0	0.5	0.6

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:03	1.0	0.0	0.5	0.8
01Jan2000	04:04	1.3	0.0	0.5	1.0
01Jan2000	04:05	1.5	0.0	0.5	1.2
01Jan2000	04:06	1.2	0.0	0.5	1.3
01Jan2000	04:07	1.0	0.0	0.5	1.2
01Jan2000	04:08	0.7	0.0	0.5	1.0
01Jan2000	04:09	0.5	0.0	0.5	0.8
01Jan2000	04:10	0.2	0.0	0.4	0.5
01Jan2000	04:11	0.2	0.0	0.4	0.3
01Jan2000	04:12	0.2	0.0	0.4	0.3
01Jan2000	04:13	0.2	0.0	0.4	0.2
01Jan2000	04:14	0.2	0.0	0.4	0.2
01Jan2000	04:15	0.2	0.0	0.4	0.2
01Jan2000	04:16	0.2	0.0	0.4	0.2
01Jan2000	04:17	0.2	0.0	0.4	0.2
01Jan2000	04:18	0.1	0.0	0.4	0.2
01Jan2000	04:19	0.1	0.0	0.4	0.1
01Jan2000	04:20	0.1	0.0	0.4	0.1
01Jan2000	04:21	0.1	0.0	0.4	0.1
01Jan2000	04:22	0.1	0.0	0.4	0.1
01Jan2000	04:23	0.1	0.0	0.4	0.1
01Jan2000	04:24	0.1	0.0	0.4	0.1
01Jan2000	04:25	0.1	0.0	0.4	0.1
01Jan2000	04:26	0.1	0.0	0.4	0.1
01Jan2000	04:27	0.1	0.0	0.4	0.1
01Jan2000	04:28	0.1	0.0	0.4	0.1
01Jan2000	04:29	0.1	0.0	0.4	0.1
01Jan2000	04:30	0.1	0.0	0.4	0.1
01Jan2000	04:31	0.1	0.0	0.4	0.1
01Jan2000	04:32	0.1	0.0	0.4	0.1
01Jan2000	04:33	0.1	0.0	0.4	0.1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:34	0.1	0.0	0.4	0.1
01Jan2000	04:35	0.1	0.0	0.4	0.1
01Jan2000	04:36	0.1	0.0	0.4	0.1
01Jan2000	04:37	0.1	0.0	0.4	0.1
01Jan2000	04:38	0.1	0.0	0.4	0.1
01Jan2000	04:39	0.1	0.0	0.4	0.1
01Jan2000	04:40	0.1	0.0	0.4	0.1
01Jan2000	04:41	0.1	0.0	0.4	0.1
01Jan2000	04:42	0.1	0.0	0.4	0.1
01Jan2000	04:43	0.1	0.0	0.4	0.1
01Jan2000	04:44	0.1	0.0	0.4	0.1
01Jan2000	04:45	0.1	0.0	0.4	0.1
01Jan2000	04:46	0.1	0.0	0.4	0.1
01Jan2000	04:47	0.1	0.0	0.4	0.1
01Jan2000	04:48	0.1	0.0	0.4	0.1
01Jan2000	04:49	0.1	0.0	0.4	0.1
01Jan2000	04:50	0.1	0.0	0.4	0.1
01Jan2000	04:51	0.1	0.0	0.4	0.1
01Jan2000	04:52	0.1	0.0	0.4	0.1
01Jan2000	04:53	0.1	0.0	0.4	0.1
01Jan2000	04:54	0.1	0.0	0.4	0.1
01Jan2000	04:55	0.1	0.0	0.4	0.1
01Jan2000	04:56	0.1	0.0	0.4	0.1
01Jan2000	04:57	0.1	0.0	0.4	0.1
01Jan2000	04:58	0.1	0.0	0.4	0.1
01Jan2000	04:59	0.1	0.0	0.4	0.1
01Jan2000	05:00	0.1	0.0	0.4	0.1
01Jan2000	05:01	0.1	0.0	0.4	0.1
01Jan2000	05:02	0.1	0.0	0.4	0.1
01Jan2000	05:03	0.1	0.0	0.4	0.1
01Jan2000	05:04	0.1	0.0	0.4	0.1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:05	0.1	0.0	0.4	0.1
01Jan2000	05:06	0.1	0.0	0.4	0.1
01Jan2000	05:07	0.1	0.0	0.4	0.1
01Jan2000	05:08	0.0	0.0	0.4	0.1
01Jan2000	05:09	0.0	0.0	0.4	0.0
01Jan2000	05:10	0.0	0.0	0.4	0.0
01Jan2000	05:11	0.0	0.0	0.4	0.0
01Jan2000	05:12	0.0	0.0	0.4	0.0
01Jan2000	05:13	0.0	0.0	0.4	0.0
01Jan2000	05:14	0.0	0.0	0.4	0.0
01Jan2000	05:15	0.0	0.0	0.4	0.0
01Jan2000	05:16	0.0	0.0	0.4	0.0
01Jan2000	05:17	0.0	0.0	0.4	0.0
01Jan2000	05:18	0.0	0.0	0.4	0.0
01Jan2000	05:19	0.0	0.0	0.4	0.0
01Jan2000	05:20	0.0	0.0	0.4	0.0
01Jan2000	05:21	0.0	0.0	0.4	0.0
01Jan2000	05:22	0.0	0.0	0.4	0.0
01Jan2000	05:23	0.0	0.0	0.4	0.0
01Jan2000	05:24	0.0	0.0	0.4	0.0
01Jan2000	05:25	0.0	0.0	0.4	0.0
01Jan2000	05:26	0.0	0.0	0.4	0.0
01Jan2000	05:27	0.0	0.0	0.4	0.0
01Jan2000	05:28	0.0	0.0	0.4	0.0
01Jan2000	05:29	0.0	0.0	0.4	0.0
01Jan2000	05:30	0.0	0.0	0.4	0.0
01Jan2000	05:31	0.0	0.0	0.4	0.0
01Jan2000	05:32	0.0	0.0	0.4	0.0
01Jan2000	05:33	0.0	0.0	0.4	0.0
01Jan2000	05:34	0.0	0.0	0.4	0.0
01Jan2000	05:35	0.0	0.0	0.4	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:36	0.0	0.0	0.4	0.0
01Jan2000	05:37	0.0	0.0	0.4	0.0
01Jan2000	05:38	0.0	0.0	0.4	0.0
01Jan2000	05:39	0.0	0.0	0.4	0.0
01Jan2000	05:40	0.0	0.0	0.4	0.0
01Jan2000	05:41	0.0	0.0	0.4	0.0
01Jan2000	05:42	0.0	0.0	0.4	0.0
01Jan2000	05:43	0.0	0.0	0.4	0.0
01Jan2000	05:44	0.0	0.0	0.4	0.0
01Jan2000	05:45	0.0	0.0	0.4	0.0
01Jan2000	05:46	0.0	0.0	0.4	0.0
01Jan2000	05:47	0.0	0.0	0.4	0.0
01Jan2000	05:48	0.0	0.0	0.4	0.0
01Jan2000	05:49	0.0	0.0	0.4	0.0
01Jan2000	05:50	0.0	0.0	0.4	0.0
01Jan2000	05:51	0.0	0.0	0.4	0.0
01Jan2000	05:52	0.0	0.0	0.4	0.0
01Jan2000	05:53	0.0	0.0	0.4	0.0
01Jan2000	05:54	0.0	0.0	0.4	0.0
01Jan2000	05:55	0.0	0.0	0.4	0.0
01Jan2000	05:56	0.0	0.0	0.4	0.0
01Jan2000	05:57	0.0	0.0	0.4	0.0
01Jan2000	05:58	0.0	0.0	0.4	0.0
01Jan2000	05:59	0.0	0.0	0.4	0.0
01Jan2000	06:00	0.0	0.0	0.4	0.0
01Jan2000	06:01	0.0	0.0	0.4	0.0
01Jan2000	06:02	0.0	0.0	0.4	0.0
01Jan2000	06:03	0.0	0.0	0.4	0.0
01Jan2000	06:04	0.0	0.0	0.4	0.0
01Jan2000	06:05	0.0	0.0	0.4	0.0



Reservoir "BMP-3" Results for Run "Q100"
Storage (AC-FT)
0.045
0.040
0.035
0.030
Elev(ft)
0.119
0.084
0.049
0.014
Flow (cfs)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
01Jan2000
Run:Q100 Element:BMP-3 Result:Storage
Run:Q100 Element:BMP-3 Result:Pool Elevation
Run:Q100 Element:BMP-3 Result:Outflow
Run:Q100 Element:BMP-3 Result:Combined Inflow

Project: Tomlinson North Property Simulation Run: Q100
Reservoir: BMP-3

Start of Run:	01Jan2000, 00:00	Basin Model:	Post_Dev
End of Run:	01Jan2000, 06:05	Meteorologic Model:	Met 1
Compute Time:	15Feb2017, 11:45:17	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow:	0.8 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 04:05
Peak Discharge:	0.0 (CFS)	Date/Time of Peak Discharge	01Jan2000, 04:35
Inflow Volume:	n/a	Peak Storage:	0.0 (AC-FT)
Discharge Volume	n/a	Peak Elevation:	0.1 (FT)

Project: Tomlinson North Property Simulation Run: Q100
Reservoir: BMP-3

Start of Run: 01Jan2000, 00:00
End of Run: 01Jan2000, 06:05
Compute Time: 15Feb2017, 11:45:17

Basin Model: Post_Dev
Meteorologic Model: Met 1
Control Specifications: Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:00	0.0	0.0	0.0	0.0
01Jan2000	00:01	0.0	0.0	0.0	0.0
01Jan2000	00:02	0.0	0.0	0.0	0.0
01Jan2000	00:03	0.0	0.0	0.0	0.0
01Jan2000	00:04	0.0	0.0	0.0	0.0
01Jan2000	00:05	0.0	0.0	0.0	0.0
01Jan2000	00:06	0.0	0.0	0.0	0.0
01Jan2000	00:07	0.0	0.0	0.0	0.0
01Jan2000	00:08	0.0	0.0	0.0	0.0
01Jan2000	00:09	0.0	0.0	0.0	0.0
01Jan2000	00:10	0.0	0.0	0.0	0.0
01Jan2000	00:11	0.0	0.0	0.0	0.0
01Jan2000	00:12	0.0	0.0	0.0	0.0
01Jan2000	00:13	0.0	0.0	0.0	0.0
01Jan2000	00:14	0.0	0.0	0.0	0.0
01Jan2000	00:15	0.0	0.0	0.0	0.0
01Jan2000	00:16	0.0	0.0	0.0	0.0
01Jan2000	00:17	0.0	0.0	0.0	0.0
01Jan2000	00:18	0.0	0.0	0.0	0.0
01Jan2000	00:19	0.0	0.0	0.0	0.0
01Jan2000	00:20	0.0	0.0	0.0	0.0
01Jan2000	00:21	0.0	0.0	0.0	0.0
01Jan2000	00:22	0.0	0.0	0.0	0.0
01Jan2000	00:23	0.0	0.0	0.0	0.0
01Jan2000	00:24	0.0	0.0	0.0	0.0
01Jan2000	00:25	0.0	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:26	0.0	0.0	0.0	0.0
01Jan2000	00:27	0.0	0.0	0.0	0.0
01Jan2000	00:28	0.0	0.0	0.0	0.0
01Jan2000	00:29	0.0	0.0	0.0	0.0
01Jan2000	00:30	0.0	0.0	0.0	0.0
01Jan2000	00:31	0.0	0.0	0.0	0.0
01Jan2000	00:32	0.0	0.0	0.0	0.0
01Jan2000	00:33	0.0	0.0	0.0	0.0
01Jan2000	00:34	0.0	0.0	0.0	0.0
01Jan2000	00:35	0.0	0.0	0.0	0.0
01Jan2000	00:36	0.0	0.0	0.0	0.0
01Jan2000	00:37	0.0	0.0	0.0	0.0
01Jan2000	00:38	0.0	0.0	0.0	0.0
01Jan2000	00:39	0.0	0.0	0.0	0.0
01Jan2000	00:40	0.0	0.0	0.0	0.0
01Jan2000	00:41	0.0	0.0	0.0	0.0
01Jan2000	00:42	0.0	0.0	0.0	0.0
01Jan2000	00:43	0.0	0.0	0.0	0.0
01Jan2000	00:44	0.0	0.0	0.0	0.0
01Jan2000	00:45	0.0	0.0	0.0	0.0
01Jan2000	00:46	0.0	0.0	0.0	0.0
01Jan2000	00:47	0.0	0.0	0.0	0.0
01Jan2000	00:48	0.0	0.0	0.0	0.0
01Jan2000	00:49	0.0	0.0	0.0	0.0
01Jan2000	00:50	0.0	0.0	0.0	0.0
01Jan2000	00:51	0.0	0.0	0.0	0.0
01Jan2000	00:52	0.0	0.0	0.0	0.0
01Jan2000	00:53	0.0	0.0	0.0	0.0
01Jan2000	00:54	0.0	0.0	0.0	0.0
01Jan2000	00:55	0.0	0.0	0.0	0.0
01Jan2000	00:56	0.0	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:57	0.0	0.0	0.0	0.0
01Jan2000	00:58	0.0	0.0	0.0	0.0
01Jan2000	00:59	0.0	0.0	0.0	0.0
01Jan2000	01:00	0.0	0.0	0.0	0.0
01Jan2000	01:01	0.0	0.0	0.0	0.0
01Jan2000	01:02	0.0	0.0	0.0	0.0
01Jan2000	01:03	0.0	0.0	0.0	0.0
01Jan2000	01:04	0.0	0.0	0.0	0.0
01Jan2000	01:05	0.0	0.0	0.0	0.0
01Jan2000	01:06	0.0	0.0	0.0	0.0
01Jan2000	01:07	0.0	0.0	0.0	0.0
01Jan2000	01:08	0.0	0.0	0.0	0.0
01Jan2000	01:09	0.0	0.0	0.0	0.0
01Jan2000	01:10	0.0	0.0	0.0	0.0
01Jan2000	01:11	0.0	0.0	0.0	0.0
01Jan2000	01:12	0.0	0.0	0.0	0.0
01Jan2000	01:13	0.0	0.0	0.0	0.0
01Jan2000	01:14	0.0	0.0	0.0	0.0
01Jan2000	01:15	0.0	0.0	0.0	0.0
01Jan2000	01:16	0.0	0.0	0.0	0.0
01Jan2000	01:17	0.0	0.0	0.0	0.0
01Jan2000	01:18	0.0	0.0	0.0	0.0
01Jan2000	01:19	0.0	0.0	0.0	0.0
01Jan2000	01:20	0.0	0.0	0.0	0.0
01Jan2000	01:21	0.0	0.0	0.0	0.0
01Jan2000	01:22	0.0	0.0	0.0	0.0
01Jan2000	01:23	0.0	0.0	0.0	0.0
01Jan2000	01:24	0.0	0.0	0.0	0.0
01Jan2000	01:25	0.0	0.0	0.0	0.0
01Jan2000	01:26	0.0	0.0	0.0	0.0
01Jan2000	01:27	0.0	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:28	0.0	0.0	0.0	0.0
01Jan2000	01:29	0.0	0.0	0.0	0.0
01Jan2000	01:30	0.0	0.0	0.0	0.0
01Jan2000	01:31	0.0	0.0	0.0	0.0
01Jan2000	01:32	0.0	0.0	0.0	0.0
01Jan2000	01:33	0.0	0.0	0.0	0.0
01Jan2000	01:34	0.0	0.0	0.0	0.0
01Jan2000	01:35	0.0	0.0	0.0	0.0
01Jan2000	01:36	0.0	0.0	0.0	0.0
01Jan2000	01:37	0.0	0.0	0.0	0.0
01Jan2000	01:38	0.0	0.0	0.0	0.0
01Jan2000	01:39	0.0	0.0	0.0	0.0
01Jan2000	01:40	0.0	0.0	0.0	0.0
01Jan2000	01:41	0.0	0.0	0.0	0.0
01Jan2000	01:42	0.0	0.0	0.0	0.0
01Jan2000	01:43	0.0	0.0	0.0	0.0
01Jan2000	01:44	0.0	0.0	0.0	0.0
01Jan2000	01:45	0.0	0.0	0.0	0.0
01Jan2000	01:46	0.0	0.0	0.0	0.0
01Jan2000	01:47	0.0	0.0	0.0	0.0
01Jan2000	01:48	0.0	0.0	0.0	0.0
01Jan2000	01:49	0.0	0.0	0.0	0.0
01Jan2000	01:50	0.0	0.0	0.0	0.0
01Jan2000	01:51	0.0	0.0	0.0	0.0
01Jan2000	01:52	0.0	0.0	0.0	0.0
01Jan2000	01:53	0.0	0.0	0.0	0.0
01Jan2000	01:54	0.0	0.0	0.0	0.0
01Jan2000	01:55	0.0	0.0	0.0	0.0
01Jan2000	01:56	0.0	0.0	0.0	0.0
01Jan2000	01:57	0.0	0.0	0.0	0.0
01Jan2000	01:58	0.0	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:59	0.0	0.0	0.0	0.0
01Jan2000	02:00	0.0	0.0	0.0	0.0
01Jan2000	02:01	0.0	0.0	0.0	0.0
01Jan2000	02:02	0.0	0.0	0.0	0.0
01Jan2000	02:03	0.0	0.0	0.0	0.0
01Jan2000	02:04	0.0	0.0	0.0	0.0
01Jan2000	02:05	0.0	0.0	0.0	0.0
01Jan2000	02:06	0.0	0.0	0.0	0.0
01Jan2000	02:07	0.0	0.0	0.0	0.0
01Jan2000	02:08	0.0	0.0	0.0	0.0
01Jan2000	02:09	0.0	0.0	0.0	0.0
01Jan2000	02:10	0.0	0.0	0.0	0.0
01Jan2000	02:11	0.0	0.0	0.0	0.0
01Jan2000	02:12	0.0	0.0	0.0	0.0
01Jan2000	02:13	0.0	0.0	0.0	0.0
01Jan2000	02:14	0.0	0.0	0.0	0.0
01Jan2000	02:15	0.0	0.0	0.0	0.0
01Jan2000	02:16	0.0	0.0	0.0	0.0
01Jan2000	02:17	0.0	0.0	0.0	0.0
01Jan2000	02:18	0.0	0.0	0.0	0.0
01Jan2000	02:19	0.0	0.0	0.0	0.0
01Jan2000	02:20	0.0	0.0	0.0	0.0
01Jan2000	02:21	0.0	0.0	0.0	0.0
01Jan2000	02:22	0.0	0.0	0.0	0.0
01Jan2000	02:23	0.0	0.0	0.0	0.0
01Jan2000	02:24	0.0	0.0	0.0	0.0
01Jan2000	02:25	0.0	0.0	0.0	0.0
01Jan2000	02:26	0.0	0.0	0.0	0.0
01Jan2000	02:27	0.0	0.0	0.0	0.0
01Jan2000	02:28	0.0	0.0	0.0	0.0
01Jan2000	02:29	0.0	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	02:30	0.0	0.0	0.0	0.0
01Jan2000	02:31	0.0	0.0	0.0	0.0
01Jan2000	02:32	0.0	0.0	0.0	0.0
01Jan2000	02:33	0.0	0.0	0.0	0.0
01Jan2000	02:34	0.0	0.0	0.0	0.0
01Jan2000	02:35	0.0	0.0	0.0	0.0
01Jan2000	02:36	0.0	0.0	0.0	0.0
01Jan2000	02:37	0.0	0.0	0.0	0.0
01Jan2000	02:38	0.0	0.0	0.0	0.0
01Jan2000	02:39	0.0	0.0	0.0	0.0
01Jan2000	02:40	0.0	0.0	0.0	0.0
01Jan2000	02:41	0.0	0.0	0.0	0.0
01Jan2000	02:42	0.0	0.0	0.0	0.0
01Jan2000	02:43	0.0	0.0	0.0	0.0
01Jan2000	02:44	0.0	0.0	0.0	0.0
01Jan2000	02:45	0.0	0.0	0.0	0.0
01Jan2000	02:46	0.0	0.0	0.0	0.0
01Jan2000	02:47	0.0	0.0	0.0	0.0
01Jan2000	02:48	0.0	0.0	0.0	0.0
01Jan2000	02:49	0.0	0.0	0.0	0.0
01Jan2000	02:50	0.0	0.0	0.0	0.0
01Jan2000	02:51	0.0	0.0	0.0	0.0
01Jan2000	02:52	0.0	0.0	0.0	0.0
01Jan2000	02:53	0.0	0.0	0.0	0.0
01Jan2000	02:54	0.0	0.0	0.0	0.0
01Jan2000	02:55	0.0	0.0	0.0	0.0
01Jan2000	02:56	0.0	0.0	0.0	0.0
01Jan2000	02:57	0.0	0.0	0.0	0.0
01Jan2000	02:58	0.0	0.0	0.0	0.0
01Jan2000	02:59	0.0	0.0	0.0	0.0
01Jan2000	03:00	0.0	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:01	0.0	0.0	0.0	0.0
01Jan2000	03:02	0.0	0.0	0.0	0.0
01Jan2000	03:03	0.0	0.0	0.0	0.0
01Jan2000	03:04	0.0	0.0	0.0	0.0
01Jan2000	03:05	0.0	0.0	0.0	0.0
01Jan2000	03:06	0.0	0.0	0.0	0.0
01Jan2000	03:07	0.0	0.0	0.0	0.0
01Jan2000	03:08	0.0	0.0	0.0	0.0
01Jan2000	03:09	0.0	0.0	0.0	0.0
01Jan2000	03:10	0.0	0.0	0.0	0.0
01Jan2000	03:11	0.0	0.0	0.0	0.0
01Jan2000	03:12	0.0	0.0	0.0	0.0
01Jan2000	03:13	0.1	0.0	0.0	0.0
01Jan2000	03:14	0.1	0.0	0.0	0.0
01Jan2000	03:15	0.1	0.0	0.0	0.0
01Jan2000	03:16	0.1	0.0	0.0	0.0
01Jan2000	03:17	0.1	0.0	0.0	0.0
01Jan2000	03:18	0.1	0.0	0.0	0.0
01Jan2000	03:19	0.1	0.0	0.0	0.0
01Jan2000	03:20	0.1	0.0	0.0	0.0
01Jan2000	03:21	0.1	0.0	0.0	0.0
01Jan2000	03:22	0.1	0.0	0.0	0.0
01Jan2000	03:23	0.1	0.0	0.0	0.0
01Jan2000	03:24	0.1	0.0	0.0	0.0
01Jan2000	03:25	0.1	0.0	0.0	0.0
01Jan2000	03:26	0.1	0.0	0.0	0.0
01Jan2000	03:27	0.1	0.0	0.0	0.0
01Jan2000	03:28	0.1	0.0	0.0	0.0
01Jan2000	03:29	0.1	0.0	0.0	0.0
01Jan2000	03:30	0.1	0.0	0.0	0.0
01Jan2000	03:31	0.1	0.0	0.0	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:32	0.1	0.0	0.0	0.0
01Jan2000	03:33	0.1	0.0	0.0	0.0
01Jan2000	03:34	0.1	0.0	0.0	0.0
01Jan2000	03:35	0.1	0.0	0.0	0.0
01Jan2000	03:36	0.1	0.0	0.0	0.0
01Jan2000	03:37	0.1	0.0	0.0	0.0
01Jan2000	03:38	0.1	0.0	0.0	0.0
01Jan2000	03:39	0.1	0.0	0.0	0.0
01Jan2000	03:40	0.1	0.0	0.0	0.0
01Jan2000	03:41	0.1	0.0	0.0	0.0
01Jan2000	03:42	0.1	0.0	0.0	0.0
01Jan2000	03:43	0.1	0.0	0.0	0.0
01Jan2000	03:44	0.1	0.0	0.0	0.0
01Jan2000	03:45	0.1	0.0	0.0	0.0
01Jan2000	03:46	0.1	0.0	0.0	0.0
01Jan2000	03:47	0.1	0.0	0.0	0.0
01Jan2000	03:48	0.1	0.0	0.0	0.0
01Jan2000	03:49	0.1	0.0	0.0	0.0
01Jan2000	03:50	0.1	0.0	0.0	0.0
01Jan2000	03:51	0.1	0.0	0.0	0.0
01Jan2000	03:52	0.1	0.0	0.0	0.0
01Jan2000	03:53	0.2	0.0	0.0	0.0
01Jan2000	03:54	0.2	0.0	0.1	0.0
01Jan2000	03:55	0.2	0.0	0.1	0.0
01Jan2000	03:56	0.2	0.0	0.1	0.0
01Jan2000	03:57	0.2	0.0	0.1	0.0
01Jan2000	03:58	0.2	0.0	0.1	0.0
01Jan2000	03:59	0.2	0.0	0.1	0.0
01Jan2000	04:00	0.2	0.0	0.1	0.0
01Jan2000	04:01	0.3	0.0	0.1	0.0
01Jan2000	04:02	0.5	0.0	0.1	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:03	0.6	0.0	0.1	0.0
01Jan2000	04:04	0.7	0.0	0.1	0.0
01Jan2000	04:05	0.8	0.0	0.1	0.0
01Jan2000	04:06	0.7	0.0	0.1	0.0
01Jan2000	04:07	0.5	0.0	0.1	0.0
01Jan2000	04:08	0.4	0.0	0.1	0.0
01Jan2000	04:09	0.2	0.0	0.1	0.0
01Jan2000	04:10	0.1	0.0	0.1	0.0
01Jan2000	04:11	0.1	0.0	0.1	0.0
01Jan2000	04:12	0.1	0.0	0.1	0.0
01Jan2000	04:13	0.1	0.0	0.1	0.0
01Jan2000	04:14	0.1	0.0	0.1	0.0
01Jan2000	04:15	0.1	0.0	0.1	0.0
01Jan2000	04:16	0.1	0.0	0.1	0.0
01Jan2000	04:17	0.1	0.0	0.1	0.0
01Jan2000	04:18	0.1	0.0	0.1	0.0
01Jan2000	04:19	0.1	0.0	0.1	0.0
01Jan2000	04:20	0.1	0.0	0.1	0.0
01Jan2000	04:21	0.1	0.0	0.1	0.0
01Jan2000	04:22	0.1	0.0	0.1	0.0
01Jan2000	04:23	0.1	0.0	0.1	0.0
01Jan2000	04:24	0.1	0.0	0.1	0.0
01Jan2000	04:25	0.1	0.0	0.1	0.0
01Jan2000	04:26	0.1	0.0	0.1	0.0
01Jan2000	04:27	0.1	0.0	0.1	0.0
01Jan2000	04:28	0.1	0.0	0.1	0.0
01Jan2000	04:29	0.1	0.0	0.1	0.0
01Jan2000	04:30	0.1	0.0	0.1	0.0
01Jan2000	04:31	0.1	0.0	0.1	0.0
01Jan2000	04:32	0.1	0.0	0.1	0.0
01Jan2000	04:33	0.0	0.0	0.1	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:34	0.0	0.0	0.1	0.0
01Jan2000	04:35	0.0	0.0	0.1	0.0
01Jan2000	04:36	0.0	0.0	0.1	0.0
01Jan2000	04:37	0.0	0.0	0.1	0.0
01Jan2000	04:38	0.0	0.0	0.1	0.0
01Jan2000	04:39	0.0	0.0	0.1	0.0
01Jan2000	04:40	0.0	0.0	0.1	0.0
01Jan2000	04:41	0.0	0.0	0.1	0.0
01Jan2000	04:42	0.0	0.0	0.1	0.0
01Jan2000	04:43	0.0	0.0	0.1	0.0
01Jan2000	04:44	0.0	0.0	0.1	0.0
01Jan2000	04:45	0.0	0.0	0.1	0.0
01Jan2000	04:46	0.0	0.0	0.1	0.0
01Jan2000	04:47	0.0	0.0	0.1	0.0
01Jan2000	04:48	0.0	0.0	0.1	0.0
01Jan2000	04:49	0.0	0.0	0.1	0.0
01Jan2000	04:50	0.0	0.0	0.1	0.0
01Jan2000	04:51	0.0	0.0	0.1	0.0
01Jan2000	04:52	0.0	0.0	0.1	0.0
01Jan2000	04:53	0.0	0.0	0.1	0.0
01Jan2000	04:54	0.0	0.0	0.1	0.0
01Jan2000	04:55	0.0	0.0	0.1	0.0
01Jan2000	04:56	0.0	0.0	0.1	0.0
01Jan2000	04:57	0.0	0.0	0.1	0.0
01Jan2000	04:58	0.0	0.0	0.1	0.0
01Jan2000	04:59	0.0	0.0	0.1	0.0
01Jan2000	05:00	0.0	0.0	0.1	0.0
01Jan2000	05:01	0.0	0.0	0.1	0.0
01Jan2000	05:02	0.0	0.0	0.1	0.0
01Jan2000	05:03	0.0	0.0	0.1	0.0
01Jan2000	05:04	0.0	0.0	0.1	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:05	0.0	0.0	0.1	0.0
01Jan2000	05:06	0.0	0.0	0.1	0.0
01Jan2000	05:07	0.0	0.0	0.1	0.0
01Jan2000	05:08	0.0	0.0	0.1	0.0
01Jan2000	05:09	0.0	0.0	0.1	0.0
01Jan2000	05:10	0.0	0.0	0.1	0.0
01Jan2000	05:11	0.0	0.0	0.1	0.0
01Jan2000	05:12	0.0	0.0	0.1	0.0
01Jan2000	05:13	0.0	0.0	0.1	0.0
01Jan2000	05:14	0.0	0.0	0.1	0.0
01Jan2000	05:15	0.0	0.0	0.1	0.0
01Jan2000	05:16	0.0	0.0	0.1	0.0
01Jan2000	05:17	0.0	0.0	0.1	0.0
01Jan2000	05:18	0.0	0.0	0.1	0.0
01Jan2000	05:19	0.0	0.0	0.1	0.0
01Jan2000	05:20	0.0	0.0	0.1	0.0
01Jan2000	05:21	0.0	0.0	0.1	0.0
01Jan2000	05:22	0.0	0.0	0.1	0.0
01Jan2000	05:23	0.0	0.0	0.1	0.0
01Jan2000	05:24	0.0	0.0	0.1	0.0
01Jan2000	05:25	0.0	0.0	0.1	0.0
01Jan2000	05:26	0.0	0.0	0.1	0.0
01Jan2000	05:27	0.0	0.0	0.1	0.0
01Jan2000	05:28	0.0	0.0	0.1	0.0
01Jan2000	05:29	0.0	0.0	0.1	0.0
01Jan2000	05:30	0.0	0.0	0.1	0.0
01Jan2000	05:31	0.0	0.0	0.1	0.0
01Jan2000	05:32	0.0	0.0	0.1	0.0
01Jan2000	05:33	0.0	0.0	0.1	0.0
01Jan2000	05:34	0.0	0.0	0.1	0.0
01Jan2000	05:35	0.0	0.0	0.1	0.0

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:36	0.0	0.0	0.1	0.0
01Jan2000	05:37	0.0	0.0	0.1	0.0
01Jan2000	05:38	0.0	0.0	0.1	0.0
01Jan2000	05:39	0.0	0.0	0.1	0.0
01Jan2000	05:40	0.0	0.0	0.1	0.0
01Jan2000	05:41	0.0	0.0	0.1	0.0
01Jan2000	05:42	0.0	0.0	0.1	0.0
01Jan2000	05:43	0.0	0.0	0.1	0.0
01Jan2000	05:44	0.0	0.0	0.1	0.0
01Jan2000	05:45	0.0	0.0	0.1	0.0
01Jan2000	05:46	0.0	0.0	0.1	0.0
01Jan2000	05:47	0.0	0.0	0.1	0.0
01Jan2000	05:48	0.0	0.0	0.1	0.0
01Jan2000	05:49	0.0	0.0	0.1	0.0
01Jan2000	05:50	0.0	0.0	0.1	0.0
01Jan2000	05:51	0.0	0.0	0.1	0.0
01Jan2000	05:52	0.0	0.0	0.1	0.0
01Jan2000	05:53	0.0	0.0	0.1	0.0
01Jan2000	05:54	0.0	0.0	0.1	0.0
01Jan2000	05:55	0.0	0.0	0.1	0.0
01Jan2000	05:56	0.0	0.0	0.1	0.0
01Jan2000	05:57	0.0	0.0	0.1	0.0
01Jan2000	05:58	0.0	0.0	0.1	0.0
01Jan2000	05:59	0.0	0.0	0.1	0.0
01Jan2000	06:00	0.0	0.0	0.1	0.0
01Jan2000	06:01	0.0	0.0	0.1	0.0
01Jan2000	06:02	0.0	0.0	0.1	0.0
01Jan2000	06:03	0.0	0.0	0.1	0.0
01Jan2000	06:04	0.0	0.0	0.1	0.0
01Jan2000	06:05	0.0	0.0	0.1	0.0

CHAPTER 5

HYDRAULIC ELEMENTS CALCULATIONS

Pipe Diameter, Depth & Velocity, Curb Inlet, and Rip Rap Energy Dissipater

5.1 PIPE DIAMETER, DEPTH & VELOCITY CALCULATIONS

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                          Analysis prepared by:

                                BHA, Inc
                      5115 Avenida Encinas, Suite L
                         Carlsbad, CA 92008-4387
                             (760) 931-8700
```

NODE 1:

```
----------------------------------------------------------------------------
   TIME/DATE OF STUDY: 11:10 04/27/2016
============================================================================
  Problem Descriptions:
   Node 1: Pipe Diameter Calculations


****************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------------
     PIPE SLOPE(FEET/FEET) =  0.0468
     PIPEFLOW(CFS) =       207.00
     MANNINGS FRICTION FACTOR = 0.013000
     >>>>>SOFFIT-FLOW PIPE DIAMETER(FEET) =   3.435 < 5' (Exist. 60" C.M.P pipe)
============================================================================


----------------------------------------------------------------------------
   TIME/DATE OF STUDY: 09:18 05/05/2016
============================================================================
  Problem Descriptions:
   Node 1: Pipe Depth and Velocity Calculations


****************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------------
     PIPE DIAMETER(FEET) =   5.000
     PIPE SLOPE(FEET/FEET) =  0.0468
     PIPEFLOW(CFS) =       207.00
     MANNINGS FRICTION FACTOR = 0.013000
============================================================================
     CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
     CRITICAL DEPTH(FEET) =      4.10
     CRITICAL FLOW AREA(SQUARE FEET) =    17.229
     CRITICAL FLOW TOP-WIDTH(FEET) =   3.843
     CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         6838.53
     CRITICAL FLOW VELOCITY(FEET/SEC.) =    12.015
     CRITICAL FLOW VELOCITY HEAD(FEET) =          2.24
     CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      4.48
     CRITICAL FLOW SPECIFIC ENERGY(FEET) =          6.34
============================================================================
     NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
     NORMAL DEPTH(FEET) =      2.10
```

```
    FLOW AREA(SQUARE FEET) =      7.81
    FLOW TOP-WIDTH(FEET) =     4.935
    FLOW PRESSURE + MOMENTUM(POUNDS) =        11056.39
    FLOW VELOCITY(FEET/SEC.) =         26.494
    FLOW VELOCITY HEAD(FEET) =         10.900
    HYDRAULIC DEPTH(FEET) =      1.58
    FROUDE NUMBER =     3.711
    SPECIFIC ENERGY(FEET) =          13.00
============================================================================
```

NODE 36:

```
----------------------------------------------------------------------------
  TIME/DATE OF STUDY: 11:18 04/27/2016
============================================================================
 Problem Descriptions:
  Node 36: Pipe Diameter Calculations


****************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    PIPE SLOPE(FEET/FEET) =  0.0364
    PIPEFLOW(CFS) =        11.70
    MANNINGS FRICTION FACTOR = 0.011000
    >>>>>SOFFIT-FLOW PIPE DIAMETER(FEET) =   1.151 < 1.5’
============================================================================


----------------------------------------------------------------------------
  TIME/DATE OF STUDY: 11:21 04/27/2016
============================================================================
 Problem Descriptions:
  Node 36: Pipe Depth and Velocity Calculations


****************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    PIPE DIAMETER(FEET) =   1.500
    PIPE SLOPE(FEET/FEET) =  0.0364
    PIPEFLOW(CFS) =        11.70
    MANNINGS FRICTION FACTOR = 0.011000
============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    CRITICAL DEPTH(FEET) =      1.30
    CRITICAL FLOW AREA(SQUARE FEET) =     1.629
    CRITICAL FLOW TOP-WIDTH(FEET) =   1.016
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         224.43
    CRITICAL FLOW VELOCITY(FEET/SEC.) =     7.184
    CRITICAL FLOW VELOCITY HEAD(FEET) =          0.80
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      1.60
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =          2.10
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =      0.74
    FLOW AREA(SQUARE FEET) =      0.88
    FLOW TOP-WIDTH(FEET) =     1.500
    FLOW PRESSURE + MOMENTUM(POUNDS) =          320.22
    FLOW VELOCITY(FEET/SEC.) =         13.362
```

```
    FLOW VELOCITY HEAD(FEET) =          2.773
    HYDRAULIC DEPTH(FEET) =      0.58
    FROUDE NUMBER =     3.082
    SPECIFIC ENERGY(FEET) =          3.52
 ============================================================================
```

NODE 30:

```
----------------------------------------------------------------------------
   TIME/DATE OF STUDY: 12:37 05/03/2016
 ============================================================================
  Problem Descriptions:
   Node 30- Pipe Diameter Calculations


****************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------
    PIPE SLOPE(FEET/FEET) =  0.0840
    PIPEFLOW(CFS) =         5.27
    MANNINGS FRICTION FACTOR = 0.011000
    >>>>>SOFFIT-FLOW PIPE DIAMETER(FEET) =   0.730 < 1' (Exist. 1' PVC pipe)
 ============================================================================
```

EXISTING NODE 104:

```
----------------------------------------------------------------------------
   TIME/DATE OF STUDY: 12:38 05/03/2016
 ============================================================================
  Problem Descriptions:
   Existing Node 104- Pipe Diameter Calculations


****************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------
    PIPE SLOPE(FEET/FEET) =  0.0840
    PIPEFLOW(CFS) =       136.40
    MANNINGS FRICTION FACTOR = 0.011000
    >>>>>SOFFIT-FLOW PIPE DIAMETER(FEET) =   2.472 > 1' (Exist. 1' PVC pipe)
 ============================================================================
```

5.2 CURB INLET CALCULATIONS

```
 ****************************************************************************
                     HYDRAULIC ELEMENTS - I  PROGRAM PACKAGE
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              Ver. 20.0  Release Date: 06/01/2013  License ID 1459

                              Analysis prepared by:

                                    BHA, Inc
                         5115 Avenida Encinas, Suite L
                            Carlsbad, CA 92008-4387
                                (760) 931-8700
```

NODE 6:

```
----------------------------------------------------------------------------
   TIME/DATE OF STUDY: 10:18 04/27/2016
 ============================================================================
  Problem Descriptions:
   Node 6: Curb Inlet Calculations
   Street Depth of Flow (100-year)

****************************************************************************
 >>>>STREETFLOW MODEL INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------
     CONSTANT STREET GRADE(FEET/FEET) = 0.040000
     CONSTANT STREET FLOW(CFS) =    9.23
     AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
     CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   12.00
     DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =    7.00
     INTERIOR STREET CROSSFALL(DECIMAL) = 0.018000
     OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.018000
     CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
     CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
     CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
     CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
     FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS

   ***STREET FLOW SPLITS OVER STREET-CROWN***

     FULL DEPTH(FEET) =    0.35   FLOOD WIDTH(FEET) =   12.00
     FULL HALF-STREET FLOW(CFS) =    6.61
     FULL HALF-STREET VELOCITY(FEET/SEC.) =    4.67
     SPLIT DEPTH(FEET) =    0.27   SPLIT FLOOD WIDTH(FEET) =    7.73
     SPLIT FLOW(CFS) =    2.62   SPLIT VELOCITY(FEET/SEC.) =    3.97
 ============================================================================
     STREET FLOW MODEL RESULTS:
 ----------------------------------------------------------------------------
     STREET FLOW DEPTH(FEET) =  0.35
     HALFSTREET FLOOD WIDTH(FEET) =   12.00
     AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.67
     PRODUCT OF DEPTH&VELOCITY =    1.61
 ============================================================================

  Problem Descriptions:
   Node 6: Curb Inlet Calculations
   Length of Curb Opening (100-year)

 ****************************************************************************
 >>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
```

Curb Inlet Capacities are approximated based on the Bureau of Public Roads nomograph plots for flowby basins and sump basins.

STREETFLOW(CFS) = 9.23
GUTTER FLOWDEPTH(FEET) = 0.35
BASIN LOCAL DEPRESSION(FEET) = 0.33

FLOWBY BASIN ANALYSIS RESULTS:

BASIN WIDTH	FLOW INTERCEPTION	
2.78	1.33	
3.00	1.43	
3.50	1.66	
4.00	1.88	
4.50	2.11	
5.00	2.33	
5.50	2.55	
6.00	2.78	
6.50	3.00	
7.00	3.22	
7.50	3.44	
8.00	3.66	
8.50	3.87	
9.00	4.09	
9.50	4.30	
10.00	4.49	
10.50	4.67	
11.00	4.84	
11.50	5.01	
12.00	5.18	
12.50	5.35	
13.00	5.52	
13.50	5.69	
14.00	5.85	
14.50	6.02	
15.00	6.18	
15.50	6.34	
16.00	6.50	
16.50	6.65	
17.00	6.79	
17.50	6.92	
18.00	7.05	
18.50	7.17	
19.00	7.29	L’= 0.65*Lt= (0.65)*27.76= 18.0, use 19.0’
19.50	7.41	Specify L’= 19.0’ on plans,
20.00	7.53	per San Diego Drainage Design Manual
20.50	7.65	page 2-5 and SDRSD D-02
21.00	7.77	
21.50	7.89	
22.00	8.00	
22.50	8.11	
23.00	8.22	
23.50	8.33	
24.00	8.44	
24.50	8.55	
25.00	8.66	
25.50	8.76	

```
          26.00            8.87
          26.50            8.97
          27.00            9.08
          27.50            9.18
          27.76            9.23
 ============================================================================



----------------------------------------------------------------------------
   TIME/DATE OF STUDY: 08:58 05/05/2016
 ============================================================================
  Problem Descriptions:
   Node 6- Curb Inlet Calculations
   Street Depth of Flow (10-year)

****************************************************************************
 >>>>STREETFLOW MODEL INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------
     CONSTANT STREET GRADE(FEET/FEET) = 0.040000
     CONSTANT STREET FLOW(CFS) =    6.20
     AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
     CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   12.00
     DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =    7.00
     INTERIOR STREET CROSSFALL(DECIMAL) = 0.018000
     OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.018000
     CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
     CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
     CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
     CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
     FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS
 ============================================================================
     STREET FLOW MODEL RESULTS:
 ----------------------------------------------------------------------------
     STREET FLOW DEPTH(FEET) =  0.34
     HALFSTREET FLOOD WIDTH(FEET) =   11.67
     AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.60
     PRODUCT OF DEPTH&VELOCITY =    1.56
 ============================================================================

  Problem Descriptions:
   Node 6- Curb Inlet Calculations
   Length of Curb Opening (10-year)

****************************************************************************
 >>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------


     Curb Inlet Capacities are approximated based on the Bureau of
     Public Roads nomograph plots for flowby basins and sump basins.


     STREETFLOW(CFS) =    6.20
     GUTTER FLOWDEPTH(FEET) =  0.34
     BASIN LOCAL DEPRESSION(FEET) =  0.33

 ----------------------------------------------------------------------------
          FLOWBY BASIN ANALYSIS RESULTS:

        BASIN WIDTH     FLOW INTERCEPTION
             1.92            0.88
```

```
            2.00            0.92
            2.50            1.14
            3.00            1.35
            3.50            1.57
            4.00            1.78
            4.50            2.00
            5.00            2.21
            5.50            2.42
            6.00            2.63
            6.50            2.84
            7.00            3.02
            7.50            3.19
            8.00            3.36
            8.50            3.53
            9.00            3.69
            9.50            3.85
           10.00            4.01
           10.50            4.17
           11.00            4.32
           11.50            4.47
           12.00            4.60
           12.50            4.72
           13.00            4.84
           13.50            4.96
           14.00            5.08
           14.50            5.19
           15.00            5.30
           15.50            5.42
           16.00            5.53
           16.50            5.63
           17.00            5.74
           17.50            5.85
           18.00            5.95
           18.50            6.05
           19.00            6.16
 Lt=       19.22            6.20       Lt(10-yr) < Lt(100-yr)

 ============================================================================
```

NODE 11:

```
----------------------------------------------------------------------------

   TIME/DATE OF STUDY: 10:11 04/27/2016
 ============================================================================
  Problem Descriptions:
   Node 11: Curb Inlet Calculations
   Street Depth of Flow (100-year)

****************************************************************************
 >>>>STREETFLOW MODEL INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------
     CONSTANT STREET GRADE(FEET/FEET) = 0.040000
     CONSTANT STREET FLOW(CFS) =    7.02
     AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
     CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   12.00
     DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =    7.00
     INTERIOR STREET CROSSFALL(DECIMAL) = 0.018000
     OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.018000
     CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
     CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
```

```
    CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
    CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
    FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS

  ***STREET FLOW SPLITS OVER STREET-CROWN***

    FULL DEPTH(FEET) =    0.35   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET FLOW(CFS) =    6.61
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    4.67
    SPLIT DEPTH(FEET) =    0.16   SPLIT FLOOD WIDTH(FEET) =    1.83
    SPLIT FLOW(CFS) =    0.41   SPLIT VELOCITY(FEET/SEC.) =    2.71
============================================================================
    STREET FLOW MODEL RESULTS:
----------------------------------------------------------------------------
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.67
    PRODUCT OF DEPTH&VELOCITY =    1.61
============================================================================
```

Problem Descriptions:
Node 11: Curb Inlet Calculations
Length of Curb Opening (100-year)

```
****************************************************************************
>>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
----------------------------------------------------------------------------


    Curb Inlet Capacities are approximated based on the Bureau of
    Public Roads nomograph plots for flowby basins and sump basins.


    STREETFLOW(CFS) =    7.02
    GUTTER FLOWDEPTH(FEET) =  0.35
    BASIN LOCAL DEPRESSION(FEET) =  0.33

----------------------------------------------------------------------------
         FLOWBY BASIN ANALYSIS RESULTS:

       BASIN WIDTH     FLOW INTERCEPTION
            2.11            1.01
            2.50            1.19
            3.00            1.41
            3.50            1.64
            4.00            1.86
            4.50            2.08
            5.00            2.30
            5.50            2.52
            6.00            2.74
            6.50            2.96
            7.00            3.17
            7.50            3.38
            8.00            3.55
            8.50            3.73
            9.00            3.90
            9.50            4.07
           10.00            4.24
           10.50            4.40
           11.00            4.57
           11.50            4.73
           12.00            4.89
```

```
          12.50            5.05
          13.00            5.18
          13.50            5.31
          14.00            5.44
          14.50            5.56
          15.00            5.68         L’= 0.65*Lt= (0.65)*20.00= 13.0, use 15.0’
          15.50            5.80         Specify L’= 15.0’ on plans,
          16.00            5.92         per San Diego Drainage Design Manual
          16.50            6.03         page 2-5 and SDRSD D-02
          17.00            6.14
          17.50            6.26
          18.00            6.37
          18.50            6.48
          19.00            6.58
          19.50            6.69
          20.00            6.79
          20.50            6.90
          21.00            7.00
 Lt=      21.11            7.02
 ============================================================================


----------------------------------------------------------------------------
   TIME/DATE OF STUDY: 09:09 05/05/2016
 ============================================================================
  Problem Descriptions:
   Node 11- Curb Inlet Calculations
   Street Depth of Flow (10-year)

****************************************************************************
 >>>>STREETFLOW MODEL INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------
     CONSTANT STREET GRADE(FEET/FEET) = 0.040000
     CONSTANT STREET FLOW(CFS) =    4.71
     AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
     CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   12.00
     DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =    1.00
     INTERIOR STREET CROSSFALL(DECIMAL) = 0.018000
     OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.018000
     CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
     CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
     CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
     CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
     FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS
 ============================================================================
     STREET FLOW MODEL RESULTS:
 ----------------------------------------------------------------------------
     STREET FLOW DEPTH(FEET) =  0.32
     HALFSTREET FLOOD WIDTH(FEET) =   10.36
     AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.34
     PRODUCT OF DEPTH&VELOCITY =    1.37
 ============================================================================

  Problem Descriptions:
   Node 11- Curb Inlet Calculations
   Length of Curb Opening- 10-year

 ****************************************************************************
 >>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
 ----------------------------------------------------------------------------
```

```
    Curb Inlet Capacities are approximated based on the Bureau of
    Public Roads nomograph plots for flowby basins and sump basins.


    STREETFLOW(CFS) =    4.71
    GUTTER FLOWDEPTH(FEET) =  0.32
    BASIN LOCAL DEPRESSION(FEET) =  0.33

----------------------------------------------------------------------------
         FLOWBY BASIN ANALYSIS RESULTS:

       BASIN WIDTH     FLOW INTERCEPTION
            1.56            0.66
            2.00            0.84
            2.50            1.04
            3.00            1.24
            3.50            1.44
            4.00            1.64
            4.50            1.84
            5.00            2.03
            5.50            2.22
            6.00            2.38
            6.50            2.54
            7.00            2.69
            7.50            2.84
            8.00            2.99
            8.50            3.14
            9.00            3.29
            9.50            3.42
           10.00            3.54
           10.50            3.65
           11.00            3.76
           11.50            3.87
           12.00            3.98
           12.50            4.09
           13.00            4.19
           13.50            4.30
           14.00            4.40
           14.50            4.50
           15.00            4.60
           15.50            4.70
Lt=        15.57            4.71       Lt(10-yr) < Lt(100-yr)
============================================================================
```

5.3 RIP RAP ENERGY DISSIPATER TABLE (PER D-40)

Node	Q_{100}(cfs)	V_{100}(fps)	Rock Class (min)	T (min)	Width	Length
5	16.13	5.74	No. 2 backing	1.1 ft	2 ft	10 ft
25	115.28	9.45	No. 2 backing	1.1 ft	6 ft	50 ft

CHAPTER 6

REFERENCES

6.1 – Methodology – Rational Method Peak Flow Determination

Hydrologic Soil Group—San Diego County Area, California
(Tomlinson North Property)

Map Scale: 1:3,130 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 40, 80, 160, 240

Feet: 0, 150, 300, 600, 900

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

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

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:3,130 if printed on A size (8.5" × 11") sheet.

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 6, Dec 17, 2007

Date(s) aerial images were photographed: 6/7/2005

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes	C	5.8	34.5%
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes , eroded	C	0.2	1.0%
HrC	Huerhuero loam, 2 to 9 percent slopes	D	10.7	63.2%
WmC	Wyman loam, 5 to 9 percent slopes	B	0.2	1.2%
Totals for Area of Interest			**16.9**	**100.0%**

Description

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

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

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

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

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

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

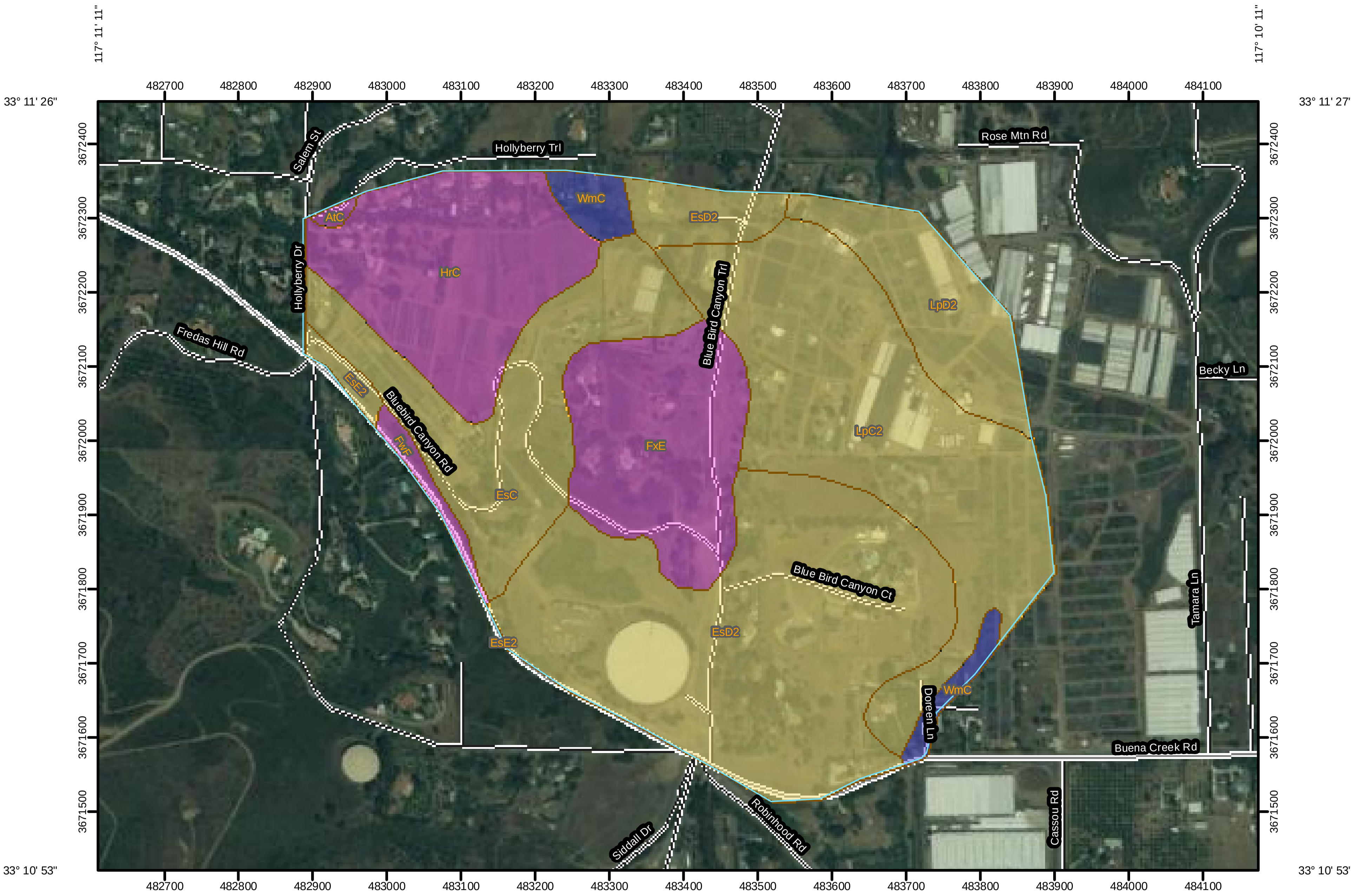
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

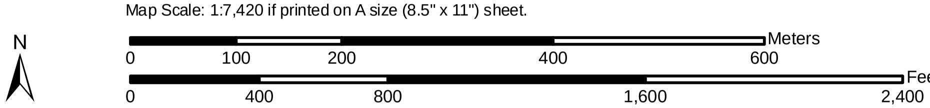
Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher



Map Scale: 1:7,420 if printed on A size (8.5" x 11") sheet.



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

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

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:7,420 if printed on A size (8.5" × 11") sheet.

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 6, Dec 17, 2007

Date(s) aerial images were photographed: 6/7/2005

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AtC	Altamont clay, 5 to 9 percent slopes	D	0.3	0.2%
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes	C	19.2	12.7%
EsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded	C	45.9	30.4%
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes , eroded	C	1.1	0.7%
FwF	Friant fine sandy loam, 30 to 50 percent slopes	D	1.3	0.9%
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes	D	16.7	11.0%
HrC	Huerhuero loam, 2 to 9 percent slopes	D	19.3	12.8%
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, erode d	C	33.7	22.3%
LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, erod ed	C	10.1	6.7%
WmC	Wyman loam, 5 to 9 percent slopes	B	3.4	2.2%
Totals for Area of Interest			**151.1**	**100.0%**

Description

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

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

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

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

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

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

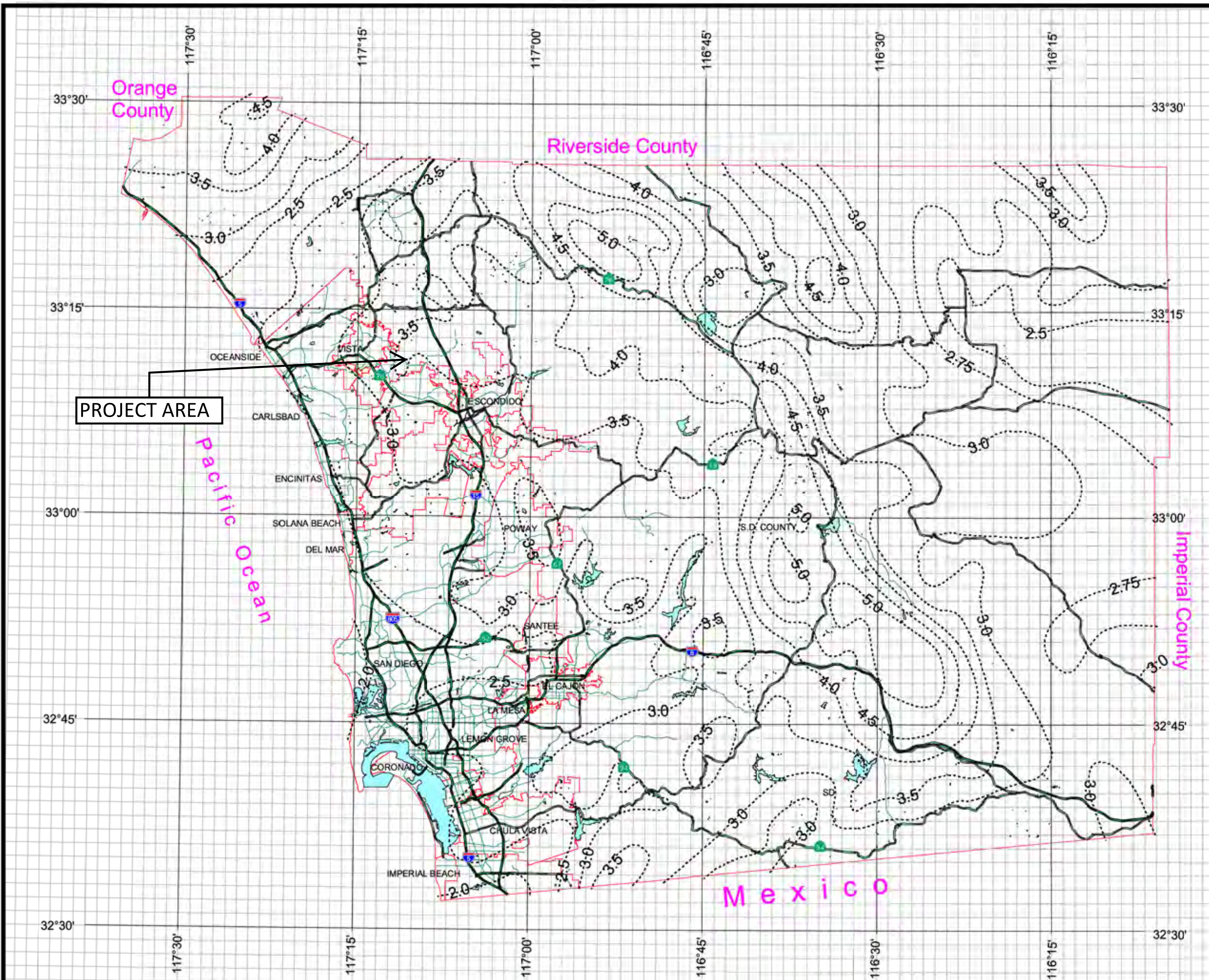
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

GPS: 33°11'16" N
-117°10'56" W

P_6 = 3.5"

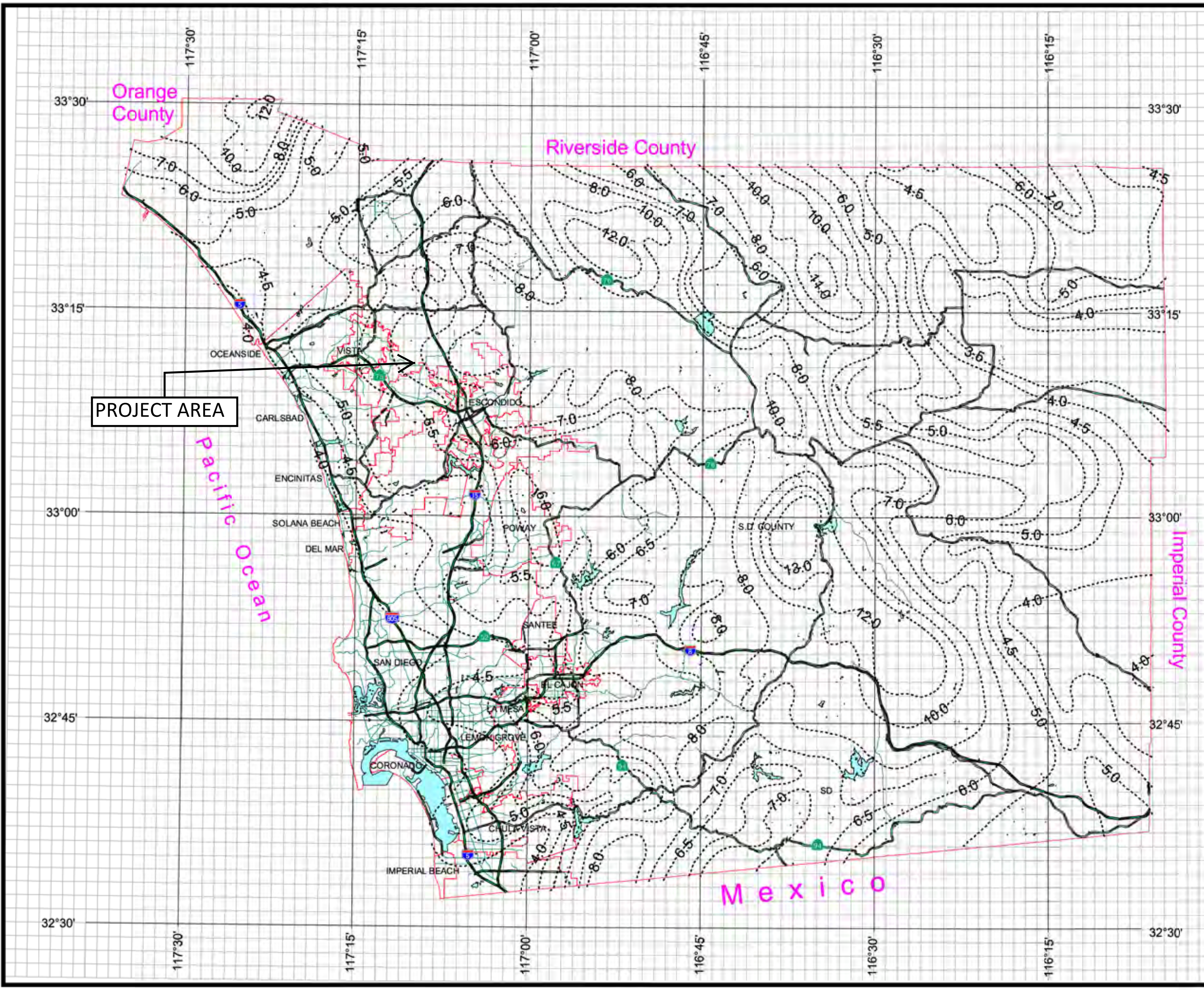
P_{24} = 6.6"

P_6 / P_{24} = 53%

DPW GIS

SanGIS We Have San Diego Covered!

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

-------- Isopluvial (inches)

GPS: 33°11'16" N
-117°10'56" W
$P_6 = 3.5"$
$P_{24} = 6.6"$
$P_6 / P_{24} = 53\%$

3 0 3 Miles

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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

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

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

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

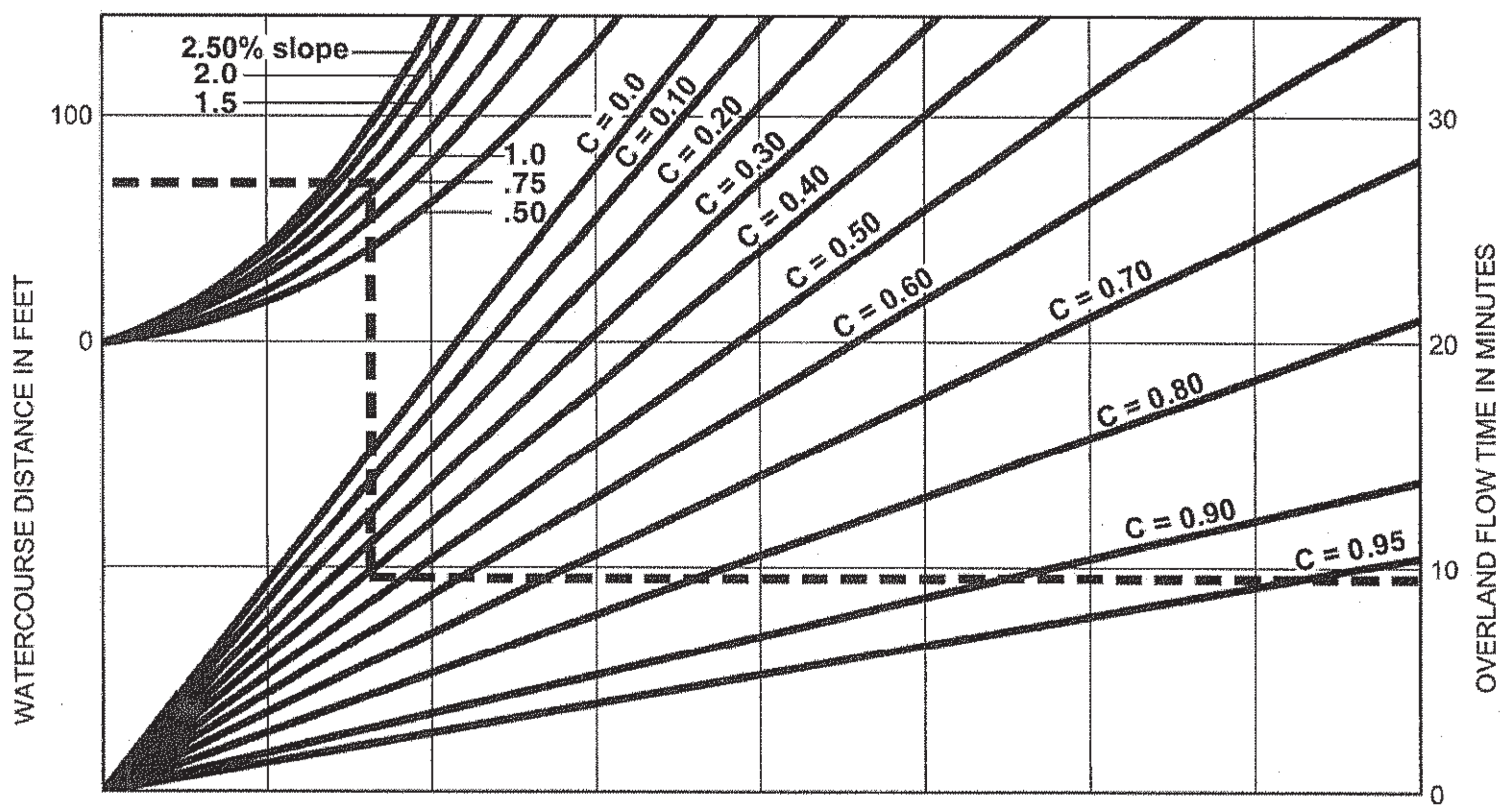
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved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

Table 3-2

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

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

*See Table 3-1 for more detailed description



EXAMPLE:

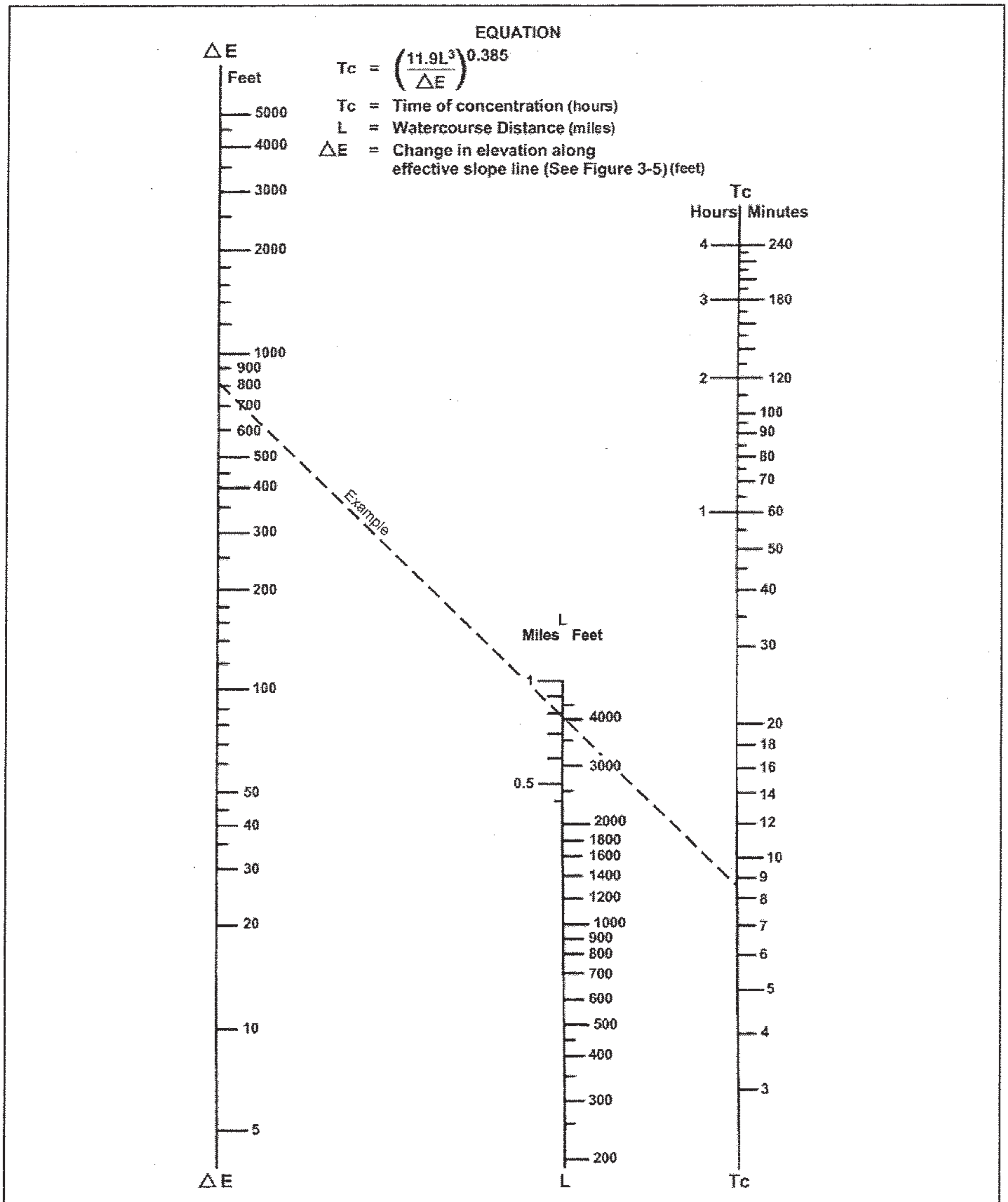
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

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

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE **3-3**

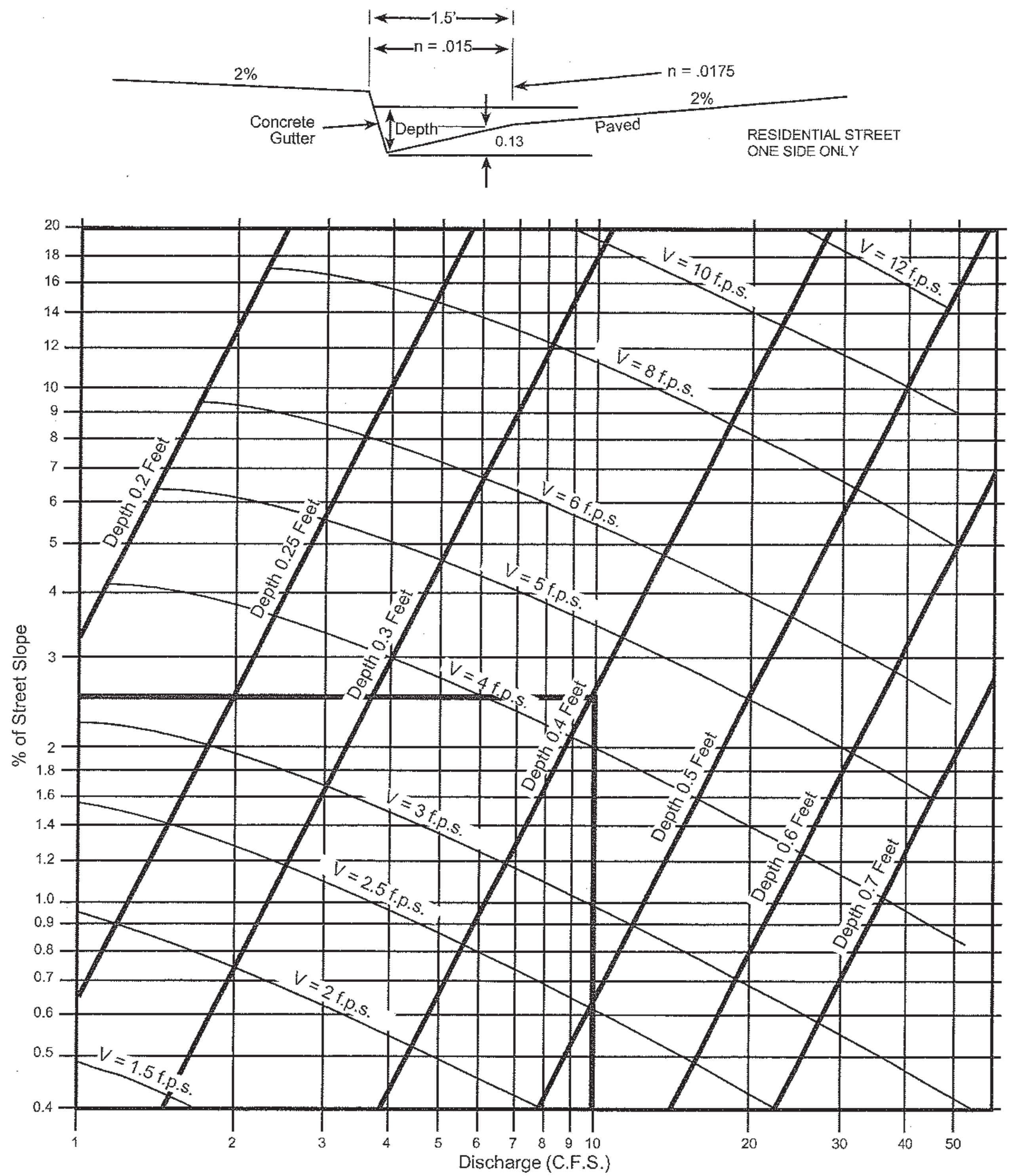
Rational Formula - Overland Time of Flow Nomograph



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

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

FIGURE
3-4

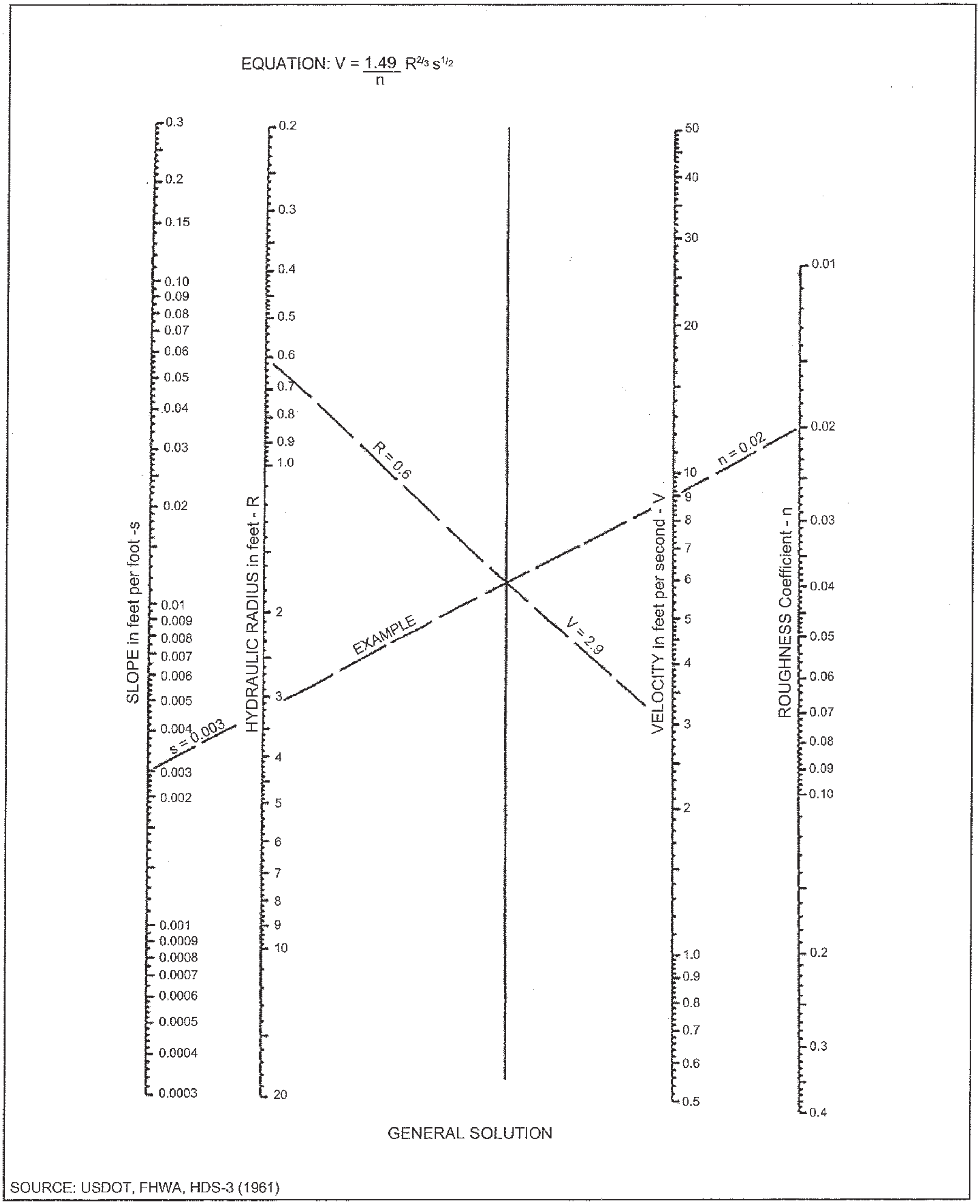


EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

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

FIGURE **3-6**

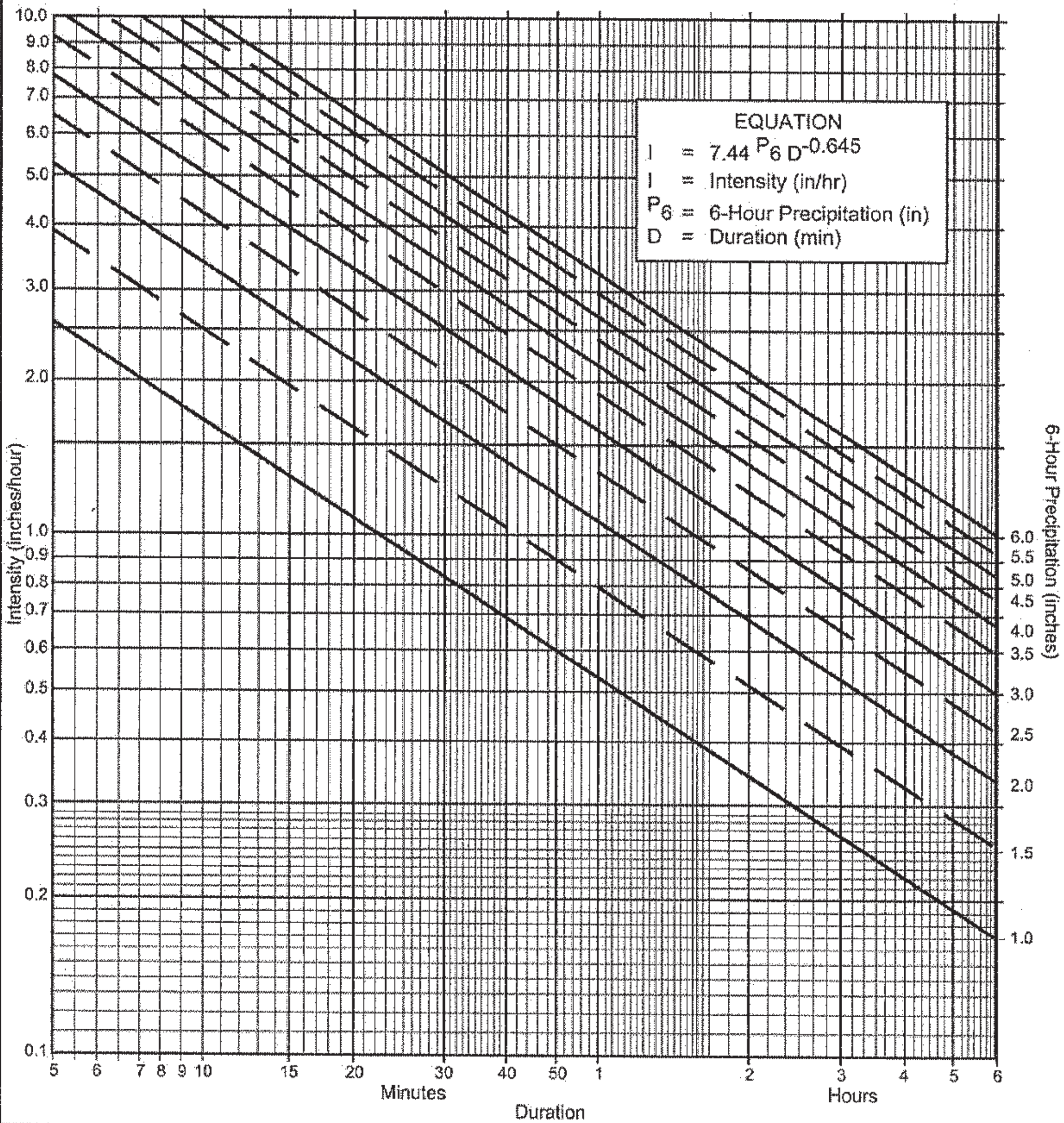
Gutter and Roadway Discharge - Velocity Chart



FIGURE

3-7

Manning's Equation Nomograph



Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency ______ year

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

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

(d) t_x = ______ min.

(e) I = ______ in./hr.

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

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

Intensity-Duration Design Chart - Template

FIGURE **3-1**

3.2 DEVELOPING INPUT DATA FOR THE RATIONAL METHOD

This section describes the development of the necessary data to perform RM calculations. Section 3.3 describes the RM calculation process. Input data for calculating peak flows and T_c's with the RM should be developed as follows:

1. On a topographic base map, outline the overall drainage area boundary, showing adjacent drains, existing and proposed drains, and overland flow paths.

2. Verify the accuracy of the drainage map in the field.

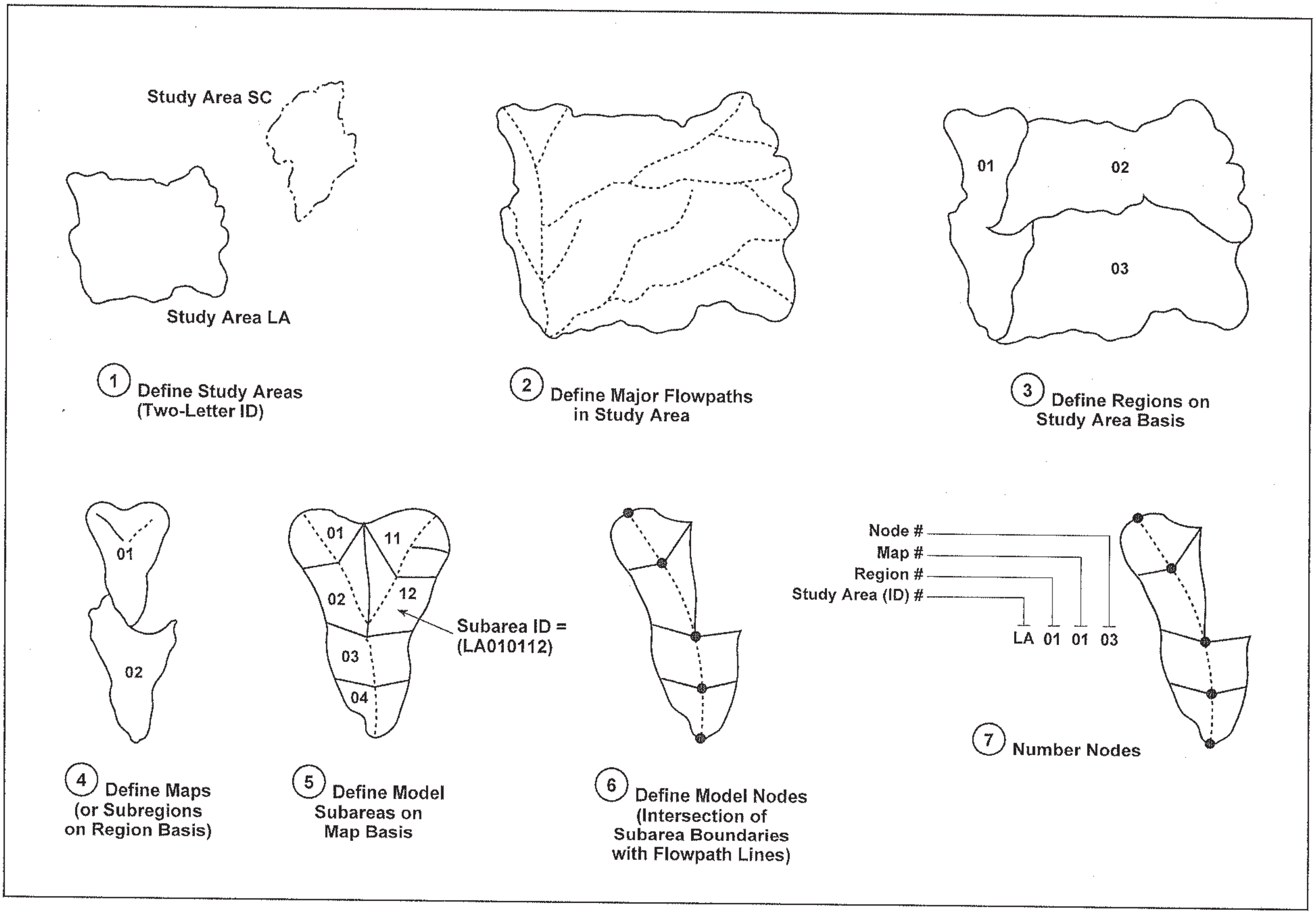
3. Divide the drainage area into subareas by locating significant points of interest. These divisions should be based on topography, soil type, and land use. Ensure that an appropriate first subarea is delineated. For natural areas, the first subarea flow path length should be less than or equal to 4,000 feet plus the overland flow length (Table 3-2). For developed areas, the initial subarea flow path length should be consistent with Table 3-2. The topography and slope within the initial subarea should be generally uniform.

4. Working from upstream to downstream, assign a number representing each subarea in the drainage system to each point of interest. Figure 3-8 provides guidelines for node numbers for geographic information system (GIS)-based studies.

5. Measure each subarea in the drainage area to determine its size in acres (A).

6. Determine the length and effective slope of the flow path in each subarea.

7. Identify the soil type for each subarea.



GIS/Hydrologic Model
Data Base Linkage Setup:
Nodes, Subareas, Links

FIGURE
3-8

8. Determine the runoff coefficient (C) for each subarea based on Table 3-1. If the subarea contains more than one type of development classification, use a proportionate average for C. In determining C for the subarea, use future land use taken from the applicable community plan, Multiple Species Conservation Plan, National Forest land use plan, etc.

9. Calculate the CA value for the subarea.

10. Calculate the Σ(CA) value(s) for the subareas upstream of the point(s) of interest.

11. Determine P_6 and P_{24} for the study using the isopluvial maps provided in Appendix B. If necessary, adjust the value for P_6 to be within 45% to 65% of the value for P_{24}.

See Section 3.3 for a description of the RM calculation process.

3.3 Performing Rational Method Calculations

This section describes the RM calculation process. Using the input data, calculation of peak flows and T_c's should be performed as follows:

1. Determine T_i for the first subarea. Use Table 3-2 or Figure 3-3 as discussed in Section 3.1.4. If the watershed is natural, the travel time to the downstream end of the first subarea can be added to T_i to obtain the T_c. Refer to paragraph 3.1.4.2 (a).

2. Determine I for the subarea using Figure 3-1. If T_i was less than 5 minutes, use the 5 minute time to determine intensity for calculating the flow.

3. Calculate the peak discharge flow rate for the subarea, where $Q_p = \Sigma(CA)\ I$.
In case that the downstream flow rate is less than the upstream flow rate, due to the long travel time that is not offset by the additional subarea runoff, use the upstream peak flow for design purposes until downstream flows increase again.

4. Estimate the T_t to the next point of interest.

5. Add the T_t to the previous T_c to obtain a new T_c.

6. Continue with step 2, above, until the final point of interest is reached.

Note: The MRM should be used to calculate the peak discharge when there is a junction from independent subareas into the drainage system.

3.4 Modified Rational Method (for Junction Analysis)

The purpose of this section is to describe the steps necessary to develop a hydrology report for a small watershed using the MRM. It is necessary to use the MRM if the watershed contains junctions of independent drainage systems. The process is based on the design manuals of the City/County of San Diego. The general process description for using this method, including an example of the application of this method, is described below.

The engineer should only use the MRM for drainage areas up to approximately 1 square mile in size. If the watershed will significantly exceed 1 square mile then the NRCS method described in Section 4 should be used. The engineer may choose to use either the RM or the MRM for calculations for up to an approximately 1-square-mile area and then transition the study to the NRCS method for additional downstream areas that exceed approximately 1 square mile. The transition process is described in Section 4.

3.4.1 Modified Rational Method General Process Description

The general process for the MRM differs from the RM only when a junction of independent drainage systems is reached. The peak Q, T_c, and I for each of the independent drainage systems at the point of the junction are calculated by the RM. The independent drainage systems are then combined using the MRM procedure described below. The peak Q, T_c, and I for each of the independent drainage systems at the point of the junction must be calculated prior to using the MRM procedure to combine the independent drainage systems, as these values will be used for the MRM calculations. After the independent drainage systems have been combined, RM calculations are continued to the next point of interest.

3.4.2 Procedure for Combining Independent Drainage Systems at a Junction

Calculate the peak Q, T_c, and I for each of the independent drainage systems at the point of the junction. These values will be used for the MRM calculations.

At the junction of two or more independent drainage systems, the respective peak flows are combined to obtain the maximum flow out of the junction at T_c. Based on the approximation that total runoff increases directly in proportion to time, a general equation may be written to determine the maximum Q and its corresponding T_c using the peak Q, T_c, and I for each of the independent drainage systems at the point immediately before the junction. The general equation requires that contributing Q's be numbered in order of increasing T_c.

Let Q_1, T_1, and I_1 correspond to the tributary area with the shortest T_c. Likewise, let Q_2, T_2, and I_2 correspond to the tributary area with the next longer T_c; Q_3, T_3, and I_3 correspond to the tributary area with the next longer T_c; and so on. When only two independent drainage systems are combined, leave Q_3, T_3, and I_3 out of the equation. Combine the independent drainage systems using the junction equation below:

Junction Equation: $T_1 < T_2 < T_3$

$$Q_{T1} = Q_1 + \frac{T_1}{T_2} Q_2 + \frac{T_1}{T_3} Q_3$$

$$Q_{T2} = Q_2 + \frac{I_2}{I_1} Q_1 + \frac{T_2}{T_3} Q_3$$

$$Q_{T3} = Q_3 + \frac{I_3}{I_1} Q_1 + \frac{I_3}{I_2} Q_2$$

Calculate Q_{T1}, Q_{T2}, and Q_{T3}. Select the largest Q and use the T_c associated with that Q for further calculations (see the three Notes for options). If the largest calculated Q's are equal (e.g., $Q_{T1} = Q_{T2} > Q_{T3}$), use the shorter of the T_c's associated with that Q.

This equation may be expanded for a junction of more than three independent drainage systems using the same concept. The concept is that when Q from a selected subarea (e.g., Q_2) is combined with Q from another subarea with a shorter T_c (e.g., Q_1), the Q from the subarea with the shorter T_c is reduced by the ratio of the I's (I_2/I_1); and when Q from a selected subarea (e.g., Q_2) is combined with Q from another subarea with a longer T_c (e.g., Q_3), the Q from the subarea with the longer T_c is reduced by the ratio of the T_c's (T_2/T_3).

Note #1: At a junction of two independent drainage systems that have the same T_c, the tributary flows may be added to obtain the Q_p.

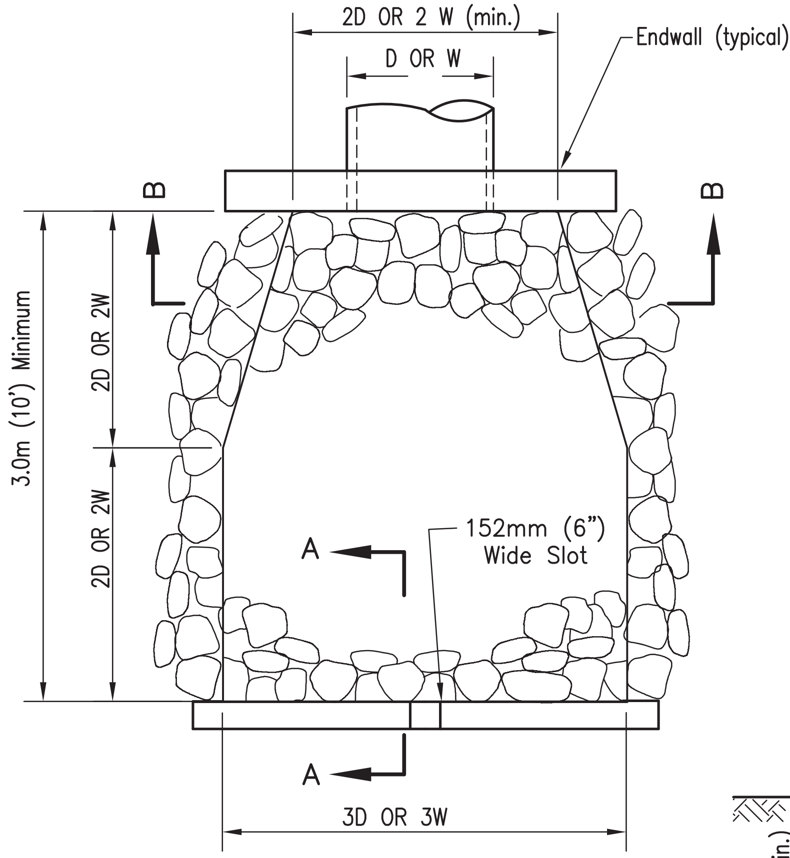
$$Q_p = Q_1 + Q_2\text{; when } T_1 = T_2\text{; and } T_c = T_1 = T_2$$

This can be verified by using the junction equation above. Let Q_3, T_3, and $I_3 = 0$. When T_1 and T_2 are the same, I_1 and I_2 are also the same, and T_1/T_2 and $I_2/I_1 = 1$. T_1/T_2 and I_2/I_1 are cancelled from the equations. At this point, $Q_{T1} = Q_{T2} = Q_1 + Q_2$.

Note #2: In the upstream part of a watershed, a conservative computation is acceptable. When the times of concentration (T_c's) are relatively close in magnitude (within 10%), use the shorter T_c for the intensity and the equation $Q = \Sigma(CA)I$.

Note #3: . An optional method of determining the T_c is to use the equation
$T_c = [(\Sigma\ (CA)7.44\ P_6)/Q]^{1.55}$

This equation is from $Q = \Sigma(CA)I = \Sigma(CA)(7.44\ P_6/T_c^{.645})$ and solving for T_c. The advantage in this option is that the T_c is consistent with the peak flow Q, and avoids inappropriate fluctuation in downstream flows in some cases.



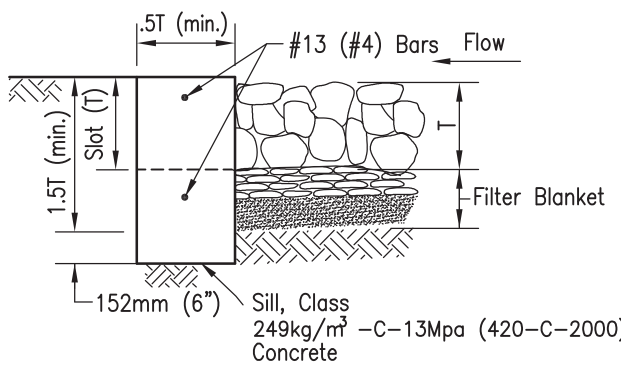
PLAN

Design Velocity m/sec (ft/sec)*	Rock Classification	T (min)
1.8–3 (6–10)	No. 2 Backing	320mm (1.1ft)
3–3.7 (10–12)	220 kg (1/4 ton)	823mm (2.7ft)
3.7–4.3 (12–14)	450 kg (1/2 ton)	1.1m (3.5ft)
4.3–4.9 (14–16)	900 kg (1 ton)	1.3m (4.4ft)
4.9–5.5 (16–18)	1.8 tonne (2 ton)	1.6m (5.4ft)

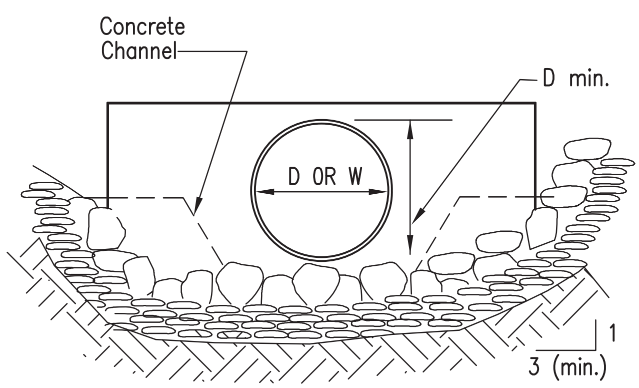
*over 5.5 mps (18 fps) requires special design

D = Pipe Diameter

W = Bottom Width of Channel



SECTION A–A



SECTION B–B

NOTES

1. Plans shall specify:
   A) Rock Class and thickness (T).
   B) Filter material, number of layers and thickness.
2. Rip rap shall be either quarry stone or broken concrete (if shown on the plans.) Cobbles are not acceptable.
3. Rip rap shall be placed over filter blanket which may be either granular material or filter fabric (woven filter slit film fabric shall not be used).
4. See Regional Supplement Amendments for selection of filter blanket.
5. Rip rap energy dissipators shall be designated as either Type 1 or Type 2. Type 1 shall be with concrete sill; Type 2 shall be without sill.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03
Add Rip Rap Table		S. Brady	04/06

SAN DIEGO REGIONAL STANDARD DRAWING

RIP RAP ENERGY DISSIPATOR

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

04/27/2006

Chairperson R.C.E. 19246 Date

DRAWING NUMBER **D-40**