DRAINAGE STUDY
FOR
SDSU MISSION VALLEY CAMPUS
(ONSITE IMPROVEMENTS)

(PRELIMINARY ENGINEERING/DESIGN DEVELOPMENT)

Job Number 18150

February 12, 2019

RICK™
ENGINEERING COMPANY

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1.0 INTRODUCTION

This drainage study presents hydrologic and hydraulic analyses for the proposed onsite improvements associated with the San Diego State University (SDSU) Mission Valley Campus Project (herein referred to as the "project"). The purpose of this report is to provide hydrologic and hydraulic support for the proposed onsite storm drain systems and to verify the proposed improvements have no significant impacts as compared to existing conditions. Off-site areas draining to the on-site storm drain systems are considered where information is available but not analyzed.

1.1 Project Location

The project is located at 9449 Friars Road within the City of San Diego, California. A vicinity map and exhibit showing the conceptual project layout and street connections is provided in Appendix A.

1.2 Project Description

The project site currently consists of a large multi-purpose former NFL stadium (San Diego Coastal Credit Union Stadium, formerly known as Qualcomm Stadium) and associated parking lot that covers most of the approximately 170 acre site. The project is bounded by the Fenton Marketplace to the West of the site and Friars road to the North of the site. An industrial fuel facility is located across of San Diego Mission Road on the northwestern corner of the site. An earthen berm adjacent to Murphy Canyon Channel bounds the eastern limits of the site. The site also features a light rail/trolley station and a reach of the San Diego River along the southern boundary of the site.

The proposed project consists of demolition of the existing stadium, regrading of the site, and construction of a large mixed-use development consisting of a smaller football stadium, SDSU campus buildings, hotels and residential properties. A major characteristic of the project will be the creation of a "River Park" along the San Diego River and Murphy Canyon Creek which will be a major focal point of the project that will serve as a floodplain buffer between both the San Diego River and Murphy Canyon Creek with the rest of the developed portions of the project area, while

also serving as an amenity for the surrounding community. The onsite improvements of the project are scheduled to be constructed through a series of phases as shown in Appendix A.

In addition to the onsite improvements, the adjacent improvements proposed by this project include connections from the onsite roads to the existing off-site roads, and the roadway improvements associated with the connections including widening and restriping. The adjacent improvements proposed by the project, from west to east, include River Park Road, Friars Road, Mission Village Road, San Diego Mission Road, and Murphy Creek Road. These adjacent improvements will generally utilize separate storm drain systems and water quality measures than those proposed by the onsite design. For a detailed discussion of the adjacent improvements and the associated drainage and water quality design, refer to the adjacent improvements reports titled, "Drainage Study for SDSU Mission Valley Campus Adjacent Improvements" (herein Adjacent Improvements Drainage Study) and "Green Streets Elements for SDSU Mission Valley Campus Adjacent Improvements," (herein Adjacent Improvements Green Street Letter) dated February 12, 2019 and prepared by Rick Engineering Company (Job Number - 18150).

There are currently eight major outfalls from the project, six that discharge south into the San Diego River and two that discharge east into the Murphy Canyon Channel. A summary of the major outfalls from the site is provided below in Table 1. To minimize environmental disturbances, the project is designed so as to maintain the existing outfall structures in the post-project condition. The onsite improvements along with the adjacent improvements associated with River Park Road, portions of Mission Village Drive, and portions of Murphy Creek Road will comingle and discharge south to the San Diego River through Outfalls 100-400. The adjacent improvements associated with Friars Road, San Diego Mission Road, and portions of Murphy Creek Road will be conveyed by separate, existing storm drain systems to the two Murphy Canyon Channel outfalls. The project proposes no improvements to the tributary areas of Outfalls 500 and 600 that also discharge south to the San Diego River.

Table 1: Summary of Project Outfalls

Outfall ID	Waterbody that Receives Outfall	Onsite[1] Basin ID/Node Number	Adjacent and Off-site[2] Basin ID/Node Number
1	San Diego River	100	N/A
2	San Diego River	200	N/A
3	San Diego River	300	N/A
4	San Diego River	400	N/A
5	San Diego River	500	4000
6	San Diego River	600	N/A
7	Murphy Canyon Channel	N/A	6000
8	Murphy Canyon Channel	N/A	7000

Note 1 – Analysis included in this report
Note 2 – Analysis included in the adjacent improvements drainage study

For additional information and analysis of the adjacent segments of the Murphy Canyon Channel and the San Diego River, please refer to the report titled "Preliminary Floodplain Analysis for SDSU Missions Valley Campus," dated December 21, 2018 and prepared by Chang Consultants.

1.3 Water Quality

SDSU is considered a Phase 2 entity with regards to MS4 Permit requirements. Hence, the project is not subject to the requirements of the San Diego Regional MS4 Permit (order R9-2013-0001); however, the project will still implement permanent storm water BMPs consistent with the requirements of the 2013 Regional MS4 Permit (R9-2013-0001) and the 2018 City of San Diego Storm Water Standards (SWS) manual dated, October 2018 where feasible to the maximum extent practicable. This includes LID site design BMPs, source control BMPs, as well as pollutant control BMPs for water quality treatment. Hydromodification Management will not be required for the project since it discharges directly to the San Diego River, which has been identified as exempt receiving water along the lower portion of the River.

The storm water design and analysis is discussed in detail in the report titled, "Water Quality Report for SDSU Mission Valley Campus Onsite Improvements," dated January 31, 2019, or subsequent versions thereof, prepared by Rick Engineering Company (Job Number - 18150).

1.4 FEMA Flood Zone Information

Portions of the project site are located within the 100-year floodplain for both the San Diego River and Murphy Canyon Creek. Therefore, the project will be subject to floodplain requirements in accordance with the FEMA National Flood Insurance Program (NFIP). As part of the redevelopment of the site, development areas will be setback from the natural channels allowing for active and passive park areas to be incorporated along the easterly and southerly edge of the development. This will provide a more natural floodplain during larger events, and will reduce or eliminate the commingling of flood waters with developed areas and associated pollutants. As part of the continued planning and design of the project, hydraulic analysis for the existing and proposed conditions should be prepared (using HEC-RAS or similar) to support onsite design and to compare water surface elevations along San Diego River and Murphy Canyon to ensure compliance with FEMA NFIP requirements. The project will need to prepare, process, and obtain approval for a Conditional Letter of Map Revision (CLOMR), as applicable per FEMA NFIP requirements, prior to issuance of a grading permit.

2.0 HYDROLOGY

Hydrologic conditions for the project area have been analyzed for pre-project and post-project/ultimate conditions.

2.1 Methodology

The 100-year, 6-hour pre-project and post-project condition flow rates have been computed using the Modified Rational Method. The hydrologic methodology utilized for the project has been taken from the City of San Diego, Drainage Design Manual (DDM), dated January 2017. The Rational Method computer program developed by Advanced Engineering Software (AES 2003) was used for this study because it satisfies the City of San Diego's design criteria.

2.2 AES Rational Method Computer Model

The AES hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The AES program has the capability to perform calculations for 15 hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significance are as follows:

Subarea Hydrologic Processes (Codes)

Code 1:	Confluence analysis at node
Code 2:	Initial subarea analysis
Code 3:	Pipe flow travel time (computer-estimate pipe sizes)
Code 4:	Pipe flow travel time (user-specified pipe size)
Code 5:	Trapezoidal channel travel time
Code 6:	Street flow analysis through a subarea
Code 7:	User-specified information at a node
Code 8:	Addition of the subarea runoff to mainline
Code 9:	V-Gutter flow through subarea
Code 10:	Copy mainstream data onto memory bank
Code 11:	Confluence a memory bank with the mainstream memory
Code 12:	Clear a memory bank

Code 13:	Clear the mainstream memory
Code 14:	Copy a memory bank onto the mainstream memory
Code 15:	Hydrologic data bank storage functions

In order to perform the hydrologic analysis; base information for the study area is required. This information includes the existing drainage facility locations and sizes, existing land uses, flow patterns, drainage basin boundaries, and topographic elevations. Drainage basin boundaries, flow patterns, and topographic elevations are shown on the drainage exhibits located in the map pockets.

2.3 Design Criteria

The hydrologic conditions were analyzed in accordance with the City of San Diego's design criteria as follows:

Design Storm:	100-year, 6-hour
Runoff Coefficients:	
Asphalt/Concrete	C = 0.95
Commercial	C = 0.85
Single Family Residential	C = 0.55
Undisturbed, Natural Terrain	C = 0.45
Soil Type:	D
Rainfall Intensity:	Based on time-intensity criteria per City of San Diego

Weighted runoff coefficients were calculated per Section A.1.2 - Runoff Coefficient of the City of San Diego, DDM dated, January 2017. A runoff coefficient of 0.85 and 0.90 was used for the future pads and streets respectively. This assumes that the developed pads and streets will be approximately 80% and 90% impervious.

2.4 Hydrologic Results

For the purpose of this report, the hydrology to each outfall location was determined for both the pre-project and post-project/ultimate condition. The results from the modified rational method, AES computer program outputs are provided in Appendix B and Appendix C of this report for the pre-project and post-project conditions, respectively. The weighted runoff coefficient backup has been included in Appendix D. Please refer to Map pocket 1 and Map Pocket 2 for the drainage area boundaries, nodes, and areas used in the Modified Rational Method analysis under pre-project and post-project conditions.

A summary of the hydrologic results is provided below in Table 2, followed by a description for the pre-project and post-project conditions.

Table 2: Summary of Hydrologic Results

	Pre-Project			Post-Project		
Basin ID	**Peak Flow, Q100 (cfs)**	**Area, A (ac)**	**Time of Concentration, Tc (min)**	**Peak Flow, Q100 (cfs)**	**Area, A (ac)**	**Time of Concentration, Tc (min)**
Basin 100	**230.3**	93.3	22.4	**194.9**	88.8	22.0
Basin 200	**35.1**	11.2	9.8	**100.6**	43.6	18.1
Basin 300	**158.1**	63.7	25.4	**46.0**	34.2	24.3
Basin 400	**9.9**	5.8	12.7	**4.8**	4.0	18.6

Pre-Project Condition

In the existing condition, the project area can be delineated into four (4) major drainage basins (Basin 100, 200, 300 and 400) and is approximately 90% impervious. Basin 100 is the largest basin contributing most of the runoff. It encompasses the western half of the existing parking lot of the SDCCU stadium. The runoff flows south along a concrete swale in the middle of the basin. The swale consists of a series of catch basins along its flowline to intercept the runoff. The runoff then

enters the existing storm drain beneath the swale and finally discharges to the San Diego River through a 36-inch storm drain outfall at Node 100.

Basin 200 is the second smallest basin and encompasses the SDCCU stadium bowl itself. The runoff from the bowl and the field is collected through an extensive storm drain network and conveyed south to the San Diego River through a 36-inch storm drain outfall at Node 200.

Basin 300 is the second largest basin and encompasses the eastern half of the existing parking lot of the SDCCU stadium. Similar to Basin 100, the runoff flows south along a concrete swale in the middle of the basin. The swale consists of a series of catch basins along its flowline to intercept the runoff. The runoff then enters the existing storm drain beneath the swale and finally discharges to the San Diego River through a 36-inch storm drain outfall at Node 300.

Basin 400 is the smallest basin and encompasses the existing Little Q Rugby Field of the Old Mission Beach Athletic Club. The runoff sheet flows south across the rugby field and flows into the San Diego River at Node 400.

In addition to those three major outfalls, there are two (2) additional existing storm drain outfalls into the San Diego River along the western edge of the project. There is an existing 96-inch storm drain pipe (at Node 500) that outfalls into the River south of the existing trolley tracks, at the terminus of Fenton Parkway. An additional 48-inch storm drain pipe (at Node 600) outfalls north of the existing trolley tracks and north of the proposed Fenton Parkway extension. The offsite drainage basins to these additional outfalls have not been analyzed at this time. The as-builts and drainage analysis for these locations are not available and it is currently not within the scope of this study to analyze these offsite areas.

Post-Project/Ultimate Condition

In the post-project condition, the drainage patterns are similar to the pre-project. The project area can be delineated into four (4) major drainage basins (Basin 100, 200, 300 and 400). Basin 100 is the largest basin contributing most of the runoff. It encompasses the western half of the project site west of the proposed Aztec Way and includes the proposed SDSU stadium, SDSU campus building,

hotels along the Friars Road west of Mission Village Drive and the western portions of the River Park. The runoff is collected via a network of inlets and catch basins that connect to three separate backbone storm drain systems that run parallel north to south along the proposed Stadium Way (System 100A), Stadium Promenade (System 100B) and Aztec Way (System 100C). System 100B and 100C confluence at Node 170 and the confluence flow from 100B and 100C confluences further downstream with System 100C at Node 180. The project proposes a bubbler structure at Node 180 to provide pressure relief during storms in excess of the storm drain capacity. The existing 36-inch storm drain downstream of Node 180 to the existing outfall at Node 100 will be protected in place.

Basin 200 encompasses the proposed residential properties of the project site east of Aztec Way and west of Street C. The runoff is collected via a network of inlets and catch basins that connect to two separate backbone storm drain systems that run parallel north to south along the proposed Street A (System 200A) and Street B (System 200B). System 200A and 200B confluence at Node 270 and the project proposes a bubbler structure further downstream at Node 285 similar to Basin 100 for pressure relief during storms in excess of the storm drain capacity. The existing 36-inch storm drain downstream of Node 285 to the existing outfall at Node 200 will be protected in place.

Basin 300 consists of the eastern portions of the project site and includes the proposed residential properties east of the proposed Street C, Dog Park, and eastern portions of the River Park west of the proposed Murphy Creek Road. The runoff is collected via a network of inlets and catch basins that connect to two separate backbone storm drain systems that run parallel north to south along the proposed Street C (System 300A) and BMP 5 (System 300B). System 300A and 300B confluence at Node 385 and the project proposes a bubbler structure further downstream at Node 394.5 similar to Basin 100 and Basin 200. The existing 36-inch storm drain downstream of Node 394.5 to the existing outfall at Node 300 will be protected in place.

Basin 400 is the smallest basin and encompasses portions of the river park west of the proposed Stadium Way, south of the proposed River Park Road and east of the existing Fenton Parkway Station. The runoff flows south across the park and flows into the San Diego River at Node 400.

Currently, the outfall at Node 200 has a significantly lower tributary area of 11.2 acres as compared to those of the outfall at Node 100 and 300. Hence, the project proposes to balance the tributary areas to each of the three major existing storm drain outfalls as shown in the table above. These three (3) existing storm drain outfalls are constructed within and through the existing 96-inch trunk sewer line; this makes the replacement of the existing storm drain outfalls infeasible. Furthermore, connecting the proposed storm drain into the existing storm drain outfalls will help avoid impacts to existing habitat and jurisdictional areas along the edge of the San Diego River, thus eliminating the need for environmental permits that would otherwise be necessary to replace storm drain and outfalls within the River.

The project also proposes to extend the existing 96-inch storm drain discussed previously, downstream an approximate 100 feet to accommodate the extension of Fenton Parkway onto the project site. The existing 48-inch storm drain will remain in place and will not receive any runoff from the project.

The overall acreage and peak flow rate discharging to each outfall has been compared to pre-project and post-project conditions. In the pre-project condition, Basin 100 receives a significant portion of the site, whereas Basin 200 has excess capacity. In order to improve conditions for the westerly and easterly outfalls, the areas have been adjusted to increase the discharge to Basin 200. Despite the increase to the central outfall, the hydraulic grade line (HGL) will remain below ground for the portions of the development not contained in the River Park for storms up to and including the design storm event (100-year).

The drainage design for the project also includes routing onsite runoff via the proposed storm drains designed to convey the peak flow rates towards the proposed River Park, where low flow structures will divert runoff for the small and more frequently occurring storms through permanent storm water BMPs for water quality purposes, then discharging runoff through each of the three (3) existing storm drain outfalls. It is important to note that, the total post-project peak flow is significantly lower than the total pre-project peak flow resulting in a net decrease in peak flow rates and volume of runoff, which can be attributed to the reduction of impervious area via the planned River Park and biofiltration BMPs.

3.0 HYDRAULICS

3.1 Hydraulic Methodology and Criteria

The hydraulic methodology and criteria for the project will utilize the City of San Diego DDM, dated January 2017. In accordance with the City of San Diego DDM, the 100-year, 6-hour storm will be the typical design storm used for hydraulic design of the project. The hydraulics must also consider the tail water effects from the San Diego River; specifically including the starting Hydraulic Grade Line (HGL) that should be used in the storm drains analyses. The following summarizes the criteria for Tailwater Elevation at San Diego River, followed by the hydraulic design and results for open channels, dry lanes, inlets, storm drains, and bubbler structure at each outlet.

3.2 Tailwater Elevation at San Diego River

The proposed storm drainage outfalls onsite outlets to a river (San Diego River) and this makes it necessary to consider the joint or coincidental probability of two hydrologic events occurring at the same time to adequately determine the tailwater elevation at the San Diego River. The project has adopted the guidance criteria for the same outlined in Chapter 7, Section 7.1.5 of the Federal Highway Administration's, Hydraulic Engineering Circular No. 22 (HEC-22), Third Edition, Urban Drainage Design Manual (UDDM) last revised, August 2013. The table below from the HEC-22 UDDM provides a comparison of discharge frequencies for coincidental occurrence for a 10- and 100-year design storm.

Table 3: Frequencies of Coincidental Occurrence

Area Ratio	10-Year Design		100-Year Design	
	Main Stream	Tributary	Main Stream	Tributary
10,000 to 1	1 10	10 1	2 100	100 2
1,000 to 1	2 10	10 2	10 100	100 10
100 to 1	5 10	10 5	25 100	100 25
10 to 1	10 10	10 10	50 100	100 50
1 to 1	10 10	10 10	100 100	100 100

This table can be used to establish an appropriate design tailwater elevation for a storm drainage system based on the expected coincident storm frequency on the outfall channel. In this case, the ratio of the San Diego River drainage area to the proposed storm drainage facilities tributary area is approximately 1000 to 1. Now from Table 3, considering a 100-year design storm occurring over both areas, the flow rate in the San Diego River will be equal to that of a 10-year storm when the proposed drainage system flow rate reaches its 100-year peak flow at the outfall and vice-versa. Hence, the 10-year Water Surface Elevation (WSEL) of the San Diego River has been assumed as the starting tailwater elevation for the proposed storm drainage outfalls.

3.3 Open Channel Design

Open channel analyses have not been conducted at this time, and are anticipated to be conducted for final engineering of the project.

3.4 Dry Lane Design

Dry lane analyses have not been conducted at this time, and are anticipated to be conducted for final engineering of the project.

3.5 Inlet Design

Inlet design calculations were completed using a spreadsheet based on the following equations from Chapter 3 of the City of San Diego Drainage Design Manual (January 2017) for grated inlets in a sump:

Type B Inlets on a Grade

$$Q = 0.7\ L_T\ (a + y)^{3/2}$$

Where:

y = depth of flow approaching the curb inlet, in feet (ft)

a = depth of depression of curb at inlet, in feet (ft)

L_T = length of clear opening of inlet for total interception, in feet (ft)

Q = interception capacity of the curb inlet, in cubic feet per second (cfs)

Type B Inlets in a Sump

For shallow depth weir conditions,

$$Q = C_w L_w d^{3/2}$$

Where: Q = inlet capacity, in cubic feet per second (cfs)

C_w = weir discharge coefficient (3.0)

L_w = weir length, in feet (ft)

d = flow depth, in feet (ft)

For higher flow depth curb inlets,

$$Q = 0.67hL(2gd_0)^{1/2}$$

Where: Q = inlet capacity, in cubic feet per second (cfs)

h = curb opening height, in feet (ft)

L = curb opening length, in feet (ft)

g = gravitational acceleration (32.2 ft/s^2)

d_0 = effective depth of flow at curb face, in feet (ft)

Effective depth of flow at curb face,

$$d_0 = (y+a) - (h/2)\sin\Theta$$

Where: y = depth of flow in adjacent gutter, in feet (ft)

a = curb inlet depression, in feet (ft)

$(h/2)\sin\Theta$ = adjustment for curb inlet throat width (h) and angle of throat incline (θ)

Grate Inlet Capacity Operating as Orifice

$$Q = C_0 A_e (2gd)^{1/2}$$

$$A_e = (1-C_A) A$$

Where: Q = inlet capacity of the grated inlet, in cubic feet per second (cfs)

C_0 = orifice coefficient (0.6)

g = gravitational acceleration (32.2 ft/s^2)

d = flow depth above inlet, in feet (ft)

A_e = effective grate area, in square feet (ft^2)

C_A = area clogging factor (0.50)

A = actual opening area of the grate inlet, in square feet (ft^2; i.e., the total area less the area of bars or vanes)

Grate Inlet Capacity Operating as Weir

$$Q = C_w P_e d^{3/2}$$

$$P_e = (1-C_L)\ P$$

Where:

Q = inlet capacity of the grated inlet, in cubic feet per second (cfs)

C_w = weir coefficient (3.0)

P_e = effective grate perimeter length, in feet (ft)

d = flow depth approaching inlet, in feet (ft)

P_e = effective grate perimeter length, in feet (ft)

C_L = clogging factor (0.50)

P = actual grate perimeter, in feet (ft; i.e., the perimeter less the total width of bars or vanes)

The capacity of the inlets as a weir and orifice was calculated and the conservative of the two results were used to size the inlet.

Inlet Results

Final inlet analysis, sizing, and locations will need to be completed during the final engineering phase of the project by the engineer of record. However, preliminary inlet locations have been identified at all sumps and on-grade inlets have been specified based on the approximate peak flow per acreage for each major basin. Grate inlets have also been specified for the interim parking areas west, north, and south of the proposed stadium, during the interim DG condition.

3.6 Storm Drain Design

The proposed peak flow rates determined using the Modified Rational Method were used to determine the HGLs for the proposed backbone storm drain systems that will also serve the project in the ultimate condition. The ultimate conditions were analyzed to ensure the HGLs are below the finished grade in the streets and pads for the 100-year, 6-hour storm event. In order to determine the required size of each outfall, the AES Pipe Flow program was used to analyze the proposed storm drain systems in Basins 100, 200, 300 and 400.

Pipe Flow Design

The AES Pipe Flow Hydraulics computer program was used to calculate the hydraulic and energy grade lines for the proposed storm drain systems. The program performs gradually varied flow and pressure flow profile computations. The results are provided in an incremental and summarized form, and indicate reaches of open channel and pressure flow within a given reach of pipe. The program also accounts for losses that may occur due to friction, junction structures, pipe bends, etc. The codes and an explanation of their function are as follows:

Pipe Flow Hydraulic Processes (Codes)

Code 1:	Friction Losses
Code 2:	Manhole Losses
Code 3:	Pipe-bend Losses
Code 4:	Sudden Pipe-enlargement
Code 5:	Junction Losses
Code 6:	Angle-point Losses
Code 7:	Sudden Pipe-reduction
Code 8:	Catch Basin Entrance Losses
Code 9:	Transition Losses

The public storm drain system will be constructed of Reinforced Concrete (RCP). The Manning's roughness coefficient “n” used for the hydraulic calculations for RCP is 0.013.

Pipe Flow Results

The AES Pipe Flow computer program outputs for ultimate condition are provided in Appendix E of this report. Node numbering used in the AES Pipe Flow computer analyses corresponds to the rational method node numbering used on the post-project drainage study map, located in map pocket 2. The AES pipe flow analyses were used to determine the storm drain sizes required to convey the 100-year, 6-hour peak flow rates.

The starting tailwater elevations are based on the 10-year WSEL of San Diego River as discussed above. Due to site constraints, utility conflicts, and fixed tie-in points; the proposed onsite storm drain systems have been designed to have an average slope of 0.5%. Although the average slope is relatively flat, the storm drain system will have velocities in excess of 2 feet per second, at a minimum. The proposed storm drain pipes should be constructed with water tight joints as they are designed for pressure flow. The hydraulic grade line (HGL) will remain below ground for the portions of the development not contained in the River Park for storms up to and including the design storm event (100-year). However, the HGL for the storm drain facilities in the proposed river park, along river park road and southern portions of the Stadium Way adjacent to the proposed river park will be above the finished grade, as was expected due to the flat slopes, fixed in tie-in points, tailwater conditions and their close proximity to the 100-year floodplain.

The proposed storm drain systems will connect into the three (3) existing 36” outfalls via modified structures (bubblers) designed to provide pressure relief during storms in excess of the storm drain capacity. The three (3) proposed bubblers will need additional detailed analysis and design during final engineering. Based on the preliminary analysis and the large flow to the bubbler at Basin 100, it is anticipated to activate/bubble out more frequently as compared to the bubbler in Basin 200 and 300. The table gives a brief summary of the HGLs at the bubblers HGLs and the corresponding peak flows.

Table 4: Summary of Outfall/Bubbler HGL and Peak Flow

SDSU MV Campus - HGL and Frequency Exceedances			
	Basin 100 Bubbler @ Node 180	***Basin 200 Bubbler @ Node 285***	***Basin 300 Bubbler @ Node 394.5***
FG/RIM	51.0	56.0	51.8
Onsite 100-Yr HGL[1]	52	51.6	50.2
SD River 100-Yr WSEL[2]	53	56	58
Onsite Return Interval [3]	~3.0-Yr	>100-Yr	>100-Yr
SD River Return Interval [4]	~50-Yr	100-Yr	~25-Yr

Notes:

1. This HGL reflects detailed pipe hydraulics with a starting tailwater corresponding to the HGL in the bubbler from a 10-year event in the SD River, as discussed in Section 3.2 above.
2. Approx. 100-yr WSEL from SD River per effective FEMA flood profiles (NAVD 88).
3. The onsite return interval has been approximated using log-log probability.
4. Approx. return intervals for SD River per effective FEMA flood profiles.

Due to site constraints, utility conflicts, fixed tie-in points, and the tailwater condition from San Diego River, the capacity of the proposed onsite storm drain system within Basin 100 will be exceeded following storms in excess of the approximately 3-year storm event. However, a small drainage channel/swale has been proposed to direct flows in excess of storm drain capacity towards the western opening in the berm and into the San Diego River, so the overflow will not impact active park areas. The channel has been sized to convey overflow from the Basin 100 storm drain for up to the 25-year storm event.

The three (3) existing storm drain outfalls are constructed within and through the existing 96-inch trunk sewer line; this makes the replacement of the existing storm drain outfalls infeasible. Furthermore, connecting the proposed storm drains into the existing storm drain outfalls will help avoid impacts to existing habitat and jurisdictional areas along the edge of the San Diego River, thus eliminating the need for environmental permits that would otherwise be necessary to replace storm drain and outfalls within the River.

4.0 TEMPORARY SEDIMENT TRAP AND SEDIMENT BASIN ANALYSES

4.1 Temporary Sediment Traps

Methodology and Criteria

Temporary sediment traps will be constructed for areas less than 5 acres each that will remain in a mass graded condition for a temporary period of time. The sediment traps will be constructed to help meet the requirements outlined in the State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities - Order No. 2009-0009-DWQ, NPDES No. CAS000002 (General Construction Permit). The methodology and criteria used for the design of each sediment trap is based on Fact Sheet SE-3, Sediment Trap, from the California Stormwater BMP Handbook – Construction, dated January 2011.

The following equation from the BMP Handbook was used to determine the minimum capacity (volume) required for the sediment traps from the bottom of the trap to the principal outlet:

$$V = (2{,}700\ ft^3/acre)*A$$

Where: A = drainage area, in acres (ac) (5 acres maximum)

V = volume, in cubic feet (ft^3)

The 2,700 ft^3/acre is derived from 67 cubic yards/acre and 33 cubic yards/acre for settling zone and sediment storage zone, respectively. According to the BMP Handbook, this is based on approximately 0.5 inches of runoff volume over a 24-hour period. The BMP Handbook does not specify a length to width ratio for Sediment Traps; however, a ratio of 2:1 is desirable to encourage settling and longer residence time. If the trap is constructed with an embankment acting as an impounding levee, the height shall not be greater than 4.5-feet nor the impounding volume more than 35,000 cubic feet, unless designed by a Registered Civil Engineer. Side slopes of 3:1 or flatter should be used. Based on these requirements, an initial size is estimated for the bottom of each trap assuming the depth from the principal outlet will be 4 feet, the side slopes will be 3:1 (horizontal: vertical), and the length will be twice the width. The calculated dimensions are then increased to ensure a length greater than twice the width.

The principal outlet for the trap is then selected to convey 100% of the 100-year 6-hour peak runoff from the drainage area in a mass graded condition assuming that the trap is full and no incidental detention is provided. The 100-year 6-hour peak runoff from the drainage area in a mass graded condition is determined using the rational method pursuant to the methodology described in the Hydrologic Methodology section (Section 2.1) of this report. The rational method runoff coefficient (C), used for a mass graded condition is 0.65.

The temporary sediment traps will utilize 30-inch (minimum) corrugated metal pipe (CMP) and/or HDPE risers for the principal outlet. Since the type of outflow through a riser (weir flow or orifice flow) and the weir coefficient for weir flow vary depending on the amount of head (water depth) over the riser crest elevation, a spreadsheet was utilized to calculate weir flow and orifice flow at incremental depths above the riser crest. Weir coefficients were obtained from Figure 9-57, Relationship of Circular Crest Coefficient Co to Ho/Rs for different Approach Depths (aerated nappe) [where Ho is head and Rs is the radius of the riser], from Design of Small Dams (United States Department of the Interior Bureau of Reclamation, 1987).

The total depth of the trap is determined by adding the riser height, the head above the riser crest elevation required to convey 100% of the 100-year 6-hour peak runoff from the drainage area in a mass graded condition, and a minimum of one foot of freeboard.

Temporary Sediment Traps Results

Temporary sediment traps have not been designed at this time, and are anticipated to be conducted for final engineering of the project.

4.2 Temporary Sediment Basins

Methodology and Criteria

Temporary sediment basins will be constructed for drainage areas greater than 5 acres, but less than 75 acres to provide sediment control during construction. The basins will be constructed based on the requirements outlined in the State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002 Waste Discharge Requirements (WDRs) for Storm Water Runoff Associated with

Construction Activity (General Construction Permit), Section A: Storm Water Pollution Prevention Plan, Item 8, Sediment Control, Option 2. The following equation from the General Construction Permit was used to determine the capacity (volume) required for the basins from the bottom of the basin to the principal outlet:

$$V = C*P_6*A$$

Where: V = volume, in cubic feet (ft^3)

C = average runoff coefficient

P_6 = 10-year 6-hour precipitation, in inches (in)

A = drainage area, in acres (ac)

In addition to the criteria for capacity, the General Construction Permit specifies that the length of the basin shall be greater than twice the width of the basin.

The principal outlet for the basin should be then selected to convey 100% of the 100-year 6-hour peak runoff from the drainage area in a mass graded condition assuming that the basin is full and no incidental detention is provided. The 100-year 6-hour peak runoff from the drainage area in a mass graded condition is determined using a runoff coefficient of 0.70.

The temporary sediment basins will utilize 30-inch (minimum) corrugated metal pipe (CMP) risers for the principal outlet. Since the type of outflow through a riser (weir flow or orifice flow) and the weir coefficient for weir flow vary depending on the amount of head (water depth) over the riser crest elevation, a spreadsheet was utilized to calculate weir flow and orifice flow at incremental depths above the riser crest. Weir coefficients were obtained from Figure 9-57, Relationship of Circular Crest Coefficient C_o to H_o/R_s for different Approach Depths (aerated nappe) [where H_o is head and R_s is the radius of the riser], from Design of Small Dams (United States Department of the Interior Bureau of Reclamation, 1987).

The total depth of the basin should be equal to the addition of the riser height, the head above the riser crest elevation required to convey 100% of the 100-year 6-hour peak runoff from the drainage area in a mass graded condition, and one foot of freeboard.

Temporary Sediment Basins Results

Temporary sediment basins have not been designed at this time, and are anticipated to be conducted for final engineering of the project.

5.0 CONCLUSION

This drainage study presents the onsite hydrologic and hydraulic analyses for SDSU Mission Valley Campus project. The 100-year pre-project and post-project/ultimate condition peak discharge rates were determined using the Modified Rational Method based on the hydrologic methodology and criteria described in the City of San Diego, Drainage Design Manual, dated January 2017. The total post-project flow is significantly lower than the total pre-project flow resulting in a net decrease in peak flow rates and volume of runoff, which can be attributed to the reduction of impervious area via the planned River Park and biofiltration BMPs.

The tail water effects of the San Diego River have been considered in sizing of the proposed storm drain systems. The 100-year, 6-hour post-project peak flow rates were determined to calculate the HGLs for the proposed storm drain systems. The storm drain system is designed to convey flow while maintaining HGLs below the finished grade throughout the proposed streets and pads. However, the HGL for the storm drain facilities in the proposed river park, along river park road and southern portions of the Stadium Way adjacent to the proposed river park will be above the finished grade, due to the flat slopes, fixed in tie-in points, tailwater conditions and their close proximity to the 100-year floodplain. Additional methodology and criteria has been outlined for open channels, inlet sizing, dry lane requirements, temporary sediment traps and sediment basins.

The results of the hydrologic and hydraulic analyses are included as appendices to this report and reflect the SDSU Mission Valley Campus project. The drainage study maps corresponding with the hydrologic and hydraulic results are also included in Map Pockets 1 and 2 within this report. Overall, the project impacts to the existing storm drain systems are anticipated to be minimal.

This report and the accompanying *Preliminary Water Quality Report for SDSU Mission Valley Campus*, both prepared by Rick Engineering Company, are intended to be preliminary in nature and are not intended to be used for the final engineering design of the onsite drainage and water quality facilities. During the final engineering phase of the project, the engineer of record will need to prepare final drainage and water quality reports to reflect the final site layout and construction documents.

APPENDIX A

Vicinity Map and Conceptual Project Layout

SDSU Mission Valley Campus
Site Plan Date: 12/18/2018

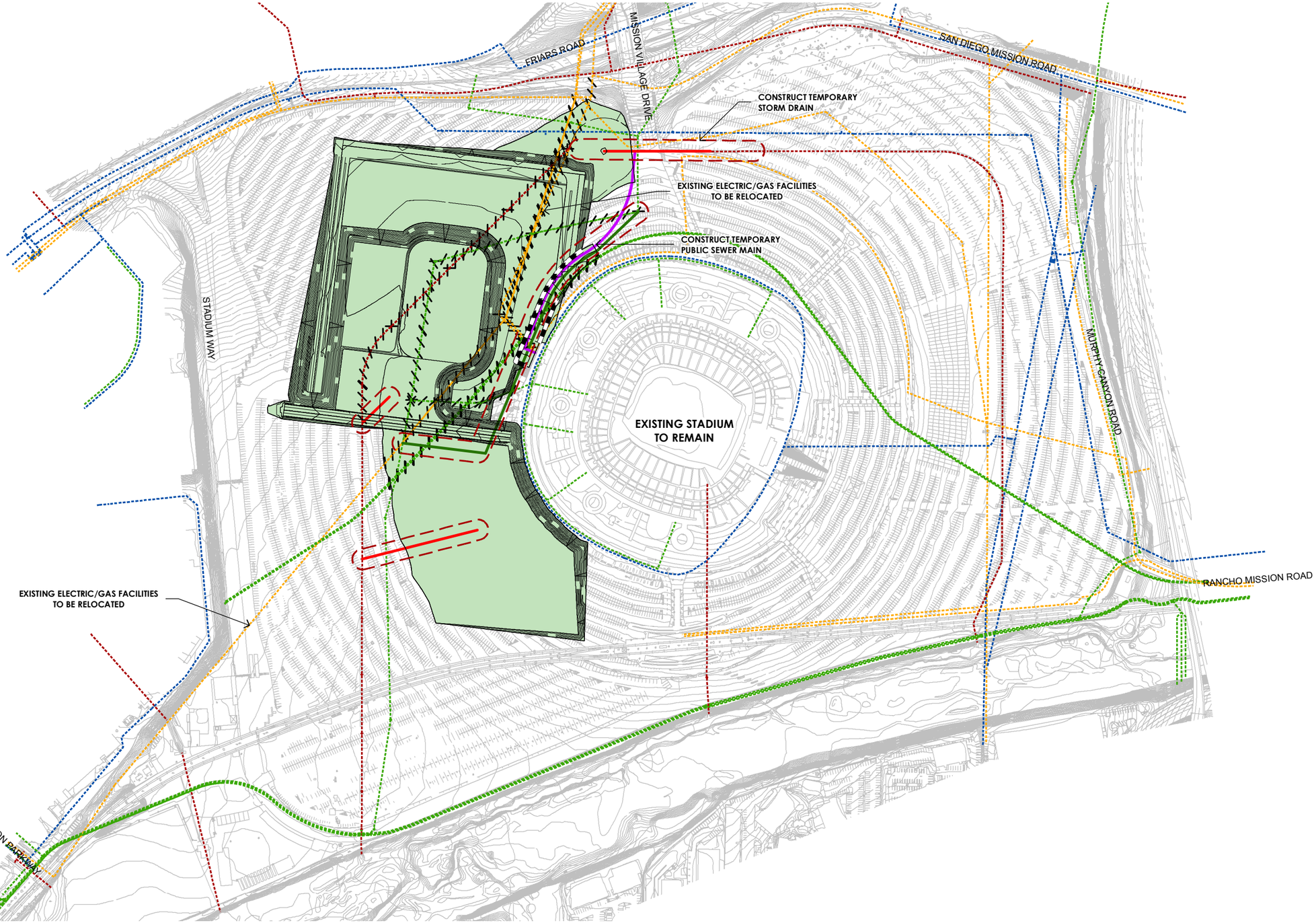
NOT TO SCALE

J-18150

PLAY AZTEC FOOTBALL FOR 2020 AND 2021 SEASONS AT SDCCU STADIUM

LEGEND

- Phase 1a
- Phase 1a Grading
- Temporary Sheet Pile Wall
- Proposed Sewer
- Proposed Storm Drain
- Proposed Joint Trench Dry Utility Temporary Relocation
- Temporary Utilities
- Existing Sewer
- Existing Storm Drain
- Existing Water
- Existing Dry Utilities
- Existing Sewer to be Demolished
- Existing Storm Drain to be Demolished
- Existing Dry Utilities to be Demolished
- Low Flow Storm Drain Diversion Structure
- Sewer Junction Structure
- 2018 Aerial Topo



CONSTRUCTION PHASE NOTES:

- DEMO EXISTING SEWER AND STORM DRAIN
- CONSTRUCT TEMPORARY SEWER AND CONNECT EXISTING STADIUM SEWER LATERAL
- CONSTRUCT TEMPORARY STORM DRAIN SYSTEMS
- EXISTING ELECTRICAL & GAS TO BE RELOCATED

RICK ENGINEERING COMPANY

Scale in Feet: 0 — 350 — 700

North

J-18150
Date of Exhibit: 1/18/2019
H:\18150\GIS\18150_PhaseMaps_3.mxd

SDSU MISSION VALLEY WEST CAMPUS

WEST STADIUM DEMOLITION AND CONSTRUCTION OF AZTEC STADIUM AND AZTEC DRIVE
DECEMBER 2021 TO APRIL 2022

LEGEND

- Phase 1a
- Phase 1b
- Stadium Limits of Work
- Phase 1a Grading
- Phase 1b Grading
- Stadium Building Wall
- Proposed Sewer
- Proposed Storm Drain
- Proposed Water
- Proposed Dry Utilities
- Proposed Fireline
- Existing Sewer
- Existing Storm Drain
- Existing Water
- Existing Dry Utilities
- Existing Sewer to be Demolished
- Existing Storm Drain to be Demolished
- Existing Water to be Demolished
- Existing Dry Utilities to be Demolished
- Low Flow Storm Drain Diversion Structure
- Sewer Junction Structure
- Stadium Demolition West Side
- 2018 Aerial Topo

APPROXIMATE GRADING QUANTITIES FOR PHASE 1B:

CUT = 410,000 CU YD
FILL = 410,000 CU YD

CONSTRUCTION PHASE NOTES:

- ACCELERATE DEMO OF SOUTHWEST CORNER OF EXISTING STADIUM
- CONSTRUCT AZTEC DRIVE AND RIVERPARK ROAD GRADING
- CONSTRUCTION PARK GRADING
- CONSTRUCT REGIONAL BIO-RETENTION BASINS
- DEMOLISH PORTION OF STADIUM
- RELOCATE 48" WATER MAIN
- CONSTRUCT UTILITIES
- RELOCATE 8"/18" SEWER

RICK ENGINEERING COMPANY

Scale in Feet
0 350 700
North

J-18150
Date of Exhibit: 1/18/2019
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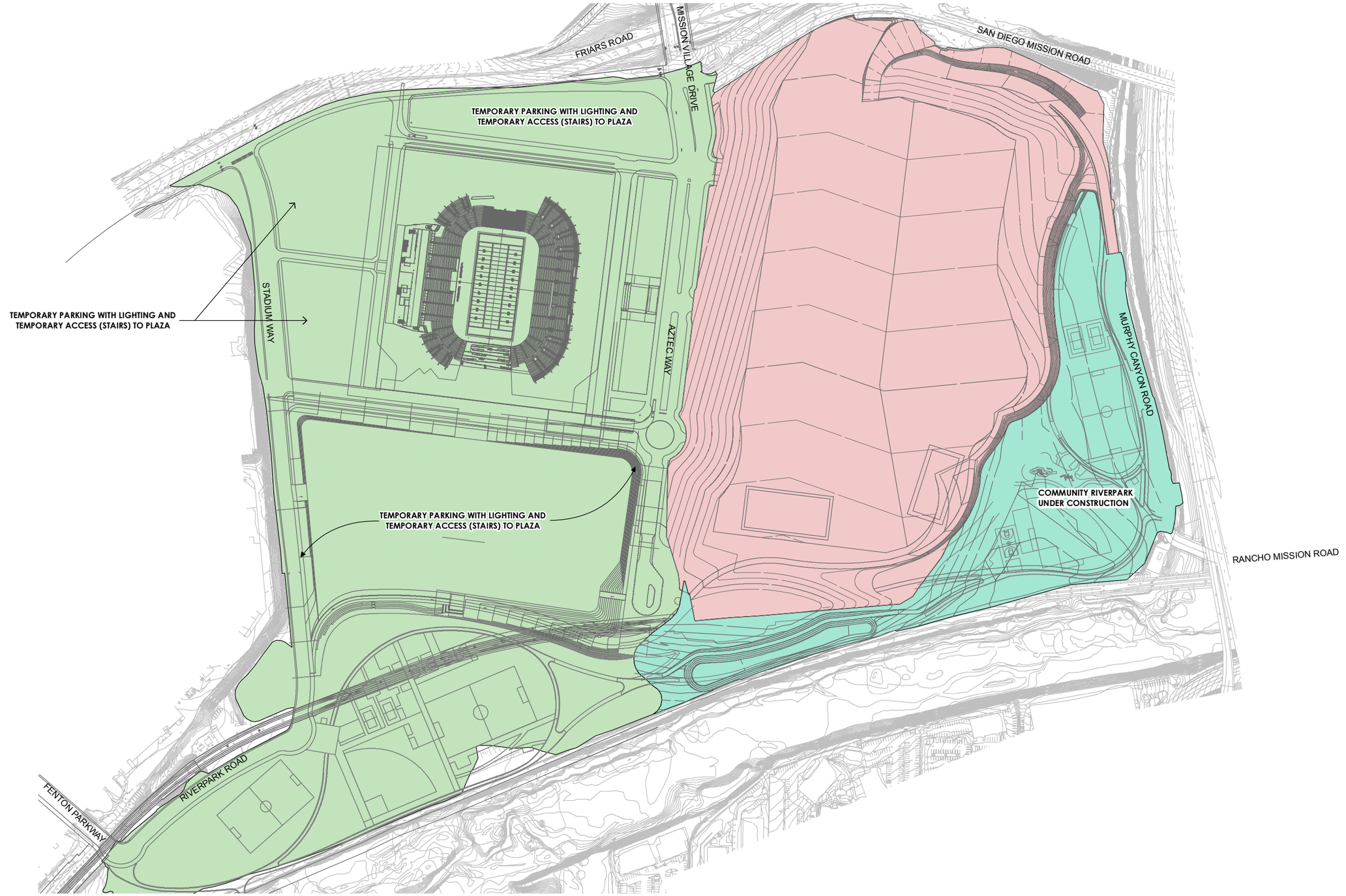
SDSU MISSION VALLEY
WEST CAMPUS

SDSU OPENING DAY PHASE 1 COMPLETE
JULY 2022

LEGEND

- Westside Grading
- Residential Grading Site
- Community Riverpark
- Phase 3 Grading
- Community Riverpark Grading
- Architectural Base
- 2018 Aerial Topo



CONSTRUCTION PHASE NOTES:

- AZTEC STADIUM COMPLETED
- SDSU RIVERPARK COMPLETED
- AZTEC DRIVE COMPLETED
- TEMPORARY PARKING COMPLETE

RICK ENGINEERING COMPANY

Scale in Feet: 0 — 350 — 700

North

J-18150
Date of Exhibit: 1/18/2019
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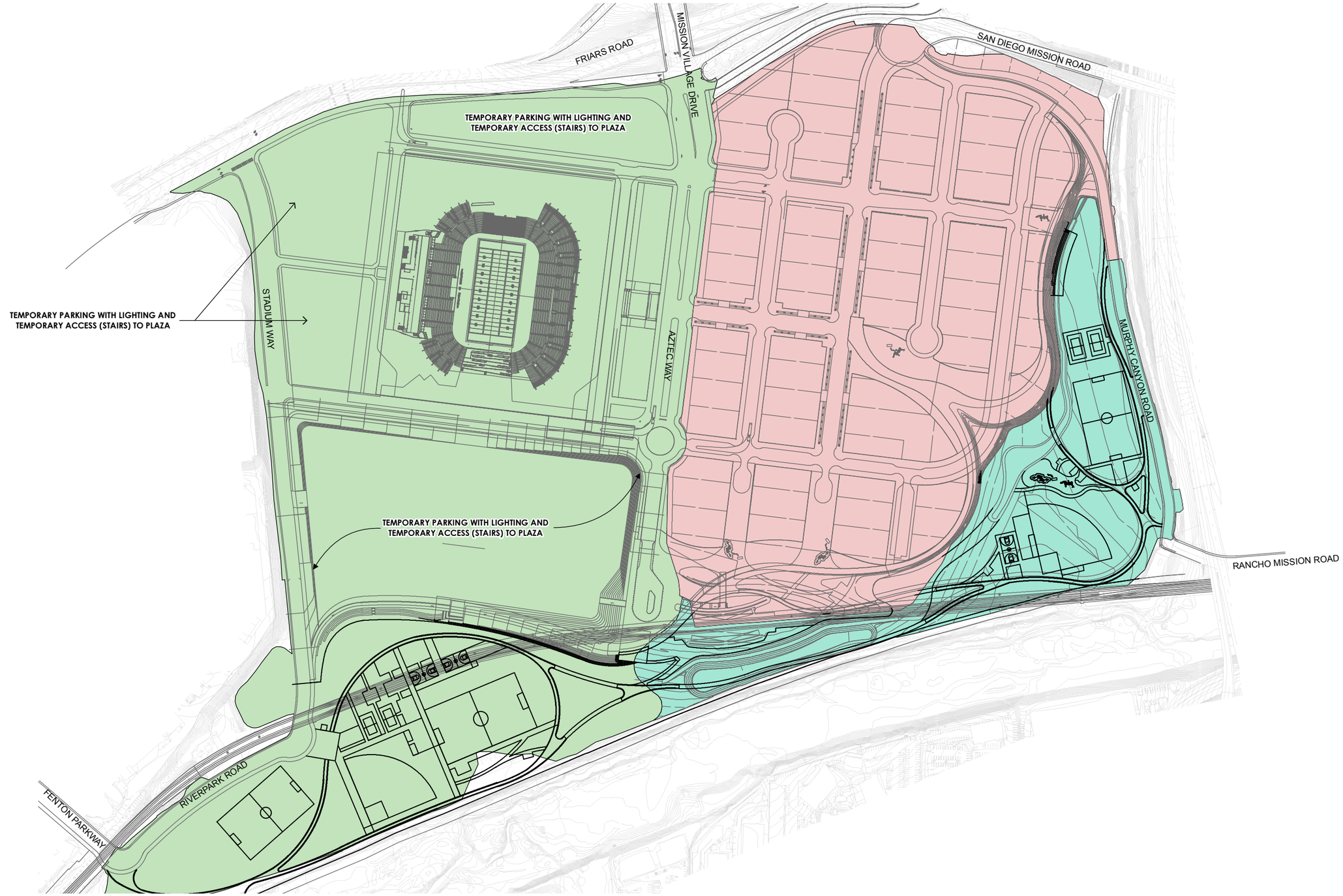
SDSU MISSION VALLEY WEST CAMPUS

COMPLETE COMMUNITY RIVERPARK
JUNE 2022 TO JUNE 2024

LEGEND

- Westside Grading
- Residential Grading
- Community Riverpark
- Phase 4 Grading
- Community Riverpark Grading
- Community Riverpark Base
- Architectural Base
- 2018 Aerial Topo



CONSTRUCTION PHASE NOTES:

- COMPLETE COMMUNITY RIVERPARK

RICK ENGINEERING COMPANY

Scale in Feet: 0 — 350 — 700

North

J-18150
Date of Exhibit: 1/18/2019
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SDSU MISSION VALLEY
WEST CAMPUS

APPENDIX B

AES Modified Rational Method Analyses
(100-year, 6-hour)

Basins: 100 - 400
[Pre-Project]

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2003 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                              Analysis prepared by:

                            RICK ENGINEERING COMPANY
                                5620 Friars Road
                             San Diego, California 92110
                           619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* JN-18150     SDSU WEST                                                 *
* BASIN 100        ONSITE           EXISTING CONDITION                   *
* 100-YR 6-HR                                                           *
 **************************************************************************

  FILE NAME: SDSW1E00.RAT
  TIME/DATE OF STUDY: 16:32 01/21/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     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
  2   42.5     37.5    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.10 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    201.00 TO NODE    202.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    112.00
  DOWNSTREAM ELEVATION(FEET) =    100.00
  ELEVATION DIFFERENCE(FEET) =     12.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.179
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

******************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    205.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  100.00  DOWNSTREAM ELEVATION(FEET) =   65.00
  STREET LENGTH(FEET) =   536.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 42.50

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  37.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.67
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.18
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.32
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
  STREET FLOW TRAVEL TIME(MIN.) =   2.07   Tc(MIN.) =   8.07
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.817
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    2.54
  TOTAL AREA(ACRES) =      0.80        PEAK FLOW RATE(CFS) =       2.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.01
  FLOW VELOCITY(FEET/SEC.) =  4.82   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    205.00 =   636.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    210.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     65.00  DOWNSTREAM(FEET) =     63.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   238.00   CHANNEL SLOPE =  0.0084
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
```

```
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.490
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      8.77
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.30
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   1.72
  Tc(MIN.) =   9.79
  SUBAREA AREA(ACRES) =     3.70       SUBAREA RUNOFF(CFS) =   11.62
  TOTAL AREA(ACRES) =      4.50        PEAK FLOW RATE(CFS) =      14.56

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   2.64
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    210.00 =   874.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    215.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    56.20  DOWNSTREAM(FEET) =    53.68
  FLOW LENGTH(FEET) =   282.80   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.24
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     14.56
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =  10.36
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    215.00 =  1156.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    215.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     63.00  DOWNSTREAM(FEET) =     60.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   281.00   CHANNEL SLOPE =  0.0107
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.252
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     22.75
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.25
  AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   1.44
  Tc(MIN.) =  11.80
  SUBAREA AREA(ACRES) =     5.30       SUBAREA RUNOFF(CFS) =   16.37
  TOTAL AREA(ACRES) =      9.80        PEAK FLOW RATE(CFS) =      30.93

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.33   FLOW VELOCITY(FEET/SEC.) =   3.52
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    215.00 =  1437.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    215.00 TO NODE    220.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    53.68  DOWNSTREAM(FEET) =    51.66
  FLOW LENGTH(FEET) =   282.80   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.50
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     30.93
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =  12.07
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    220.00 =  1720.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    215.00 TO NODE    220.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     60.00  DOWNSTREAM(FEET) =     58.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   281.00   CHANNEL SLOPE =  0.0071
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.063
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     39.22
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.25
  AVERAGE FLOW DEPTH(FEET) =   0.40   TRAVEL TIME(MIN.) =   1.44
  Tc(MIN.) =  13.51
  SUBAREA AREA(ACRES) =     5.70       SUBAREA RUNOFF(CFS) =   16.59
  TOTAL AREA(ACRES) =     15.50         PEAK FLOW RATE(CFS) =      47.52

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.44   FLOW VELOCITY(FEET/SEC.) =   3.40
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    220.00 =  2001.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    225.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    51.66  DOWNSTREAM(FEET) =    48.64
  FLOW LENGTH(FEET) =   282.80   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.13
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     47.52
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =  13.83
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    225.00 =  2284.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    225.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     58.00  DOWNSTREAM(FEET) =     55.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   284.00   CHANNEL SLOPE =  0.0106
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.902
  *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     56.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.11
  AVERAGE FLOW DEPTH(FEET) =   0.43   TRAVEL TIME(MIN.) =   1.15
  Tc(MIN.) =  14.98
  SUBAREA AREA(ACRES) =     6.20       SUBAREA RUNOFF(CFS) =   17.10
  TOTAL AREA(ACRES) =     21.70         PEAK FLOW RATE(CFS) =      64.62

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.46   FLOW VELOCITY(FEET/SEC.) =   4.25
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    225.00 =  2568.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE    230.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    48.64  DOWNSTREAM(FEET) =    46.82
  FLOW LENGTH(FEET) =   230.75   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.57
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     64.62
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =  15.16
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    230.00 =  2799.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE    230.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     55.00  DOWNSTREAM(FEET) =     53.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   233.00   CHANNEL SLOPE =  0.0086
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.811
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     73.69
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.09
  AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   0.95
  Tc(MIN.) =  16.11
  SUBAREA AREA(ACRES) =     6.80       SUBAREA RUNOFF(CFS) =   18.16
  TOTAL AREA(ACRES) =     28.50         PEAK FLOW RATE(CFS) =      82.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.54   FLOW VELOCITY(FEET/SEC.) =   4.18
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    230.00 =  3032.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    235.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    46.82  DOWNSTREAM(FEET) =    45.86
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.86
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     82.77
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =  16.31
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    235.00 =  3232.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    235.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     53.00  DOWNSTREAM(FEET) =     51.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0060
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.725
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9400
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     92.51
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.79
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   0.88
  Tc(MIN.) =  17.19
  SUBAREA AREA(ACRES) =     7.60       SUBAREA RUNOFF(CFS) =   19.47
  TOTAL AREA(ACRES) =     36.10         PEAK FLOW RATE(CFS) =     102.24

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.63   FLOW VELOCITY(FEET/SEC.) =   3.91
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    235.00 =  3432.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    235.00 TO NODE    240.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    45.86  DOWNSTREAM(FEET) =    44.90
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.83
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    102.24
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =  17.35
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    240.00 =  3632.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    235.00 TO NODE    240.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     51.80  DOWNSTREAM(FEET) =     50.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0065
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.646
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8800
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    110.39
```

```
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.07
  AVERAGE FLOW DEPTH(FEET) =   0.64   TRAVEL TIME(MIN.) =   0.82
  Tc(MIN.) =  18.17
  SUBAREA AREA(ACRES) =     7.00       SUBAREA RUNOFF(CFS) =   16.30
  TOTAL AREA(ACRES) =     43.10         PEAK FLOW RATE(CFS) =     118.54

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.66   FLOW VELOCITY(FEET/SEC.) =   4.17
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    240.00 =  3832.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    245.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    44.90  DOWNSTREAM(FEET) =    43.94
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  24.15
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    118.54
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =  18.31
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    245.00 =  4032.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    245.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     50.50  DOWNSTREAM(FEET) =     49.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0050
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.566
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    125.46
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.84
  AVERAGE FLOW DEPTH(FEET) =   0.71   TRAVEL TIME(MIN.) =   0.87
  Tc(MIN.) =  19.18
  SUBAREA AREA(ACRES) =     6.20       SUBAREA RUNOFF(CFS) =   13.84
  TOTAL AREA(ACRES) =     49.30         PEAK FLOW RATE(CFS) =     132.38

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.74   FLOW VELOCITY(FEET/SEC.) =   3.85
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    245.00 =  4232.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    245.00 TO NODE    250.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    43.94  DOWNSTREAM(FEET) =    40.99
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.73
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =    132.38
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  19.35
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    250.00 =  4432.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    245.00 TO NODE    250.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     49.50  DOWNSTREAM(FEET) =     48.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   205.00   CHANNEL SLOPE =  0.0073
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.493
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    139.49
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.53
  AVERAGE FLOW DEPTH(FEET) =   0.69   TRAVEL TIME(MIN.) =   0.75
  Tc(MIN.) =  20.11
  SUBAREA AREA(ACRES) =     6.20       SUBAREA RUNOFF(CFS) =   14.22
  TOTAL AREA(ACRES) =     55.50        PEAK FLOW RATE(CFS) =     146.61

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.71   FLOW VELOCITY(FEET/SEC.) =   4.58
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    250.00 =  4637.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    255.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    40.99  DOWNSTREAM(FEET) =    40.39
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.74
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    146.61
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =  20.27
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    255.00 =  4837.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    255.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     48.00  DOWNSTREAM(FEET) =     47.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   192.00   CHANNEL SLOPE =  0.0052
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.437
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9300
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    152.95
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.06
  AVERAGE FLOW DEPTH(FEET) =   0.77   TRAVEL TIME(MIN.) =   0.79
  Tc(MIN.) =  21.06
```

```
  SUBAREA AREA(ACRES) =     5.60       SUBAREA RUNOFF(CFS) =   12.69
  TOTAL AREA(ACRES) =     61.10         PEAK FLOW RATE(CFS) =     159.30

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.78   FLOW VELOCITY(FEET/SEC.) =   4.14
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    255.00 =  5029.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    255.00 TO NODE    260.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    40.39  DOWNSTREAM(FEET) =    39.79
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.54
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    159.30
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =  21.20
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    260.00 =  5229.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    255.00 TO NODE    260.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     47.00  DOWNSTREAM(FEET) =     46.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   202.00   CHANNEL SLOPE =  0.0030
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  25.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.370
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9300
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    194.79
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.51
  AVERAGE FLOW DEPTH(FEET) =   0.96   TRAVEL TIME(MIN.) =   0.96
  Tc(MIN.) =  22.16
  SUBAREA AREA(ACRES) =    32.20       SUBAREA RUNOFF(CFS) =   70.98
  TOTAL AREA(ACRES) =     93.30         PEAK FLOW RATE(CFS) =     230.27

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.03   FLOW VELOCITY(FEET/SEC.) =   3.67
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    260.00 =  5431.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    265.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    39.79  DOWNSTREAM(FEET) =    39.19
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  32.58
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    230.27
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =  22.27
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    265.00 =  5631.15 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    265.00 TO NODE    270.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    39.19  DOWNSTREAM(FEET) =    38.58
  FLOW LENGTH(FEET) =   172.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  32.58
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    230.27
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =  22.35
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    270.00 =  5803.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    200.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    38.58  DOWNSTREAM(FEET) =    38.50
  FLOW LENGTH(FEET) =    41.75   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  32.58
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    230.27
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  22.38
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    200.00 =  5844.90 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     93.30  TC(MIN.) =     22.38
  PEAK FLOW RATE(CFS)   =    230.27
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

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**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2003 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                              Analysis prepared by:

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                                5620 Friars Road
                             San Diego, California 92110
                           619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* JN-18150        SDSU WEST                                              *
* BASIN 200          ONSITE            EXISTING CONDITION               *
* 100-YR 6-HR                                                           *
 **************************************************************************

  FILE NAME: SDSW2E00.RAT
  TIME/DATE OF STUDY: 16:33 01/21/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     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    301.00 TO NODE    302.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
```

```
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     86.00
  DOWNSTREAM ELEVATION(FEET) =     76.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.253
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    305.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     76.00  DOWNSTREAM(FEET) =     52.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   567.00   CHANNEL SLOPE =  0.0409
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.714
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8400
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     17.10
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.62
  AVERAGE FLOW DEPTH(FEET) =   0.23   TRAVEL TIME(MIN.) =   2.61
  Tc(MIN.) =   8.61
  SUBAREA AREA(ACRES) =    10.60       SUBAREA RUNOFF(CFS) =   33.07
  TOTAL AREA(ACRES) =     10.70         PEAK FLOW RATE(CFS) =      33.47

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.34   FLOW VELOCITY(FEET/SEC.) =   4.63
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    305.00 =   667.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    305.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.714
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    1.62
  TOTAL AREA(ACRES) =     11.20   TOTAL RUNOFF(CFS) =   35.08
  TC(MIN.) =   8.61

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    310.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    43.75  DOWNSTREAM(FEET) =    41.08
  FLOW LENGTH(FEET) =   663.56   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.17
```

```
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     35.08
  PIPE TRAVEL TIME(MIN.) =   0.99    Tc(MIN.) =   9.60
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    310.00 =  1330.56 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    300.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    41.08  DOWNSTREAM(FEET) =    41.00
  FLOW LENGTH(FEET) =   129.25   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.17
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     35.08
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   9.79
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    300.00 =  1459.81 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     11.20  TC(MIN.) =      9.79
  PEAK FLOW RATE(CFS)   =     35.08
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2003 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                              Analysis prepared by:

                            RICK ENGINEERING COMPANY
                                5620 Friars Road
                             San Diego, California 92110
                           619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* JN-18150          SDSU WEST                                            *
* BASIN 300         ONSITE           EXISTING CONDITION                  *
* 100-YR 6-HR                                                           *
 **************************************************************************

  FILE NAME: SDSW3E00.RAT
  TIME/DATE OF STUDY: 18:39 01/21/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     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    301.00 TO NODE    302.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
```

```
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     87.00
  DOWNSTREAM ELEVATION(FEET) =     77.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.253
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    305.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   77.00  DOWNSTREAM ELEVATION(FEET) =   65.00
  STREET LENGTH(FEET) =   152.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 42.50

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  37.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.79
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.17
    HALFSTREET FLOOD WIDTH(FEET) =    2.29
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.63
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.80
  STREET FLOW TRAVEL TIME(MIN.) =   0.55   Tc(MIN.) =   6.55
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.106
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    0.78
  TOTAL AREA(ACRES) =      0.30        PEAK FLOW RATE(CFS) =       1.18

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.20   HALFSTREET FLOOD WIDTH(FEET) =   3.82
  FLOW VELOCITY(FEET/SEC.) =  4.46   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    305.00 =   252.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    310.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     65.00  DOWNSTREAM(FEET) =     63.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   178.00   CHANNEL SLOPE =  0.0112
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.839
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.65
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.11
 AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   1.41
 Tc(MIN.) =   7.95
 SUBAREA AREA(ACRES) =     2.00       SUBAREA RUNOFF(CFS) =    6.91
 TOTAL AREA(ACRES) =      2.30        PEAK FLOW RATE(CFS) =       8.09

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   2.52
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    310.00 =   430.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    310.00 TO NODE    315.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.89  DOWNSTREAM(FEET) =    56.27
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS   9.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.01
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      8.09
 PIPE TRAVEL TIME(MIN.) =   0.48    Tc(MIN.) =   8.43
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    315.00 =   630.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    310.00 TO NODE    315.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     63.00  DOWNSTREAM(FEET) =     61.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0100
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.525
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9300
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     13.66
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.84
 AVERAGE FLOW DEPTH(FEET) =   0.23   TRAVEL TIME(MIN.) =   1.17
 Tc(MIN.) =   9.60
 SUBAREA AREA(ACRES) =     3.40       SUBAREA RUNOFF(CFS) =   11.15
 TOTAL AREA(ACRES) =      5.70        PEAK FLOW RATE(CFS) =      19.24

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.27   FLOW VELOCITY(FEET/SEC.) =   3.03
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    315.00 =   830.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    315.00 TO NODE    320.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    56.27  DOWNSTREAM(FEET) =    54.87
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
```

```
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.12
 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     19.24
 PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =  10.15
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    320.00 =  1030.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    315.00 TO NODE    320.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     61.00  DOWNSTREAM(FEET) =     59.80
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0060
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.300
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9400
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     25.13
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.73
 AVERAGE FLOW DEPTH(FEET) =   0.34   TRAVEL TIME(MIN.) =   1.22
 Tc(MIN.) =  11.37
 SUBAREA AREA(ACRES) =     3.80       SUBAREA RUNOFF(CFS) =   11.79
 TOTAL AREA(ACRES) =      9.50         PEAK FLOW RATE(CFS) =      31.02

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.38   FLOW VELOCITY(FEET/SEC.) =   2.86
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    320.00 =  1230.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    320.00 TO NODE    325.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.87  DOWNSTREAM(FEET) =    53.47
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.87
 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     31.02
 PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =  11.71
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    325.00 =  1430.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    320.00 TO NODE    325.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     59.80  DOWNSTREAM(FEET) =     58.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0065
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.143
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9500
 S.C.S. CURVE NUMBER (AMC II) =   0
```

```
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     37.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.08
  AVERAGE FLOW DEPTH(FEET) =   0.40   TRAVEL TIME(MIN.) =   1.08
  Tc(MIN.) =  12.79
  SUBAREA AREA(ACRES) =     4.10       SUBAREA RUNOFF(CFS) =   12.24
  TOTAL AREA(ACRES) =     13.60         PEAK FLOW RATE(CFS) =      43.27

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.43   FLOW VELOCITY(FEET/SEC.) =   3.19
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    325.00 =  1630.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    330.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    53.47  DOWNSTREAM(FEET) =    52.51
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.77
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     43.27
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =  13.03
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    330.00 =  1830.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    330.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     58.50  DOWNSTREAM(FEET) =     57.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0045
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.988
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     48.52
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.86
  AVERAGE FLOW DEPTH(FEET) =   0.49   TRAVEL TIME(MIN.) =   1.17
  Tc(MIN.) =  14.20
  SUBAREA AREA(ACRES) =     3.70       SUBAREA RUNOFF(CFS) =   10.50
  TOTAL AREA(ACRES) =     17.30         PEAK FLOW RATE(CFS) =      53.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.51   FLOW VELOCITY(FEET/SEC.) =   2.99
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    330.00 =  2030.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    335.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    52.51  DOWNSTREAM(FEET) =    51.50
  FLOW LENGTH(FEET) =   315.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.12
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
```

```
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     53.77
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =  14.50
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    335.00 =  2345.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    335.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     57.60  DOWNSTREAM(FEET) =     56.75
  CHANNEL LENGTH THRU SUBAREA(FEET) =   315.00   CHANNEL SLOPE =  0.0027
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.775
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9300
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     63.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.56
  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   2.05
  Tc(MIN.) =  16.56
  SUBAREA AREA(ACRES) =     7.70       SUBAREA RUNOFF(CFS) =   19.87
  TOTAL AREA(ACRES) =     25.00         PEAK FLOW RATE(CFS) =      73.64

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.65   FLOW VELOCITY(FEET/SEC.) =   2.66
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    335.00 =  2660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    335.00 TO NODE    340.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    51.00  DOWNSTREAM(FEET) =    50.48
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.00
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     73.64
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =  16.78
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    340.00 =  2860.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    335.00 TO NODE    340.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     56.75  DOWNSTREAM(FEET) =     56.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0012
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.626
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     79.01
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.03
  AVERAGE FLOW DEPTH(FEET) =   0.79   TRAVEL TIME(MIN.) =   1.64
```

```
  Tc(MIN.) =  18.43
  SUBAREA AREA(ACRES) =     4.30       SUBAREA RUNOFF(CFS) =   10.73
  TOTAL AREA(ACRES) =     29.30         PEAK FLOW RATE(CFS) =      84.37

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.81   FLOW VELOCITY(FEET/SEC.) =   2.06
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    340.00 =  3060.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    345.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    50.48  DOWNSTREAM(FEET) =    49.96
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.19
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     84.37
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =  18.62
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    345.00 =  3260.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    345.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     56.50  DOWNSTREAM(FEET) =     55.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0050
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.534
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     88.70
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.48
  AVERAGE FLOW DEPTH(FEET) =   0.62   TRAVEL TIME(MIN.) =   0.96
  Tc(MIN.) =  19.58
  SUBAREA AREA(ACRES) =     3.60       SUBAREA RUNOFF(CFS) =    8.67
  TOTAL AREA(ACRES) =     32.90         PEAK FLOW RATE(CFS) =      93.04

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.63   FLOW VELOCITY(FEET/SEC.) =   3.55
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    345.00 =  3460.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    345.00 TO NODE    350.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    49.96  DOWNSTREAM(FEET) =    49.44
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.95
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     93.04
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  19.75
```

```
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    350.00 =  3660.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    345.00 TO NODE    350.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     55.50  DOWNSTREAM(FEET) =     55.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0025
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.443
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     97.33
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.77
 AVERAGE FLOW DEPTH(FEET) =   0.74   TRAVEL TIME(MIN.) =   1.21
 Tc(MIN.) =  20.96
 SUBAREA AREA(ACRES) =     3.70       SUBAREA RUNOFF(CFS) =    8.59
 TOTAL AREA(ACRES) =     36.60         PEAK FLOW RATE(CFS) =     101.62

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.76   FLOW VELOCITY(FEET/SEC.) =   2.80
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    350.00 =  3860.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    355.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    49.44  DOWNSTREAM(FEET) =    48.92
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =  20.70
 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
 GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    101.62
 PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =  21.12
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    355.00 =  4060.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    355.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     55.00  DOWNSTREAM(FEET) =     54.75
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0012
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.342
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    106.29
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.19
 AVERAGE FLOW DEPTH(FEET) =   0.89   TRAVEL TIME(MIN.) =   1.52
 Tc(MIN.) =  22.64
 SUBAREA AREA(ACRES) =     4.20       SUBAREA RUNOFF(CFS) =    9.34
 TOTAL AREA(ACRES) =     40.80         PEAK FLOW RATE(CFS) =     110.97
```

```
  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.91   FLOW VELOCITY(FEET/SEC.) =   2.19
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    355.00 =  4260.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    360.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    48.92  DOWNSTREAM(FEET) =    48.40
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.61
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    110.97
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =  22.79
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    360.00 =  4460.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    360.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     54.75  DOWNSTREAM(FEET) =     54.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0037
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.273
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    114.96
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.34
  AVERAGE FLOW DEPTH(FEET) =   0.74   TRAVEL TIME(MIN.) =   1.00
  Tc(MIN.) =  23.78
  SUBAREA AREA(ACRES) =     3.70       SUBAREA RUNOFF(CFS) =    7.99
  TOTAL AREA(ACRES) =     44.50         PEAK FLOW RATE(CFS) =     118.95

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.74   FLOW VELOCITY(FEET/SEC.) =   3.38
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    360.00 =  4660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    365.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    47.88  DOWNSTREAM(FEET) =    46.26
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.83
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    118.95
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =  23.98
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    365.00 =  4860.00 FEET.

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

```
  FLOW PROCESS FROM NODE    360.00 TO NODE    365.00 IS CODE =  51
----------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     54.00  DOWNSTREAM(FEET) =     53.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0050
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.208
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9400
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    122.48
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.77
  AVERAGE FLOW DEPTH(FEET) =   0.71   TRAVEL TIME(MIN.) =   0.88
  Tc(MIN.) =  24.87
  SUBAREA AREA(ACRES) =     3.40       SUBAREA RUNOFF(CFS) =    7.06
  TOTAL AREA(ACRES) =     47.90         PEAK FLOW RATE(CFS) =     126.01

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.72   FLOW VELOCITY(FEET/SEC.) =   3.80
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    365.00 =  5060.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    365.00 TO NODE    370.00 IS CODE =  41
----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    46.26  DOWNSTREAM(FEET) =    44.49
  FLOW LENGTH(FEET) =   110.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.83
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    126.01
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =  24.97
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    370.00 =  5170.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    365.00 TO NODE    370.00 IS CODE =  51
----------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     53.00  DOWNSTREAM(FEET) =     52.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   110.00   CHANNEL SLOPE =  0.0091
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.186
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9300
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    142.08
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.92
  AVERAGE FLOW DEPTH(FEET) =   0.67   TRAVEL TIME(MIN.) =   0.37
  Tc(MIN.) =  25.34
  SUBAREA AREA(ACRES) =    15.80       SUBAREA RUNOFF(CFS) =   32.13
  TOTAL AREA(ACRES) =     63.70         PEAK FLOW RATE(CFS) =     158.14

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.70   FLOW VELOCITY(FEET/SEC.) =   5.06
```

```
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    370.00 =  5280.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    370.00 TO NODE    300.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    44.49  DOWNSTREAM(FEET) =    44.00
  FLOW LENGTH(FEET) =    63.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.37
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    158.14
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =  25.39
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    300.00 =  5343.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     63.70  TC(MIN.) =     25.39
  PEAK FLOW RATE(CFS)   =    158.14
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

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**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2003 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                              Analysis prepared by:

                            RICK ENGINEERING COMPANY
                                5620 Friars Road
                              San Diego, California 92110
                           619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* JN-18150     SDSU WEST                                                 *
* BASIN 400          ONSITE            EXISTING CONDITION               *
* 100-YR 6-HR                                                           *
 **************************************************************************

  FILE NAME: SDSW4E00.RAT
  TIME/DATE OF STUDY: 16:34 01/21/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     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    101.00 TO NODE    102.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
```

```
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =     67.00
  DOWNSTREAM ELEVATION(FEET) =     55.00
  ELEVATION DIFFERENCE(FEET) =     12.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.339
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.19
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.19

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    100.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     55.00  DOWNSTREAM(FEET) =     49.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   600.00   CHANNEL SLOPE =  0.0100
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.149
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5400
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.06
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.48
  AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =   6.74
  Tc(MIN.) =  12.74
  SUBAREA AREA(ACRES) =     5.70       SUBAREA RUNOFF(CFS) =    9.69
  TOTAL AREA(ACRES) =      5.80         PEAK FLOW RATE(CFS) =       9.88

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   1.89
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    100.00 =   660.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      5.80  TC(MIN.) =     12.74
  PEAK FLOW RATE(CFS)   =      9.88
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

APPENDIX C

AES Modified Rational Method Analyses
(100-year, 6-hour)

Basins: 100-400
[Post-Project/Ultimate]

****

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
2003,1985,1981 HYDROLOGY MANUAL

Ver. 1.5A Release Date: 01/01/2003 License ID 1261

Analysis prepared by:

RICK ENGINEERING COMPANY
5620 Friars Road
San Diego, California 92110
619-291-0707 Fax 619-291-4165

********** DESCRIPTION OF STUDY **********
* JN-18150 SDSU WEST *
* BASIN 100 ONSITE ULTIMATE CONDITION *
* 100-YR 6-HR *
****

FILE NAME: SDSW1P00.RAT
TIME/DATE OF STUDY: 17:42 01/21/2019

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
*USER SPECIFIED:
NUMBER OF [TIME,INTENSITY] DATA PAIRS = 9
1) 5.000; 4.400
2) 10.000; 3.450
3) 15.000; 2.900
4) 20.000; 2.500
5) 25.000; 2.200
6) 30.000; 2.000
7) 40.000; 1.700
8) 50.000; 1.500
9) 60.000; 1.300
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP	HIKE	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150
2	20.0	15.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
3	35.0	30.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
4	23.0	18.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
5	63.0	58.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
6	48.0	43.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
7	26.0	21.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.10 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    101.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =     86.60
  DOWNSTREAM ELEVATION(FEET) =     86.00
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   86.00  DOWNSTREAM ELEVATION(FEET) =   85.00
  STREET LENGTH(FEET) =   400.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.19
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.41
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.26
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.47
  STREET FLOW TRAVEL TIME(MIN.) =   5.28   Tc(MIN.) =  11.28
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.309
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    7.60
  TOTAL AREA(ACRES) =      2.80        PEAK FLOW RATE(CFS) =       7.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.04
  FLOW VELOCITY(FEET/SEC.) =  1.48   DEPTH*VELOCITY(FT*FT/SEC.) =   0.66
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    105.00 =   460.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    78.00  DOWNSTREAM(FEET) =    68.87
  FLOW LENGTH(FEET) =   936.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.39
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.95
  PIPE TRAVEL TIME(MIN.) =   2.44    Tc(MIN.) =  13.72
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    110.00 =  1396.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.041
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    5.10   SUBAREA RUNOFF(CFS) =   13.18
  TOTAL AREA(ACRES) =      7.90   TOTAL RUNOFF(CFS) =   21.13
  TC(MIN.) =  13.72

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    68.87  DOWNSTREAM(FEET) =    59.07
  FLOW LENGTH(FEET) =   278.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.94
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     21.13
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =  14.08
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    120.00 =  1674.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.001
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    7.30   SUBAREA RUNOFF(CFS) =   19.72
  TOTAL AREA(ACRES) =     15.20   TOTAL RUNOFF(CFS) =   40.85
  TC(MIN.) =  14.08

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  14.08
  RAINFALL INTENSITY(INCH/HR) =   3.00
  TOTAL STREAM AREA(ACRES) =    15.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     40.85

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

```
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
 UPSTREAM ELEVATION(FEET) =    115.70
 DOWNSTREAM ELEVATION(FEET) =    114.00
 ELEVATION DIFFERENCE(FEET) =      1.70
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.681
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =      0.40
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  5 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  114.00  DOWNSTREAM ELEVATION(FEET) =  102.00
 STREET LENGTH(FEET) =   380.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 63.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  58.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.05
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.27
   HALFSTREET FLOOD WIDTH(FEET) =    7.01
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.36
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
 STREET FLOW TRAVEL TIME(MIN.) =   1.88   Tc(MIN.) =   7.88
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.852
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    3.29
 TOTAL AREA(ACRES) =      1.00        PEAK FLOW RATE(CFS) =       3.69

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.22
 FLOW VELOCITY(FEET/SEC.) =  3.81   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
 LONGEST FLOWPATH FROM NODE    111.00 TO NODE    113.00 =   450.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    120.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  100.00  DOWNSTREAM ELEVATION(FEET) =   65.00
 STREET LENGTH(FEET) =   700.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 35.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.37
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.59
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.35
  STREET FLOW TRAVEL TIME(MIN.) =   2.54   Tc(MIN.) =  10.43
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.403
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7200
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    3.10      SUBAREA RUNOFF(CFS) =    7.60
  TOTAL AREA(ACRES) =      4.10        PEAK FLOW RATE(CFS) =      11.29

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.01
  FLOW VELOCITY(FEET/SEC.) =  5.04   DEPTH*VELOCITY(FT*FT/SEC.) =   1.65
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    120.00 =  1150.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  10.43
  RAINFALL INTENSITY(INCH/HR) =   3.40
  TOTAL STREAM AREA(ACRES) =     4.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.29

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       40.85    14.08        3.001        15.20
      2       11.29    10.43        3.403         4.10

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       47.32    10.43       3.403
      2       50.81    14.08       3.001

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     50.81   Tc(MIN.) =   14.08
  TOTAL AREA(ACRES) =     19.30
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    120.00 =  1674.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    59.07  DOWNSTREAM(FEET) =    52.00
  FLOW LENGTH(FEET) =   770.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  22.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.96
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     50.81
  PIPE TRAVEL TIME(MIN.) =   1.29    Tc(MIN.) =  15.37
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    130.00 =  2444.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   65.00  DOWNSTREAM ELEVATION(FEET) =   58.00
  STREET LENGTH(FEET) =   770.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 23.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  18.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      52.96
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.63
    HALFSTREET FLOOD WIDTH(FEET) =   29.60
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.84
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.43
  STREET FLOW TRAVEL TIME(MIN.) =   3.34   Tc(MIN.) =  18.71
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.603
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    4.30
  TOTAL AREA(ACRES) =     21.50        PEAK FLOW RATE(CFS) =      55.11

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.64   HALFSTREET FLOOD WIDTH(FEET) =  29.91
  FLOW VELOCITY(FEET/SEC.) =  3.89   DEPTH*VELOCITY(FT*FT/SEC.) =   2.48
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    130.00 =  3214.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    130.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.603
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
```

```
  SUBAREA AREA(ACRES) =   10.30   SUBAREA RUNOFF(CFS) =   22.79
  TOTAL AREA(ACRES) =     31.80   TOTAL RUNOFF(CFS) =   77.90
  TC(MIN.) =  18.71

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    52.00  DOWNSTREAM(FEET) =    45.64
  FLOW LENGTH(FEET) =   425.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  16.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.14
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   2
  PIPE-FLOW(CFS) =     77.90
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =  19.35
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    140.00 =  3639.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   58.00  DOWNSTREAM ELEVATION(FEET) =   51.00
  STREET LENGTH(FEET) =   460.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 23.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  18.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      80.19
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.66
    HALFSTREET FLOOD WIDTH(FEET) =   30.88
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.23
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    3.44
  STREET FLOW TRAVEL TIME(MIN.) =   1.47   Tc(MIN.) =  20.81
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.451
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.50      SUBAREA RUNOFF(CFS) =    4.60
  TOTAL AREA(ACRES) =     34.30        PEAK FLOW RATE(CFS) =      82.49

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.66   HALFSTREET FLOOD WIDTH(FEET) =  31.13
  FLOW VELOCITY(FEET/SEC.) =  5.27   DEPTH*VELOCITY(FT*FT/SEC.) =   3.49
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    140.00 =  4099.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    140.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.451
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    3.80   SUBAREA RUNOFF(CFS) =    7.92
 TOTAL AREA(ACRES) =     38.10   TOTAL RUNOFF(CFS) =   90.41
 TC(MIN.) =  20.81

****************************************************************************
 FLOW PROCESS FROM NODE    140.00 TO NODE    100.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.64  DOWNSTREAM(FEET) =    43.60
 FLOW LENGTH(FEET) =   510.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  26.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.03
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   2
 PIPE-FLOW(CFS) =     90.41
 PIPE TRAVEL TIME(MIN.) =   1.21    Tc(MIN.) =  22.02
 LONGEST FLOWPATH FROM NODE    101.00 TO NODE    100.00 =  4609.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    140.00 TO NODE    100.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.379
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =   16.70   SUBAREA RUNOFF(CFS) =   19.86
 TOTAL AREA(ACRES) =     54.80   TOTAL RUNOFF(CFS) =  110.27
 TC(MIN.) =  22.02

****************************************************************************
 FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    151.00 TO NODE    152.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     87.00
 DOWNSTREAM ELEVATION(FEET) =     56.00
 ELEVATION DIFFERENCE(FEET) =     31.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    0.860
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =      0.40
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

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

```
 FLOW PROCESS FROM NODE    152.00 TO NODE    155.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     56.00  DOWNSTREAM(FEET) =     54.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00   CHANNEL SLOPE =  0.0050
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.347
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .7200
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.06
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.35
 AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   4.93
 Tc(MIN.) =  10.93
 SUBAREA AREA(ACRES) =     5.40       SUBAREA RUNOFF(CFS) =   13.01
 TOTAL AREA(ACRES) =      5.50        PEAK FLOW RATE(CFS) =      13.41

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.36   FLOW VELOCITY(FEET/SEC.) =   1.72
 LONGEST FLOWPATH FROM NODE    151.00 TO NODE    155.00 =   500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    155.00 TO NODE    160.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    51.50  DOWNSTREAM(FEET) =    50.70
 FLOW LENGTH(FEET) =   292.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  17.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.52
 GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.41
 PIPE TRAVEL TIME(MIN.) =   1.08    Tc(MIN.) =  12.01
 LONGEST FLOWPATH FROM NODE    151.00 TO NODE    160.00 =   792.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.70  DOWNSTREAM(FEET) =    44.80
 FLOW LENGTH(FEET) =  1142.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  14.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.75
 GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.41
 PIPE TRAVEL TIME(MIN.) =   3.31    Tc(MIN.) =  15.32
 LONGEST FLOWPATH FROM NODE    151.00 TO NODE    170.00 =  1934.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  15.32
 RAINFALL INTENSITY(INCH/HR) =   2.87
```

```
  TOTAL STREAM AREA(ACRES) =     5.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.41

****************************************************************************
  FLOW PROCESS FROM NODE    101.50 TO NODE    102.50 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    111.00
  DOWNSTREAM ELEVATION(FEET) =    101.50
  ELEVATION DIFFERENCE(FEET) =      9.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.168
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    102.50 TO NODE    105.50 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  6 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  101.50  DOWNSTREAM ELEVATION(FEET) =   76.00
  STREET LENGTH(FEET) =   622.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 48.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  43.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.01
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    5.55
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.53
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   2.93   Tc(MIN.) =   8.93
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.653
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.50      SUBAREA RUNOFF(CFS) =    5.20
  TOTAL AREA(ACRES) =      1.60        PEAK FLOW RATE(CFS) =       5.60

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.65
  FLOW VELOCITY(FEET/SEC.) =  3.99   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    105.50 =   712.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.50 TO NODE    115.50 IS CODE =  41
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    69.60  DOWNSTREAM(FEET) =    69.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   8.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.86
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      5.60
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   9.10
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    115.50 =   772.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.50 TO NODE    115.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.620
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =   10.00   SUBAREA RUNOFF(CFS) =   30.77
  TOTAL AREA(ACRES) =     11.60   TOTAL RUNOFF(CFS) =   36.38
  TC(MIN.) =   9.10

****************************************************************************
  FLOW PROCESS FROM NODE    115.50 TO NODE    125.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    69.00  DOWNSTREAM(FEET) =    64.90
  FLOW LENGTH(FEET) =   408.54   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.24
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     36.38
  PIPE TRAVEL TIME(MIN.) =   0.74    Tc(MIN.) =   9.84
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    125.50 =  1180.54 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.50 TO NODE    125.50 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  6 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   76.00  DOWNSTREAM ELEVATION(FEET) =   74.50
  STREET LENGTH(FEET) =   455.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 48.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  43.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      38.33
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.68
```

```
    HALFSTREET FLOOD WIDTH(FEET) =   36.24
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.27
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.54
  STREET FLOW TRAVEL TIME(MIN.) =   3.34   Tc(MIN.) =  13.18
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.100
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.40      SUBAREA RUNOFF(CFS) =    3.91
  TOTAL AREA(ACRES) =     13.00        PEAK FLOW RATE(CFS) =      40.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.68   HALFSTREET FLOOD WIDTH(FEET) =  37.08
  FLOW VELOCITY(FEET/SEC.) =  2.30   DEPTH*VELOCITY(FT*FT/SEC.) =   1.58
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    125.50 =  1635.54 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.50 TO NODE    125.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.100
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.64
  TOTAL AREA(ACRES) =     14.00   TOTAL RUNOFF(CFS) =   42.92
  TC(MIN.) =  13.18

****************************************************************************
  FLOW PROCESS FROM NODE    125.50 TO NODE    135.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    64.90  DOWNSTREAM(FEET) =    60.45
  FLOW LENGTH(FEET) =   445.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  21.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.83
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     42.92
  PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =  13.93
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    135.50 =  2080.54 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    125.50 TO NODE    135.50 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  6 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   74.50  DOWNSTREAM ELEVATION(FEET) =   72.50
  STREET LENGTH(FEET) =   445.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 48.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  43.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      44.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.67
    HALFSTREET FLOOD WIDTH(FEET) =   36.08
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.66
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.79
  STREET FLOW TRAVEL TIME(MIN.) =   2.79   Tc(MIN.) =  16.72
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.762
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    3.23
  TOTAL AREA(ACRES) =     15.30        PEAK FLOW RATE(CFS) =      46.15

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.68   HALFSTREET FLOOD WIDTH(FEET) =  36.75
  FLOW VELOCITY(FEET/SEC.) =  2.68   DEPTH*VELOCITY(FT*FT/SEC.) =   1.82
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    135.50 =  2525.54 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.50 TO NODE    135.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.762
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.40   SUBAREA RUNOFF(CFS) =    3.29
  TOTAL AREA(ACRES) =     16.70   TOTAL RUNOFF(CFS) =   49.44
  TC(MIN.) =  16.72

****************************************************************************
  FLOW PROCESS FROM NODE    135.50 TO NODE    145.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    60.45  DOWNSTREAM(FEET) =    56.00
  FLOW LENGTH(FEET) =   495.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  20.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.79
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     49.44
  PIPE TRAVEL TIME(MIN.) =   0.84    Tc(MIN.) =  17.56
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    145.50 =  3020.54 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    140.50 TO NODE    145.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.695
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    5.40   SUBAREA RUNOFF(CFS) =   12.37
  TOTAL AREA(ACRES) =     22.10   TOTAL RUNOFF(CFS) =   61.81
  TC(MIN.) =  17.56

****************************************************************************
  FLOW PROCESS FROM NODE    145.50 TO NODE    155.50 IS CODE =  41
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    56.00  DOWNSTREAM(FEET) =    54.09
  FLOW LENGTH(FEET) =   211.80   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  23.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.39
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     61.81
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =  17.90
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    155.50 =  3232.34 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.50 TO NODE    155.50 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  7 USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) =   72.50  DOWNSTREAM ELEVATION(FEET) =   65.00
  STREET LENGTH(FEET) =   735.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 26.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  21.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      63.79
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.66
    HALFSTREET FLOOD WIDTH(FEET) =   34.08
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.66
  STREET FLOW TRAVEL TIME(MIN.) =   3.04   Tc(MIN.) =  20.95
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.443
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.80      SUBAREA RUNOFF(CFS) =    3.96
  TOTAL AREA(ACRES) =     23.90        PEAK FLOW RATE(CFS) =      65.76

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.67   HALFSTREET FLOOD WIDTH(FEET) =  34.32
  FLOW VELOCITY(FEET/SEC.) =  4.06   DEPTH*VELOCITY(FT*FT/SEC.) =   2.71
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    155.50 =  3967.34 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    155.50 TO NODE    160.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    54.09  DOWNSTREAM(FEET) =    52.42
  FLOW LENGTH(FEET) =   131.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  21.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.00
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     65.76
```

```
 PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  21.13
 LONGEST FLOWPATH FROM NODE    101.50 TO NODE    160.50 =  4098.34 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    150.50 TO NODE    160.50 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.432
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    4.60   SUBAREA RUNOFF(CFS) =    9.51
 TOTAL AREA(ACRES) =     28.50   TOTAL RUNOFF(CFS) =   75.27
 TC(MIN.) =  21.13

****************************************************************************
 FLOW PROCESS FROM NODE    160.50 TO NODE    170.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.42  DOWNSTREAM(FEET) =    44.80
 FLOW LENGTH(FEET) =   867.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  26.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.80
 GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     75.27
 PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =  22.47
 LONGEST FLOWPATH FROM NODE    101.50 TO NODE    170.00 =  4965.34 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  22.47
 RAINFALL INTENSITY(INCH/HR) =   2.35
 TOTAL STREAM AREA(ACRES) =    28.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     75.27

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       13.41    15.32        2.875         5.50
     2       75.27    22.47        2.352        28.50

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       75.00    15.32        2.875
     2       86.25    22.47        2.352

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     86.25   Tc(MIN.) =   22.47
 TOTAL AREA(ACRES) =     34.00
 LONGEST FLOWPATH FROM NODE    101.50 TO NODE    170.00 =  4965.34 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    100.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    44.80  DOWNSTREAM(FEET) =    43.80
  FLOW LENGTH(FEET) =   174.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  28.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.53
  GIVEN PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     86.25
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =  22.77
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    100.00 =  5139.34 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 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       86.25    22.77        2.334       34.00
  LONGEST FLOWPATH FROM NODE    101.50 TO NODE    100.00 =  5139.34 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc       INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1      110.27    22.02        2.379       54.80
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    100.00 =  4609.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc       INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     194.89      22.02        2.379
      2     194.43      22.77        2.334

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    194.89   Tc(MIN.) =   22.02
  TOTAL AREA(ACRES) =     88.80
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     88.80  TC(MIN.) =     22.02
  PEAK FLOW RATE(CFS)   =    194.89
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
2003,1985,1981 HYDROLOGY MANUAL

Ver. 1.5A Release Date: 01/01/2003 License ID 1261

Analysis prepared by:

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San Diego, California 92110
619-291-0707 Fax 619-291-4165

********** DESCRIPTION OF STUDY **********
* JN-18150 SDSU WEST *
* BASIN 200 ONSITE ULTIMATE CONDITION *
* 100-YR 6-HR *
****

FILE NAME: SDSW2P00.RAT
TIME/DATE OF STUDY: 17:27 01/21/2019

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
*USER SPECIFIED:
NUMBER OF [TIME,INTENSITY] DATA PAIRS = 9
1) 5.000; 4.400
2) 10.000; 3.450
3) 15.000; 2.900
4) 20.000; 2.500
5) 25.000; 2.200
6) 30.000; 2.000
7) 40.000; 1.700
8) 50.000; 1.500
9) 60.000; 1.300
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150
2	48.0	43.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
3	26.0	21.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
4	19.0	14.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
5	22.0	17.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150
6	28.0	23.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.10 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    201.00 TO NODE    202.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
 UPSTREAM ELEVATION(FEET) =     73.32
 DOWNSTREAM ELEVATION(FEET) =     72.82
 ELEVATION DIFFERENCE(FEET) =      0.50
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.182
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =      0.36
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

**************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    205.00 IS CODE =  62
--------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
==========================================================================
 UPSTREAM ELEVATION(FEET) =   72.82  DOWNSTREAM ELEVATION(FEET) =   71.78
 STREET LENGTH(FEET) =   190.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 19.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  14.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.03
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.23
   HALFSTREET FLOOD WIDTH(FEET) =    5.36
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.27
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.30
 STREET FLOW TRAVEL TIME(MIN.) =   2.49   Tc(MIN.) =   8.49
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.737
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.40      SUBAREA RUNOFF(CFS) =    1.35
 TOTAL AREA(ACRES) =      0.50        PEAK FLOW RATE(CFS) =       1.70

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.00
 FLOW VELOCITY(FEET/SEC.) =  1.40   DEPTH*VELOCITY(FT*FT/SEC.) =   0.37
 LONGEST FLOWPATH FROM NODE    201.00 TO NODE    205.00 =   240.00 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    205.00 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.737
 *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.80   SUBAREA RUNOFF(CFS) =    5.72
  TOTAL AREA(ACRES) =      2.30   TOTAL RUNOFF(CFS) =    7.42
  TC(MIN.) =   8.49

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    215.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    63.69  DOWNSTREAM(FEET) =    63.23
  FLOW LENGTH(FEET) =    77.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  11.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.13
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.42
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   8.74
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    215.00 =   317.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    215.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.690
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    1.99
  TOTAL AREA(ACRES) =      2.90   TOTAL RUNOFF(CFS) =    9.41
  TC(MIN.) =   8.74

****************************************************************************
  FLOW PROCESS FROM NODE    215.00 TO NODE    225.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    63.23  DOWNSTREAM(FEET) =    60.78
  FLOW LENGTH(FEET) =   396.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.52
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      9.41
  PIPE TRAVEL TIME(MIN.) =   1.20    Tc(MIN.) =   9.94
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    225.00 =   713.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    215.00 TO NODE    225.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  5 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   71.78  DOWNSTREAM ELEVATION(FEET) =   68.50
  STREET LENGTH(FEET) =   465.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 22.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  17.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.25
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.42
    HALFSTREET FLOOD WIDTH(FEET) =   14.46
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.32
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
  STREET FLOW TRAVEL TIME(MIN.) =   3.34   Tc(MIN.) =  13.28
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.089
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    1.67
  TOTAL AREA(ACRES) =      3.50        PEAK FLOW RATE(CFS) =      11.08

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.93
  FLOW VELOCITY(FEET/SEC.) =  2.36   DEPTH*VELOCITY(FT*FT/SEC.) =   1.00
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    225.00 =  1178.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    225.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.089
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.80   SUBAREA RUNOFF(CFS) =    4.73
  TOTAL AREA(ACRES) =      5.30   TOTAL RUNOFF(CFS) =   15.81
  TC(MIN.) =  13.28

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    225.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.089
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.63
  TOTAL AREA(ACRES) =      6.30   TOTAL RUNOFF(CFS) =   18.43
  TC(MIN.) =  13.28

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE    235.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    60.78  DOWNSTREAM(FEET) =    60.45
  FLOW LENGTH(FEET) =    67.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  18.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.97
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     18.43
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =  13.46
```

```
 LONGEST FLOWPATH FROM NODE    201.00 TO NODE    235.00 =  1245.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    230.00 TO NODE    235.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.069
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.80   SUBAREA RUNOFF(CFS) =    2.21
 TOTAL AREA(ACRES) =      7.10   TOTAL RUNOFF(CFS) =   20.64
 TC(MIN.) =  13.46

****************************************************************************
 FLOW PROCESS FROM NODE    235.00 TO NODE    245.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.45  DOWNSTREAM(FEET) =    58.22
 FLOW LENGTH(FEET) =   409.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  18.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.37
 GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     20.64
 PIPE TRAVEL TIME(MIN.) =   1.07    Tc(MIN.) =  14.54
 LONGEST FLOWPATH FROM NODE    201.00 TO NODE    245.00 =  1654.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    235.00 TO NODE    245.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  5 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   68.50  DOWNSTREAM ELEVATION(FEET) =   64.44
 STREET LENGTH(FEET) =   473.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 22.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  17.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      21.26
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.50
   HALFSTREET FLOOD WIDTH(FEET) =   18.51
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.00
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.49
 STREET FLOW TRAVEL TIME(MIN.) =   2.63   Tc(MIN.) =  17.17
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.727
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    1.23
 TOTAL AREA(ACRES) =      7.60        PEAK FLOW RATE(CFS) =      21.87
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  18.74
  FLOW VELOCITY(FEET/SEC.) =  3.02   DEPTH*VELOCITY(FT*FT/SEC.) =   1.51
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    245.00 =  2127.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    245.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.727
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.80   SUBAREA RUNOFF(CFS) =    4.17
  TOTAL AREA(ACRES) =      9.40   TOTAL RUNOFF(CFS) =   26.04
  TC(MIN.) =  17.17

****************************************************************************
  FLOW PROCESS FROM NODE    242.00 TO NODE    245.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.727
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.32
  TOTAL AREA(ACRES) =     10.40   TOTAL RUNOFF(CFS) =   28.36
  TC(MIN.) =  17.17

****************************************************************************
  FLOW PROCESS FROM NODE    245.00 TO NODE    255.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    58.22  DOWNSTREAM(FEET) =    57.88
  FLOW LENGTH(FEET) =    67.50   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  20.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.72
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     28.36
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =  17.33
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    255.00 =  2194.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    255.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.713
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    2.69
  TOTAL AREA(ACRES) =     11.50   TOTAL RUNOFF(CFS) =   31.05
  TC(MIN.) =  17.33

****************************************************************************
  FLOW PROCESS FROM NODE    255.00 TO NODE    265.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    57.88  DOWNSTREAM(FEET) =    55.95
  FLOW LENGTH(FEET) =   404.50   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  22.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.71
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     31.05
  PIPE TRAVEL TIME(MIN.) =   1.00    Tc(MIN.) =  18.34
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    265.00 =  2599.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    265.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.633
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    4.40   SUBAREA RUNOFF(CFS) =    9.85
  TOTAL AREA(ACRES) =     15.90   TOTAL RUNOFF(CFS) =   40.89
  TC(MIN.) =  18.34

****************************************************************************
  FLOW PROCESS FROM NODE    265.00 TO NODE    270.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    55.95  DOWNSTREAM(FEET) =    54.50
  FLOW LENGTH(FEET) =   281.75   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.27
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     40.89
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =  18.98
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    270.00 =  2880.75 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    201.50 TO NODE    202.50 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =     73.85
  DOWNSTREAM ELEVATION(FEET) =     73.15
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.987
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40
```

```
**************************************************************************
 FLOW PROCESS FROM NODE    202.50 TO NODE    205.50 IS CODE =  62
--------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  6 USED)<<<<<
==========================================================================
 UPSTREAM ELEVATION(FEET) =   73.15  DOWNSTREAM ELEVATION(FEET) =   71.06
 STREET LENGTH(FEET) =   260.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 28.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  23.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.57
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.25
   HALFSTREET FLOOD WIDTH(FEET) =    6.12
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.59
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.40
 STREET FLOW TRAVEL TIME(MIN.) =   2.73   Tc(MIN.) =   8.73
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.692
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    2.33
 TOTAL AREA(ACRES) =      0.80        PEAK FLOW RATE(CFS) =       2.73

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.01
 FLOW VELOCITY(FEET/SEC.) =  1.79   DEPTH*VELOCITY(FT*FT/SEC.) =   0.51
 LONGEST FLOWPATH FROM NODE    201.50 TO NODE    205.50 =   320.00 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE    203.50 TO NODE    205.50 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.692
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    3.00   SUBAREA RUNOFF(CFS) =    9.41
 TOTAL AREA(ACRES) =      3.80   TOTAL RUNOFF(CFS) =   12.14
 TC(MIN.) =   8.73

**************************************************************************
 FLOW PROCESS FROM NODE    204.50 TO NODE    205.50 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.692
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    3.45
 TOTAL AREA(ACRES) =      4.90   TOTAL RUNOFF(CFS) =   15.59
 TC(MIN.) =   8.73
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    205.50 TO NODE    215.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    63.95  DOWNSTREAM(FEET) =    63.47
  FLOW LENGTH(FEET) =    69.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  14.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.55
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     15.59
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   8.90
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    215.50 =   389.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.50 TO NODE    215.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.659
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    2.96
  TOTAL AREA(ACRES) =      5.80   TOTAL RUNOFF(CFS) =   18.56
  TC(MIN.) =   8.90

****************************************************************************
  FLOW PROCESS FROM NODE    215.50 TO NODE    225.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    63.47  DOWNSTREAM(FEET) =    60.73
  FLOW LENGTH(FEET) =   396.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  16.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.82
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     18.56
  PIPE TRAVEL TIME(MIN.) =   0.97    Tc(MIN.) =   9.87
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    225.50 =   785.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    215.50 TO NODE    225.50 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  6 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   71.06  DOWNSTREAM ELEVATION(FEET) =   67.90
  STREET LENGTH(FEET) =   465.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 28.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  23.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      19.55
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.50
    HALFSTREET FLOOD WIDTH(FEET) =   18.89
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.68
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.34
  STREET FLOW TRAVEL TIME(MIN.) =   2.89   Tc(MIN.) =  12.76
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.146
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    1.98
  TOTAL AREA(ACRES) =      6.50        PEAK FLOW RATE(CFS) =      20.54

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.51   HALFSTREET FLOOD WIDTH(FEET) =  19.61
  FLOW VELOCITY(FEET/SEC.) =  2.71   DEPTH*VELOCITY(FT*FT/SEC.) =   1.38
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    225.50 =  1250.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.50 TO NODE    225.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.146
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    2.41
  TOTAL AREA(ACRES) =      7.40   TOTAL RUNOFF(CFS) =   22.95
  TC(MIN.) =  12.76

****************************************************************************
  FLOW PROCESS FROM NODE    222.50 TO NODE    225.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.146
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    2.94
  TOTAL AREA(ACRES) =      8.50   TOTAL RUNOFF(CFS) =   25.89
  TC(MIN.) =  12.76

****************************************************************************
  FLOW PROCESS FROM NODE    225.50 TO NODE    235.50 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    60.73  DOWNSTREAM(FEET) =    57.00
  FLOW LENGTH(FEET) =   476.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.70
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     25.89
  PIPE TRAVEL TIME(MIN.) =   1.03    Tc(MIN.) =  13.79
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    235.50 =  1726.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    225.50 TO NODE    235.50 IS CODE =  62
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  6 USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) =   67.90  DOWNSTREAM ELEVATION(FEET) =   64.76
  STREET LENGTH(FEET) =   476.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 28.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  23.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      27.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.56
    HALFSTREET FLOOD WIDTH(FEET) =   24.29
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.84
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.58
  STREET FLOW TRAVEL TIME(MIN.) =   2.79   Tc(MIN.) =  16.58
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.773
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.20      SUBAREA RUNOFF(CFS) =    3.00
  TOTAL AREA(ACRES) =      9.70        PEAK FLOW RATE(CFS) =      28.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.56   HALFSTREET FLOOD WIDTH(FEET) =  25.18
  FLOW VELOCITY(FEET/SEC.) =  2.87   DEPTH*VELOCITY(FT*FT/SEC.) =   1.62
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    235.50 =  2202.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.50 TO NODE    235.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.773
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    2.12
  TOTAL AREA(ACRES) =     10.60   TOTAL RUNOFF(CFS) =   31.00
  TC(MIN.) =  16.58

****************************************************************************
  FLOW PROCESS FROM NODE    232.50 TO NODE    235.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.773
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.80   SUBAREA RUNOFF(CFS) =    6.60
  TOTAL AREA(ACRES) =     13.40   TOTAL RUNOFF(CFS) =   37.60
  TC(MIN.) =  16.58

****************************************************************************
  FLOW PROCESS FROM NODE    235.50 TO NODE    245.50 IS CODE =  41
```

```
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    57.00  DOWNSTREAM(FEET) =    56.43
  FLOW LENGTH(FEET) =    81.80   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.66
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     37.60
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  16.76
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    245.50 =  2283.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.50 TO NODE    245.50 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.759
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.40   SUBAREA RUNOFF(CFS) =    3.48
  TOTAL AREA(ACRES) =     14.80   TOTAL RUNOFF(CFS) =   41.08
  TC(MIN.) =  16.76

****************************************************************************
  FLOW PROCESS FROM NODE    245.50 TO NODE    270.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    56.43  DOWNSTREAM(FEET) =    54.50
  FLOW LENGTH(FEET) =   390.50   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.14
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     41.08
  PIPE TRAVEL TIME(MIN.) =   0.91    Tc(MIN.) =  17.67
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    270.00 =  2674.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    260.50 TO NODE    270.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.686
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.70   SUBAREA RUNOFF(CFS) =    3.88
  TOTAL AREA(ACRES) =     16.50   TOTAL RUNOFF(CFS) =   44.96
  TC(MIN.) =  17.67

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 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       44.96    17.67       2.686       16.50
  LONGEST FLOWPATH FROM NODE    201.50 TO NODE    270.00 =  2674.30 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)   (MIN.)   (INCH/HOUR)   (ACRE)
      1       40.89    18.98       2.581       15.90
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    270.00 =  2880.75 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      84.26      17.67        2.686
      2      84.10      18.98        2.581

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     84.26   Tc(MIN.) =   17.67
  TOTAL AREA(ACRES) =     32.40

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    200.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    54.50  DOWNSTREAM(FEET) =    44.50
  FLOW LENGTH(FEET) =   379.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  20.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.42
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     84.26
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =  18.06
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    200.00 =  3259.75 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    265.00 TO NODE    200.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.656
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =   11.20   SUBAREA RUNOFF(CFS) =   16.36
  TOTAL AREA(ACRES) =     43.60   TOTAL RUNOFF(CFS) =  100.62
  TC(MIN.) =  18.06
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     43.60  TC(MIN.) =     18.06
  PEAK FLOW RATE(CFS)   =    100.62
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2003 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                              Analysis prepared by:

                            RICK ENGINEERING COMPANY
                                5620 Friars Road
                             San Diego, California 92110
                           619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* JN-18150        SDSU WEST                                              *
* BASIN 300       ONSITE        ULTIMATE CONDITION                       *
* 100-YR 6-HR                                                            *
 **************************************************************************

  FILE NAME: SDSW3P00.RAT
  TIME/DATE OF STUDY: 14:07 01/16/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     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
  2   16.0     11.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  3   19.0     14.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.10 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    301.00 TO NODE    302.00 IS CODE =  21
--------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =     75.28
  DOWNSTREAM ELEVATION(FEET) =     74.58
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.649
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.38
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.38

********************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    305.00 IS CODE =  62
--------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) =   74.58  DOWNSTREAM ELEVATION(FEET) =   73.92
  STREET LENGTH(FEET) =   117.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  11.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.73
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.21
    HALFSTREET FLOOD WIDTH(FEET) =    4.26
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.22
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.26
  STREET FLOW TRAVEL TIME(MIN.) =   1.60   Tc(MIN.) =   7.60
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.906
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    0.70
  TOTAL AREA(ACRES) =      0.30        PEAK FLOW RATE(CFS) =       1.08

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   5.47
  FLOW VELOCITY(FEET/SEC.) =  1.30   DEPTH*VELOCITY(FT*FT/SEC.) =   0.31
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    305.00 =   177.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    315.00 IS CODE =  41
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    66.78  DOWNSTREAM(FEET) =    63.33
  FLOW LENGTH(FEET) =   417.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   3.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.34
```

```
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      1.08
 PIPE TRAVEL TIME(MIN.) =   2.08    Tc(MIN.) =   9.68
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    315.00 =   594.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    305.00 TO NODE    315.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   74.12  DOWNSTREAM ELEVATION(FEET) =   71.83
 STREET LENGTH(FEET) =   390.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 19.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  14.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.90
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.27
   HALFSTREET FLOOD WIDTH(FEET) =    7.27
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.47
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.40
 STREET FLOW TRAVEL TIME(MIN.) =   4.43   Tc(MIN.) =  14.11
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.997
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    1.62
 TOTAL AREA(ACRES) =      0.90        PEAK FLOW RATE(CFS) =       2.70

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.58
 FLOW VELOCITY(FEET/SEC.) =  1.58   DEPTH*VELOCITY(FT*FT/SEC.) =   0.47
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    315.00 =   984.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    310.00 TO NODE    315.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.997
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.55
 TOTAL AREA(ACRES) =      1.90   TOTAL RUNOFF(CFS) =    5.25
 TC(MIN.) =  14.11

****************************************************************************
 FLOW PROCESS FROM NODE    312.00 TO NODE    315.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.997
 *USER SPECIFIED(SUBAREA):
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    2.80
  TOTAL AREA(ACRES) =      3.00   TOTAL RUNOFF(CFS) =    8.05
  TC(MIN.) =  14.11

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    320.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    63.33  DOWNSTREAM(FEET) =    62.63
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS   9.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.25
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.05
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =  14.30
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    320.00 =  1054.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    320.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.977
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.40   SUBAREA RUNOFF(CFS) =    1.07
  TOTAL AREA(ACRES) =      3.40   TOTAL RUNOFF(CFS) =    9.12
  TC(MIN.) =  14.30

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    62.63  DOWNSTREAM(FEET) =    57.69
  FLOW LENGTH(FEET) =   522.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.35
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      9.12
  PIPE TRAVEL TIME(MIN.) =   1.37    Tc(MIN.) =  15.67
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    330.00 =  1576.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   71.83  DOWNSTREAM ELEVATION(FEET) =   67.80
  STREET LENGTH(FEET) =   522.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 19.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  14.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.16
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.41
    HALFSTREET FLOOD WIDTH(FEET) =   14.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.41
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   3.61   Tc(MIN.) =  19.28
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.557
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    2.07
  TOTAL AREA(ACRES) =      4.30        PEAK FLOW RATE(CFS) =      11.19

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.71
  FLOW VELOCITY(FEET/SEC.) =  2.45   DEPTH*VELOCITY(FT*FT/SEC.) =   1.03
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    330.00 =  2098.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.557
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.17
  TOTAL AREA(ACRES) =      5.30   TOTAL RUNOFF(CFS) =   13.37
  TC(MIN.) =  19.28

****************************************************************************
  FLOW PROCESS FROM NODE    327.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.557
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.20   SUBAREA RUNOFF(CFS) =    2.61
  TOTAL AREA(ACRES) =      6.50   TOTAL RUNOFF(CFS) =   15.98
  TC(MIN.) =  19.28

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    385.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    57.69  DOWNSTREAM(FEET) =    54.55
  FLOW LENGTH(FEET) =   411.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.82
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     15.98
  PIPE TRAVEL TIME(MIN.) =   1.00    Tc(MIN.) =  20.29
```

```
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    385.00 =  2509.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    335.00 TO NODE    385.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     67.50  DOWNSTREAM(FEET) =     66.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   340.00   CHANNEL SLOPE =  0.0044
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   4.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.323
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     16.79
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.13
 AVERAGE FLOW DEPTH(FEET) =   0.63   TRAVEL TIME(MIN.) =   2.66
 Tc(MIN.) =  22.95
 SUBAREA AREA(ACRES) =     1.40       SUBAREA RUNOFF(CFS) =    1.63
 TOTAL AREA(ACRES) =      7.90         PEAK FLOW RATE(CFS) =      17.60

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.65   FLOW VELOCITY(FEET/SEC.) =   2.17
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    385.00 =  2849.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    385.00 TO NODE    385.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  22.95
 RAINFALL INTENSITY(INCH/HR) =   2.32
 TOTAL STREAM AREA(ACRES) =     7.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.60

****************************************************************************
 FLOW PROCESS FROM NODE    341.00 TO NODE    342.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .9000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
 UPSTREAM ELEVATION(FEET) =     75.28
 DOWNSTREAM ELEVATION(FEET) =     74.63
 ELEVATION DIFFERENCE(FEET) =      0.65
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.715
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =      0.38
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.38

****************************************************************************
 FLOW PROCESS FROM NODE    342.00 TO NODE    350.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
```

```
  UPSTREAM ELEVATION(FEET) =   74.63  DOWNSTREAM ELEVATION(FEET) =   71.93
  STREET LENGTH(FEET) =   315.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 19.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  14.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.19
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.08
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.57
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.36
  STREET FLOW TRAVEL TIME(MIN.) =   3.33   Tc(MIN.) =   9.33
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.576
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    1.61
  TOTAL AREA(ACRES) =      0.60        PEAK FLOW RATE(CFS) =       1.99

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   6.78
  FLOW VELOCITY(FEET/SEC.) =  1.72   DEPTH*VELOCITY(FT*FT/SEC.) =   0.45
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    350.00 =   375.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    345.00 TO NODE    350.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.576
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    2.74
  TOTAL AREA(ACRES) =      1.50   TOTAL RUNOFF(CFS) =    4.72
  TC(MIN.) =   9.33

****************************************************************************
  FLOW PROCESS FROM NODE    347.00 TO NODE    350.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.576
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    3.04
  TOTAL AREA(ACRES) =      2.50   TOTAL RUNOFF(CFS) =    7.76
  TC(MIN.) =   9.33

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    355.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    64.70  DOWNSTREAM(FEET) =    64.32
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  12.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.88
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.76
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =   9.59
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    355.00 =   450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    355.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.528
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.20   SUBAREA RUNOFF(CFS) =    0.63
  TOTAL AREA(ACRES) =      2.70   TOTAL RUNOFF(CFS) =    8.40
  TC(MIN.) =   9.59

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    360.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    64.32  DOWNSTREAM(FEET) =    63.66
  FLOW LENGTH(FEET) =   138.70   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  12.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.86
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.40
  PIPE TRAVEL TIME(MIN.) =   0.48    Tc(MIN.) =  10.07
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    360.00 =   588.70 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    370.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    63.66  DOWNSTREAM(FEET) =    61.22
  FLOW LENGTH(FEET) =   323.70   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.77
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.40
  PIPE TRAVEL TIME(MIN.) =   0.93    Tc(MIN.) =  11.00
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    370.00 =   912.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    365.00 TO NODE    370.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   71.93  DOWNSTREAM ELEVATION(FEET) =   68.33
  STREET LENGTH(FEET) =   320.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 19.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  14.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.24
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   12.57
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.72
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.03
  STREET FLOW TRAVEL TIME(MIN.) =   1.96   Tc(MIN.) =  12.96
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.124
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    1.69
  TOTAL AREA(ACRES) =      3.30        PEAK FLOW RATE(CFS) =      10.09

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.07
  FLOW VELOCITY(FEET/SEC.) =  2.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.07
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    370.00 =  1232.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    370.00 TO NODE    380.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    61.22  DOWNSTREAM(FEET) =    58.40
  FLOW LENGTH(FEET) =   354.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  11.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.13
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     10.09
  PIPE TRAVEL TIME(MIN.) =   0.96    Tc(MIN.) =  13.92
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    380.00 =  1586.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    375.00 TO NODE    380.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   68.33  DOWNSTREAM ELEVATION(FEET) =   65.18
  STREET LENGTH(FEET) =   320.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 19.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  14.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.72
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.40
    HALFSTREET FLOOD WIDTH(FEET) =   13.72
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.68
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.07
  STREET FLOW TRAVEL TIME(MIN.) =   1.99   Tc(MIN.) =  15.92
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.827
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    1.27
  TOTAL AREA(ACRES) =      3.80        PEAK FLOW RATE(CFS) =      11.36

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.05
  FLOW VELOCITY(FEET/SEC.) =  2.71   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    380.00 =  1906.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    376.00 TO NODE    380.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.827
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.30   SUBAREA RUNOFF(CFS) =    3.12
  TOTAL AREA(ACRES) =      5.10   TOTAL RUNOFF(CFS) =   14.48
  TC(MIN.) =  15.92

****************************************************************************
  FLOW PROCESS FROM NODE    377.00 TO NODE    380.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.827
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    2.16
  TOTAL AREA(ACRES) =      6.00   TOTAL RUNOFF(CFS) =   16.64
  TC(MIN.) =  15.92

****************************************************************************
  FLOW PROCESS FROM NODE    380.00 TO NODE    385.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    58.40  DOWNSTREAM(FEET) =    54.55
  FLOW LENGTH(FEET) =   136.20   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   9.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.96
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     16.64
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =  16.12
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    385.00 =  2042.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    385.00 TO NODE    385.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  16.12
  RAINFALL INTENSITY(INCH/HR) =   2.81
  TOTAL STREAM AREA(ACRES) =     6.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.64

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       17.60    22.95        2.323          7.90
      2       16.64    16.12        2.810          6.00

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       31.19    16.12       2.810
      2       31.36    22.95       2.323

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     31.36   Tc(MIN.) =   22.95
  TOTAL AREA(ACRES) =     13.90
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    385.00 =  2849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    385.00 TO NODE    390.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    54.55  DOWNSTREAM(FEET) =    53.80
  FLOW LENGTH(FEET) =   144.60   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  21.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.95
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     31.36
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =  23.30
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    390.00 =  2993.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    386.00 TO NODE    390.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.302
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.70   SUBAREA RUNOFF(CFS) =    1.45
  TOTAL AREA(ACRES) =     14.60   TOTAL RUNOFF(CFS) =   32.81
  TC(MIN.) =  23.30

****************************************************************************
  FLOW PROCESS FROM NODE    390.00 TO NODE    391.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    53.80  DOWNSTREAM(FEET) =    52.33
  FLOW LENGTH(FEET) =    63.60   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.32
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     32.81
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =  23.38
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    391.00 =  3057.20 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    391.00 TO NODE    393.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    52.33  DOWNSTREAM(FEET) =    47.87
  FLOW LENGTH(FEET) =   196.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  13.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.12
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     32.81
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =  23.65
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    393.00 =  3253.20 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    393.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.281
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    3.60   SUBAREA RUNOFF(CFS) =    3.69
  TOTAL AREA(ACRES) =     18.20   TOTAL RUNOFF(CFS) =   36.51
  TC(MIN.) =  23.65

****************************************************************************
  FLOW PROCESS FROM NODE    393.00 TO NODE    300.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    47.87  DOWNSTREAM(FEET) =    46.60
  FLOW LENGTH(FEET) =   259.50   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  22.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.09
  GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     36.51
  PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =  24.26
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    300.00 =  3512.70 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    300.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  24.26
  RAINFALL INTENSITY(INCH/HR) =   2.24
  TOTAL STREAM AREA(ACRES) =    18.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     36.51
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    395.00 TO NODE    396.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =     74.50
  DOWNSTREAM ELEVATION(FEET) =     74.00
  ELEVATION DIFFERENCE(FEET) =      0.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.890
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.661
  SUBAREA RUNOFF(CFS) =      0.18
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.18

****************************************************************************
  FLOW PROCESS FROM NODE    396.00 TO NODE    397.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     74.00  DOWNSTREAM(FEET) =     72.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   550.00   CHANNEL SLOPE =  0.0036
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.229
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.13
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.59
  AVERAGE FLOW DEPTH(FEET) =   0.09   TRAVEL TIME(MIN.) =  15.62
  Tc(MIN.) =  24.51
  SUBAREA AREA(ACRES) =     1.60       SUBAREA RUNOFF(CFS) =    1.78
  TOTAL AREA(ACRES) =      1.70         PEAK FLOW RATE(CFS) =       1.97

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.13   FLOW VELOCITY(FEET/SEC.) =   0.76
  LONGEST FLOWPATH FROM NODE    395.00 TO NODE    397.00 =   610.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    397.00 TO NODE    398.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    72.00  DOWNSTREAM(FEET) =    56.60
  FLOW LENGTH(FEET) =   275.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   2.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.39
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      1.97
  PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =  25.13
  LONGEST FLOWPATH FROM NODE    395.00 TO NODE    398.00 =   885.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    398.00 TO NODE    300.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     56.60  DOWNSTREAM(FEET) =     51.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1470.00   CHANNEL SLOPE =  0.0033
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.598
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.81
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.23
  AVERAGE FLOW DEPTH(FEET) =   0.30   TRAVEL TIME(MIN.) =  19.98
  Tc(MIN.) =  45.11
  SUBAREA AREA(ACRES) =    14.30       SUBAREA RUNOFF(CFS) =   11.42
  TOTAL AREA(ACRES) =     16.00         PEAK FLOW RATE(CFS) =      13.39

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.41   FLOW VELOCITY(FEET/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE    395.00 TO NODE    300.00 =  2355.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    300.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  45.11
  RAINFALL INTENSITY(INCH/HR) =   1.60
  TOTAL STREAM AREA(ACRES) =    16.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.39

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       36.51    24.26        2.244         18.20
      2       13.39    45.11        1.598         16.00

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       46.04    24.26       2.244
      2       39.38    45.11       1.598

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     46.04   Tc(MIN.) =   24.26
  TOTAL AREA(ACRES) =     34.20
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    300.00 =  3512.70 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     34.20  TC(MIN.) =     24.26
  PEAK FLOW RATE(CFS)   =     46.04
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2003 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                              Analysis prepared by:

                            RICK ENGINEERING COMPANY
                                5620 Friars Road
                              San Diego, California 92110
                           619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* JN-18150          SDSU WEST                                            *
* BASIN 400           ONSITE            ULTIMATE CONDITION               *
* 100-YR 6-HR                                                            *
 **************************************************************************

  FILE NAME: SDSW4P00.RAT
  TIME/DATE OF STUDY: 17:08 01/21/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     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    401.00 TO NODE    402.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
```

```
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =     54.00
  DOWNSTREAM ELEVATION(FEET) =     53.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.692
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.699
  SUBAREA RUNOFF(CFS) =      0.17
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    400.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     53.00  DOWNSTREAM(FEET) =     49.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   590.00   CHANNEL SLOPE =  0.0068
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.611
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.54
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.99
  AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   9.92
  Tc(MIN.) =  18.61
  SUBAREA AREA(ACRES) =     3.90       SUBAREA RUNOFF(CFS) =    4.58
  TOTAL AREA(ACRES) =      4.00        PEAK FLOW RATE(CFS) =       4.75

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.18   FLOW VELOCITY(FEET/SEC.) =   1.27
  LONGEST FLOWPATH FROM NODE    401.00 TO NODE    400.00 =   660.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      4.00  TC(MIN.) =     18.61
  PEAK FLOW RATE(CFS)   =      4.75
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

APPENDIX D

Backup Calculations for Weighted Runoff Coefficients

SDSU West
J-18150
1/28/2019

Weighted Runoff Coefficient Back-up

	Pre-Project	
	Land Use	
	Undisturbed Natural Terrain	Asphalt/Concrete
Runoff Coefficient for 'D' Soils[1]	0.45	0.95
% Imperviousness	0%	100%

U/S Node	D/S Node	AES Code	Area by Land Use		Weighted Runoff Coefficient
			Undisturbed Natural Terrain	Asphalt/Concrete	
101	102	2	0.0	0.1	0.95
102	105	6	0.0	0.7	0.95
105	110	5	0.4	3.3	0.90
110	115	5	0.1	5.2	0.95
115	120	5	0.1	5.7	0.95
120	125	5	0.1	6.0	0.95
125	130	5	0.0	6.8	0.95
130	135	5	0.3	7.4	0.94
135	140	5	1.1	5.9	0.88
140	145	5	1.0	5.1	0.87
145	150	5	0.4	5.8	0.92
150	155	5	0.3	5.4	0.93
155	160	5	1.5	30.6	0.93
201	202	2	0.0	0.1	0.95
202	205	5	2.5	8.1	0.84
203	205	8	0.1	0.4	0.87
301	302	2	0.0	0.1	0.95
302	305	6	0.0	0.2	0.95
305	310	5	0.2	1.8	0.90
310	315	5	0.1	3.4	0.93
315	320	5	0.1	3.7	0.94
320	325	5	0.1	4.0	0.95
325	330	5	0.0	3.7	0.95
330	335	5	0.4	7.3	0.93
335	340	5	0.1	4.2	0.95

SDSU West
J-18150
1/28/2019

U/S Node	D/S Node	AES Code	Area by Land Use		Weighted Runoff Coefficient
			Undisturbed Natural Terrain	Asphalt/Concrete	
340	345	5	0.1	3.5	0.95
345	350	5	0.0	3.7	0.95
350	355	5	0.1	4.2	0.95
355	360	5	0.0	3.7	0.95
360	365	5	0.1	3.6	0.94
365	370	5	0.7	15.2	0.93
401	402	2	0.1	0.0	0.45
402	400	5	4.7	1.0	0.54

Notes:
1. The runoff coefficients for each land use are based on guidance provided in the City of San Diego Drainage Design Manual (January 2017) and are modeled based on type 'D' soils.

SDSU West
J-18150
1/28/2019

Runoff Coefficient Back-up

	Post-Project	
	Land Use	
	Undisturbed Natural Terrain	Asphalt/Concrete
Runoff Coefficient for 'D' Soils[1]	0.45	0.95
% Imperviousness	0%	100%

U/S Node	D/S Node	% Area by Land Use		Weighted Runoff Coefficient
		Undisturbed Natural Terrain	Asphalt/Concrete	
101	102	20%	80%	0.85
102	105	20%	80%	0.85
106	110	20%	80%	0.85
115	120	10%	90%	0.90
111	112	0%	100%	0.95
112	113	0%	100%	0.95
113	120	46%	54%	0.72
120	130	40%	60%	0.75
125	130	20%	80%	0.85
130	140	40%	60%	0.75
135	140	20%	80%	0.85
140	100	90%	10%	0.50
151	152	0%	100%	0.95
152	155	46%	54%	0.72
101.5	102.5	0%	100%	0.95
102.5	105.5	0%	100%	0.95
110.5	115.5	20%	80%	0.85
115.5	125.5	10%	90%	0.90
120.5	125.5	20%	80%	0.85
125.5	135.5	10%	90%	0.90
130.5	135.5	20%	80%	0.85
140.5	145.5	20%	80%	0.85
135.5	155.5	10%	90%	0.90
150.5	160.5	20%	80%	0.85
201	202	20%	80%	0.85

SDSU West
J-18150
1/28/2019

U/S Node	D/S Node	% Area by Land Use		Weighted Runoff Coefficient
		Undisturbed Natural Terrain	Asphalt/Concrete	
202	205	10%	90%	0.90
203	205	20%	80%	0.85
210	215	10%	90%	0.90
215	225	10%	90%	0.90
220	225	20%	80%	0.85
222	225	20%	80%	0.85
230	235	10%	90%	0.90
235	245	10%	90%	0.90
240	245	20%	80%	0.85
242	245	20%	80%	0.85
250	255	10%	90%	0.90
260	265	20%	80%	0.85
201.5	202.5	0%	100%	0.95
202.5	205.5	10%	90%	0.90
203.5	205.5	20%	80%	0.85
204.5	205.5	20%	80%	0.85
210.5	215.5	10%	90%	0.90
215.5	225.5	10%	90%	0.90
220.5	225.5	20%	80%	0.85
222.5	225.5	20%	80%	0.85
225.5	235.5	10%	90%	0.90
230.5	235.5	20%	80%	0.85
232.5	235.5	20%	80%	0.85
240.5	245.5	10%	90%	0.90
260.5	270	20%	80%	0.85
265	200	80%	20%	0.55
301	302	10%	90%	0.90
302	305	10%	90%	0.90
305	315	10%	90%	0.90
310	315	20%	80%	0.85
312	315	20%	80%	0.85
320	320	10%	90%	0.90
320	330	10%	90%	0.90
325	330	20%	80%	0.85
327	330	20%	80%	0.85
335	385	90%	10%	0.50
341	342	10%	90%	0.90
342	350	10%	90%	0.90
345	350	20%	80%	0.85

SDSU West
J-18150
1/28/2019

U/S Node	D/S Node	% Area by Land Use		Weighted Runoff Coefficient
		Undisturbed Natural Terrain	Asphalt/Concrete	
347	350	20%	80%	0.85
355	355	10%	90%	0.90
365	370	10%	90%	0.90
375	380	10%	90%	0.90
376	380	20%	80%	0.85
377	380	20%	80%	0.85
386	390	10%	90%	0.90
392	393	100%	0%	0.45
395	396	90%	10%	0.50
396	397	90%	10%	0.50
398	300	90%	10%	0.50
401	402	100%	0%	0.45
402	400	100%	0%	0.45

Notes:
1. The runoff coefficients for each land use are based on guidance provided in the City of San Diego Drainage Design Manual (January 2017) and are modeled based on type 'D' soils.

APPENDIX E

AES Pipe Flow Hydraulic Analyses
(100-year, 6-hour)

Backbone SD Systems: 100A-100C, 200A-200B & 300A-300B
[Post-Project/Ultimate]

```
**************************************************************************
               PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
          (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
        (c) Copyright 1982-2012 Advanced Engineering Software (aes)
            Ver. 19.1  Release Date: 08/09/2012  License ID 1261

                          Analysis prepared by:

                        Rick Engineering Company
                            5620 Friars Road
                           San Diego, CA. 92110
                       Ph 619-291-0707 Fx 619-291-4165

  ************************* DESCRIPTION OF STUDY *************************
 * JN-18150      SDSU WEST                                                *
 * BASIN 100  BUBBLER HGL ANALYSIS   NODE 100-180   ULTIMATE CONDITION    *
 * 100-YR 6-HR  HGL0 = 45.5' = 10-YR WSEL OF SD RIVER                     *
  **************************************************************************

   FILE NAME: 100_18.PIP
   TIME/DATE OF STUDY: 12:44 02/01/2019

**************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                           NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                    DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+          FLOW          PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   100.00-             5.25*          12067.04        2.82           11260.39
         } FRICTION
   180.00-             5.22*          12053.59        2.99 Dc        11073.51
         } CATCH BASIN
   180.00-            19.38*           7888.36        2.99 Dc          658.32
--------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
**************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   100.00           FLOWLINE ELEVATION =    40.25
  PIPE FLOW =     194.89 CFS       PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    45.500 FEET
--------------------------------------------------------------------------
  NODE   100.00 : HGL = <   45.500>;EGL= <   57.304>;FLOWLINE= <   40.250>

**************************************************************************
  FLOW PROCESS FROM NODE   100.00 TO NODE   180.00 IS CODE =  1
  UPSTREAM NODE   180.00     ELEVATION =    43.60  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     194.89 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      38.88 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    194.89)/(   666.985))**2 = 0.08538
  HF=L*SF = (     38.88)*(0.08538) =      3.319
--------------------------------------------------------------------------
  NODE   180.00 : HGL = <   48.819>;EGL= <   60.623>;FLOWLINE= <   43.600>

**************************************************************************
  FLOW PROCESS FROM NODE   180.00 TO NODE   180.00 IS CODE =  8
```

```
  UPSTREAM NODE   180.00     ELEVATION =    43.60  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =     194.89 CFS          PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =  27.57 FEET/SEC.    VELOCITY HEAD = 11.804 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*( 11.804) =  2.361
--------------------------------------------------------------------------------
  NODE   180.00 : HGL = <   62.984>;EGL= <   62.984>;FLOWLINE= <   43.600>

********************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   180.00            FLOWLINE ELEVATION =    43.60
  ASSUMED UPSTREAM CONTROL HGL =     46.59 FOR DOWNSTREAM RUN ANALYSIS

================================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

****

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 19.1 Release Date: 08/09/2012 License ID 1261

Analysis prepared by:

Rick Engineering Company
5620 Friars Road
San Diego, CA. 92110
Ph 619-291-0707 Fx 619-291-4165

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

* JN-18150 SDSU WEST *
* BASIN 100 BACKBONE SYSTEM 100A ULTIMATE CONDITION *
* 100-YR 6-HR HGL0 = 6" ABOVE BUBBLER RIM @ 53.0 *

****

FILE NAME: SDSW100A.PIP
TIME/DATE OF STUDY: 08:43 01/29/2019

****

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
180.00-		9.40*	9260.76	2.64	2244.95
	} FRICTION				
145.00-		8.43*	8076.66	2.70 Dc	2243.22
	} JUNCTION				
145.00-		8.45*	7890.09	2.42	1850.57
	} FRICTION				
140.00-		7.95*	7271.67	2.50 Dc	1847.85
	} JUNCTION				
140.00-		8.07*	7428.00	1.48	2608.60
	} FRICTION				
137.00-		4.00*	2610.47	2.50 Dc	1847.85
	} JUNCTION				
137.00-		3.95*	2563.01	2.24	1882.49
	} FRICTION				
136.00-		3.21*	2046.70	2.03	1969.62
	} JUNCTION				
136.00-		2.85*	1901.18	2.19	1895.37
	} FRICTION		} HYDRAULIC JUMP		
130.00-		2.50*Dc	1847.85	2.50*Dc	1847.85
	} JUNCTION				
130.00-		2.85*	1638.48	2.31	1618.20
	} FRICTION		} HYDRAULIC JUMP		
126.00-		2.52*Dc	1601.87	2.51*Dc	1601.87
	} JUNCTION				
126.00-		3.33*	1476.81	1.66	1307.14
	} FRICTION		} HYDRAULIC JUMP		
120.00-		2.23*Dc	1165.38	2.23*Dc	1165.38
	} JUNCTION				
120.00-		3.87*	1559.43	2.14 Dc	994.08
	} FRICTION				
116.00-		3.82*	1539.79	2.14 Dc	994.08
	} JUNCTION				
116.00-		4.13*	1615.50	1.73	962.83

```
        } FRICTION
   110.70-              3.50*          1339.43        2.08 Dc          917.73
        } JUNCTION
   110.70-              4.02*          1568.25        1.48            1068.96
        } FRICTION        } HYDRAULIC JUMP
   110.30-              2.08*Dc         917.73        2.08*Dc          917.73
        } JUNCTION
   110.30-              3.03*           936.93        1.30             732.48
        } FRICTION        } HYDRAULIC JUMP
   110.00-              1.80*Dc         635.23        1.80*Dc          635.23
        } JUNCTION
   110.00-              2.10*           808.91        1.88 Dc          780.02
        } FRICTION
   109.00-              3.83*          1146.63        1.76             785.54
        } JUNCTION
   109.00-              3.77*          1135.86        1.88 Dc          780.02
        } FRICTION
   108.00-              5.50*          1474.63        1.88 Dc          780.02
        } JUNCTION
   108.00-              8.25*          1459.73        0.82             127.23
        } FRICTION
   107.00-              6.34*          1085.06        0.79             130.43
        } JUNCTION
   107.00-              6.24*          1066.03        0.83             126.50
        } FRICTION
   105.00-              4.71*           765.40        1.00 Dc          119.57
        } JUNCTION
   105.00-              4.78*           779.72        1.00 Dc          119.57
--------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
********************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   180.00            FLOWLINE ELEVATION =    43.60
  PIPE FLOW =      90.41 CFS        PIPE DIAMETER =  60.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    53.000 FEET
--------------------------------------------------------------------------------
  NODE   180.00 : HGL = <   53.000>;EGL= <   53.329>;FLOWLINE= <   43.600>

********************************************************************************
  FLOW PROCESS FROM NODE   180.00 TO NODE   145.00 IS CODE =  1
  UPSTREAM NODE   145.00     ELEVATION =    44.98  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      90.41 CFS     PIPE DIAMETER =  60.00 INCHES
  PIPE LENGTH =     343.18 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     90.41)/(  2604.442))**2 = 0.00121
  HF=L*SF = (    343.18)*(0.00121) =      0.414
--------------------------------------------------------------------------------
  NODE   145.00 : HGL = <   53.414>;EGL= <   53.743>;FLOWLINE= <   44.980>

********************************************************************************
  FLOW PROCESS FROM NODE   145.00 TO NODE   145.00 IS CODE =  5
  UPSTREAM NODE   145.00     ELEVATION =    45.08  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      77.90    60.00      0.00      45.08      2.50        3.967
    DOWNSTREAM     90.41    60.00       -        44.98      2.70        4.605
```

```
    LATERAL #1     12.51    24.00     44.23     45.08      1.27        3.982
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00089
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00120
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00105
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.004 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.033)+( 0.000) =   0.033
--------------------------------------------------------------------------------
  NODE   145.00 : HGL = <   53.531>;EGL= <   53.775>;FLOWLINE= <   45.080>

********************************************************************************
  FLOW PROCESS FROM NODE   145.00 TO NODE   140.00 IS CODE =  1
  UPSTREAM NODE   140.00     ELEVATION =    45.73  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      77.90 CFS     PIPE DIAMETER =  60.00 INCHES
  PIPE LENGTH =     162.35 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     77.90)/(  2604.436))**2 = 0.00089
  HF=L*SF = (    162.35)*(0.00089) =      0.145
--------------------------------------------------------------------------------
  NODE   140.00 : HGL = <   53.676>;EGL= <   53.921>;FLOWLINE= <   45.730>

********************************************************************************
  FLOW PROCESS FROM NODE   140.00 TO NODE   140.00 IS CODE =  5
  UPSTREAM NODE   140.00     ELEVATION =    45.83  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      77.90    60.00     57.20     45.83      2.50        3.967
    DOWNSTREAM     77.90    60.00       -       45.73      2.50        3.967
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00089
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00089
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00089
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.004 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.228)+( 0.000) =   0.228
--------------------------------------------------------------------------------
  NODE   140.00 : HGL = <   53.904>;EGL= <   54.148>;FLOWLINE= <   45.830>

********************************************************************************
  FLOW PROCESS FROM NODE   140.00 TO NODE   137.00 IS CODE =  1
  UPSTREAM NODE   137.00     ELEVATION =    49.92  (FLOW SEALS IN REACH)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      77.90 CFS     PIPE DIAMETER =  60.00 INCHES
  PIPE LENGTH =     122.05 FEET          MANNING'S N  =  0.01300
================================================================================
```

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 8.07

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	8.074	3.967	8.318	7428.00
94.240	5.000	3.967	5.244	3661.98

NORMAL DEPTH(FT) = 1.37 CRITICAL DEPTH(FT) = 2.50

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 5.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
94.240	5.000	3.966	5.244	3661.98
97.235	4.900	3.985	5.147	3542.44
100.161	4.800	4.020	5.051	3426.15
103.044	4.700	4.066	4.957	3312.71
105.888	4.600	4.121	4.863	3202.14
108.697	4.499	4.184	4.771	3094.54
111.470	4.399	4.256	4.681	2990.06
114.206	4.299	4.336	4.591	2888.85
116.903	4.199	4.424	4.503	2791.05
119.560	4.099	4.520	4.417	2696.83
122.050	4.004	4.621	4.335	2610.47

NODE 137.00 : HGL = < 53.924>;EGL= < 54.255>;FLOWLINE= < 49.920>

****

FLOW PROCESS FROM NODE 137.00 TO NODE 137.00 IS CODE = 5
UPSTREAM NODE 137.00 ELEVATION = 50.02 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	77.90	60.00	21.70	50.02	2.50	4.683
DOWNSTREAM	77.90	60.00	-	49.92	2.50	4.622
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00096
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00093
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00095
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.004 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.055)+(0.000) = 0.055

NODE 137.00 : HGL = < 53.969>;EGL= < 54.310>;FLOWLINE= < 50.020>

****

FLOW PROCESS FROM NODE 137.00 TO NODE 136.00 IS CODE = 1
UPSTREAM NODE 136.00 ELEVATION = 50.75 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 77.90 CFS PIPE DIAMETER = 60.00 INCHES

PIPE LENGTH = 148.63 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 2.28 CRITICAL DEPTH(FT) = 2.50

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 3.95

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	3.949	4.681	4.290	2563.01
12.216	3.891	4.750	4.242	2513.45
24.365	3.833	4.821	4.194	2465.28
36.442	3.775	4.896	4.148	2418.53
48.445	3.717	4.975	4.102	2373.23
60.367	3.659	5.058	4.056	2329.43
72.204	3.601	5.144	4.012	2287.16
83.947	3.543	5.235	3.969	2246.47
95.588	3.485	5.330	3.926	2207.40
107.119	3.427	5.430	3.885	2169.99
118.526	3.369	5.534	3.844	2134.29
129.796	3.310	5.644	3.805	2100.36
140.911	3.252	5.759	3.768	2068.24
148.630	3.211	5.844	3.742	2046.70

NODE 136.00 : HGL = < 53.961>;EGL= < 54.492>;FLOWLINE= < 50.750>

****

FLOW PROCESS FROM NODE 136.00 TO NODE 136.00 IS CODE = 5

UPSTREAM NODE 136.00 ELEVATION = 50.95 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	77.90	60.00	0.00	50.95	2.50	6.732
DOWNSTREAM	77.90	60.00	-	50.75	2.50	5.846
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES

UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00232

DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00162

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00197

JUNCTION LENGTH = 4.00 FEET

FRICTION LOSSES = 0.008 FEET ENTRANCE LOSSES = 0.000 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (0.014)+(0.000) = 0.014

NODE 136.00 : HGL = < 53.802>;EGL= < 54.506>;FLOWLINE= < 50.950>

****

FLOW PROCESS FROM NODE 136.00 TO NODE 130.00 IS CODE = 1

UPSTREAM NODE 130.00 ELEVATION = 52.04 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):

PIPE FLOW = 77.90 CFS PIPE DIAMETER = 60.00 INCHES

PIPE LENGTH = 189.48 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 2.18 CRITICAL DEPTH(FT) = 2.50

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.497	7.943	3.478	1847.85
0.058	2.485	7.995	3.478	1847.92
0.239	2.472	8.047	3.478	1848.15
0.553	2.459	8.100	3.479	1848.53
1.014	2.447	8.153	3.480	1849.06
1.635	2.434	8.207	3.481	1849.75
2.434	2.422	8.262	3.482	1850.60
3.430	2.409	8.318	3.484	1851.60
4.646	2.396	8.374	3.486	1852.77
6.109	2.384	8.432	3.488	1854.11
7.851	2.371	8.490	3.491	1855.61
9.911	2.358	8.548	3.494	1857.27
12.335	2.346	8.608	3.497	1859.11
15.184	2.333	8.668	3.501	1861.12
18.532	2.321	8.729	3.505	1863.31
22.473	2.308	8.791	3.509	1865.67
27.135	2.295	8.854	3.513	1868.22
32.686	2.283	8.918	3.518	1870.94
39.367	2.270	8.983	3.524	1873.85
47.528	2.257	9.048	3.530	1876.95
57.710	2.245	9.115	3.536	1880.24
70.824	2.232	9.182	3.542	1883.72
88.575	2.220	9.250	3.549	1887.39
114.792	2.207	9.320	3.557	1891.27
161.768	2.194	9.390	3.564	1895.34
189.480	2.194	9.391	3.565	1895.37

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.85

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.852	6.730	3.556	1901.18
1.629	2.838	6.771	3.550	1897.17
3.227	2.824	6.813	3.545	1893.31
4.793	2.809	6.855	3.539	1889.60
6.324	2.795	6.898	3.534	1886.03
7.819	2.781	6.941	3.530	1882.61
9.277	2.767	6.985	3.525	1879.34
10.694	2.753	7.030	3.520	1876.22
12.070	2.738	7.075	3.516	1873.25
13.402	2.724	7.120	3.512	1870.43
14.687	2.710	7.167	3.508	1867.77
15.922	2.696	7.214	3.504	1865.27
17.106	2.682	7.261	3.501	1862.93
18.234	2.667	7.309	3.498	1860.75
19.304	2.653	7.358	3.495	1858.73
20.311	2.639	7.408	3.492	1856.88
21.252	2.625	7.458	3.489	1855.19
22.122	2.611	7.509	3.487	1853.68
22.915	2.597	7.561	3.485	1852.33
23.628	2.582	7.613	3.483	1851.15

24.253	2.568	7.666	3.481	1850.15
24.784	2.554	7.720	3.480	1849.33
25.213	2.540	7.775	3.479	1848.69
25.532	2.526	7.830	3.478	1848.22
25.731	2.511	7.886	3.478	1847.94
25.801	2.497	7.943	3.478	1847.85
189.480	2.497	7.943	3.478	1847.85

----------END OF HYDRAULIC JUMP ANALYSIS----------

PRESSURE+MOMENTUM BALANCE OCCURS AT 2.38 FEET UPSTREAM OF NODE 136.00
DOWNSTREAM DEPTH = 2.831 FEET, UPSTREAM CONJUGATE DEPTH = 2.194 FEET

NODE 130.00 : HGL = < 54.537>;EGL= < 55.518>;FLOWLINE= < 52.040>

****

FLOW PROCESS FROM NODE 130.00 TO NODE 130.00 IS CODE = 5
UPSTREAM NODE 130.00 ELEVATION = 52.14 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	64.41	42.00	0.00	52.14	2.52	7.684
DOWNSTREAM	77.90	60.00	-	52.04	2.50	7.946
LATERAL #1	12.44	24.00	90.00	52.14	1.27	3.960
LATERAL #2	1.05	24.00	90.00	52.14	0.35	0.334
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00415
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00359
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00387
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.015 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.387)+(0.000) = 0.387

NODE 130.00 : HGL = < 54.987>;EGL= < 55.904>;FLOWLINE= < 52.140>

****

FLOW PROCESS FROM NODE 130.00 TO NODE 126.00 IS CODE = 1
UPSTREAM NODE 126.00 ELEVATION = 55.27 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 64.41 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 453.31 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 2.30 CRITICAL DEPTH(FT) = 2.52

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.51

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.514	8.704	3.691	1601.87
0.052	2.506	8.735	3.691	1601.90
0.189	2.497	8.767	3.692	1601.99
0.418	2.489	8.798	3.692	1602.12
0.748	2.481	8.831	3.692	1602.31
1.188	2.472	8.863	3.693	1602.56

1.751	2.464	8.896	3.694	1602.86
2.449	2.456	8.929	3.694	1603.21
3.297	2.447	8.962	3.695	1603.61
4.314	2.439	8.996	3.696	1604.07
5.521	2.430	9.030	3.697	1604.59
6.945	2.422	9.065	3.699	1605.16
8.618	2.414	9.099	3.700	1605.79
10.579	2.405	9.134	3.702	1606.48
12.879	2.397	9.170	3.703	1607.22
15.582	2.389	9.206	3.705	1608.02
18.774	2.380	9.242	3.707	1608.88
22.569	2.372	9.278	3.709	1609.80
27.129	2.363	9.315	3.712	1610.78
32.691	2.355	9.352	3.714	1611.81
39.621	2.347	9.390	3.717	1612.91
48.535	2.338	9.428	3.719	1614.07
60.584	2.330	9.466	3.722	1615.29
78.358	2.321	9.505	3.725	1616.58
110.164	2.313	9.544	3.728	1617.92
453.310	2.311	9.552	3.729	1618.20

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.85

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.847	7.682	3.764	1638.48
1.930	2.834	7.715	3.759	1635.73
3.825	2.821	7.749	3.754	1633.08
5.682	2.808	7.784	3.749	1630.52
7.501	2.794	7.819	3.744	1628.07
9.280	2.781	7.855	3.740	1625.72
11.016	2.768	7.891	3.735	1623.47
12.709	2.754	7.928	3.731	1621.33
14.355	2.741	7.965	3.727	1619.29
15.952	2.728	8.003	3.723	1617.36
17.499	2.715	8.042	3.719	1615.53
18.990	2.701	8.081	3.716	1613.82
20.425	2.688	8.121	3.713	1612.21
21.798	2.675	8.161	3.710	1610.71
23.105	2.662	8.202	3.707	1609.33
24.342	2.648	8.244	3.704	1608.06
25.505	2.635	8.287	3.702	1606.90
26.586	2.622	8.330	3.700	1605.86
27.580	2.608	8.373	3.698	1604.94
28.479	2.595	8.418	3.696	1604.13
29.274	2.582	8.463	3.695	1603.45
29.956	2.569	8.509	3.694	1602.88
30.513	2.555	8.555	3.693	1602.44
30.932	2.542	8.603	3.692	1602.12
31.197	2.529	8.651	3.691	1601.93
31.290	2.516	8.699	3.691	1601.87
453.310	2.516	8.699	3.691	1601.87

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 15.27 FEET UPSTREAM OF NODE 130.00
DOWNSTREAM DEPTH = 2.734 FEET, UPSTREAM CONJUGATE DEPTH = 2.311 FEET

NODE 126.00 : HGL = < 57.784>;EGL= < 58.961>;FLOWLINE= < 55.270>

****

FLOW PROCESS FROM NODE 126.00 TO NODE 126.00 IS CODE = 5
UPSTREAM NODE 126.00 ELEVATION = 55.55 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	50.81	42.00	0.00	55.55	2.23	5.381
DOWNSTREAM	64.41	42.00	-	55.27	2.52	8.702
LATERAL #1	12.50	24.00	90.00	55.55	1.27	3.979
LATERAL #2	1.10	24.00	90.00	55.55	0.36	0.350
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00221
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00546
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00384
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.015 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.364)+(0.000) = 0.364

NODE 126.00 : HGL = < 58.876>;EGL= < 59.326>;FLOWLINE= < 55.550>

****

FLOW PROCESS FROM NODE 126.00 TO NODE 120.00 IS CODE = 1
UPSTREAM NODE 120.00 ELEVATION = 59.07 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 50.81 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 276.88 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.64 CRITICAL DEPTH(FT) = 2.23

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.23

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.227	7.864	3.188	1165.38
0.067	2.204	7.961	3.188	1165.59
0.264	2.180	8.061	3.190	1166.19
0.605	2.157	8.164	3.192	1167.20
1.102	2.133	8.271	3.196	1168.62
1.774	2.110	8.380	3.201	1170.47
2.637	2.087	8.492	3.207	1172.76
3.716	2.063	8.608	3.215	1175.49
5.035	2.040	8.728	3.223	1178.69
6.625	2.016	8.851	3.233	1182.37
8.522	1.993	8.978	3.245	1186.54
10.771	1.969	9.109	3.259	1191.21
13.427	1.946	9.243	3.274	1196.41
16.555	1.923	9.383	3.290	1202.15
20.241	1.899	9.526	3.309	1208.44
24.595	1.876	9.675	3.330	1215.31
29.759	1.852	9.828	3.353	1222.78
35.929	1.829	9.986	3.378	1230.86
43.378	1.805	10.149	3.406	1239.59
52.507	1.782	10.318	3.436	1248.97

63.936	1.759	10.493	3.469	1259.04
78.707	1.735	10.674	3.505	1269.83
98.770	1.712	10.861	3.545	1281.36
128.510	1.688	11.054	3.587	1293.66
181.995	1.665	11.255	3.633	1306.76
276.880	1.664	11.261	3.635	1307.14

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 3.33

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	3.326	5.379	3.776	1476.81
3.533	3.282	5.420	3.739	1455.02
6.984	3.238	5.465	3.702	1433.89
10.359	3.194	5.515	3.667	1413.44
13.661	3.150	5.569	3.632	1393.65
16.890	3.106	5.627	3.598	1374.53
20.047	3.063	5.690	3.566	1356.10
23.130	3.019	5.757	3.534	1338.37
26.139	2.975	5.828	3.502	1321.35
29.069	2.931	5.904	3.472	1305.07
31.918	2.887	5.984	3.443	1289.53
34.681	2.843	6.068	3.415	1274.77
37.352	2.799	6.158	3.388	1260.81
39.925	2.755	6.252	3.363	1247.66
42.393	2.711	6.352	3.338	1235.36
44.746	2.667	6.456	3.315	1223.94
46.974	2.623	6.567	3.293	1213.41
49.066	2.579	6.683	3.273	1203.82
51.006	2.536	6.805	3.255	1195.20
52.779	2.492	6.933	3.238	1187.59
54.365	2.448	7.068	3.224	1181.02
55.740	2.404	7.211	3.212	1175.53
56.879	2.360	7.360	3.202	1171.17
57.747	2.316	7.518	3.194	1167.99
58.305	2.272	7.684	3.189	1166.04
58.503	2.228	7.859	3.188	1165.38
276.880	2.228	7.859	3.188	1165.38

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 28.72 FEET UPSTREAM OF NODE 126.00
DOWNSTREAM DEPTH = 2.936 FEET, UPSTREAM CONJUGATE DEPTH = 1.665 FEET

NODE 120.00 : HGL = < 61.297>;EGL= < 62.258>;FLOWLINE= < 59.070>

FLOW PROCESS FROM NODE 120.00 TO NODE 120.00 IS CODE = 5
UPSTREAM NODE 120.00 ELEVATION = 59.27 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	43.34	36.00	90.00	59.27	2.14	8.016
DOWNSTREAM	50.81	42.00	-	59.07	2.23	7.866
LATERAL #1	4.98	36.00	0.00	59.17	0.70	0.903
LATERAL #2	2.49	24.00	90.00	59.27	0.55	0.793
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-

```
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00571
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00474
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00522
  JUNCTION LENGTH =   5.00 FEET
  FRICTION LOSSES =  0.026 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.154)+( 0.000) =   0.154
--------------------------------------------------------------------------------
  NODE   120.00 : HGL = <   61.414>;EGL= <   62.412>;FLOWLINE= <   59.270>

********************************************************************************
  FLOW PROCESS FROM NODE   120.00 TO NODE   116.00 IS CODE =  1
  UPSTREAM NODE   116.00     ELEVATION =    59.54  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      43.34 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      53.40 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     43.34)/(   666.987))**2 = 0.00422
  HF=L*SF = (     53.40)*(0.00422) =      0.225
--------------------------------------------------------------------------------
  NODE   116.00 : HGL = <   63.363>;EGL= <   63.947>;FLOWLINE= <   59.540>

********************************************************************************
  FLOW PROCESS FROM NODE   116.00 TO NODE   116.00 IS CODE =  5
  UPSTREAM NODE   116.00     ELEVATION =    59.64  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      40.85    36.00     30.00     59.64      2.08        5.779
    DOWNSTREAM     43.34    36.00       -       59.54      2.14        6.131
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           2.49===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00375
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00422
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00399
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.016 FEET         ENTRANCE LOSSES =  0.117 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.220)+( 0.117) =   0.337
--------------------------------------------------------------------------------
  NODE   116.00 : HGL = <   63.765>;EGL= <   64.284>;FLOWLINE= <   59.640>

********************************************************************************
  FLOW PROCESS FROM NODE   116.00 TO NODE   110.70 IS CODE =  1
  UPSTREAM NODE   110.70     ELEVATION =    60.64  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      40.85 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      99.73 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     40.85)/(   666.984))**2 = 0.00375
  HF=L*SF = (     99.73)*(0.00375) =      0.374
--------------------------------------------------------------------------------
  NODE   110.70 : HGL = <   64.139>;EGL= <   64.658>;FLOWLINE= <   60.640>

********************************************************************************
  FLOW PROCESS FROM NODE   110.70 TO NODE   110.70 IS CODE =  5
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UPSTREAM NODE 110.70 ELEVATION = 60.74 (FLOW IS UNDER PRESSURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	40.85	36.00	65.30	60.74	2.08	5.779
DOWNSTREAM	40.85	36.00	-	60.64	2.08	5.779
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00375
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00375
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00375
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.015 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.619)+(0.000) = 0.619

NODE 110.70 : HGL = < 64.758>;EGL= < 65.277>;FLOWLINE= < 60.740>

****

FLOW PROCESS FROM NODE 110.70 TO NODE 110.30 IS CODE = 1
UPSTREAM NODE 110.30 ELEVATION = 64.06 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 40.85 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 197.71 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.45 CRITICAL DEPTH(FT) = 2.08

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.08

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.080	7.810	3.027	917.73
0.061	2.054	7.916	3.028	917.95
0.239	2.029	8.025	3.030	918.58
0.543	2.004	8.138	3.033	919.61
0.988	1.979	8.255	3.038	921.08
1.587	1.954	8.377	3.044	922.99
2.358	1.929	8.502	3.052	925.35
3.321	1.904	8.632	3.062	928.18
4.499	1.879	8.767	3.073	931.50
5.920	1.853	8.907	3.086	935.32
7.617	1.828	9.052	3.101	939.67
9.631	1.803	9.202	3.119	944.56
12.010	1.778	9.358	3.139	950.01
14.817	1.753	9.520	3.161	956.04
18.127	1.728	9.688	3.186	962.68
22.042	1.703	9.863	3.214	969.96
26.691	1.678	10.044	3.245	977.89
32.254	1.652	10.233	3.279	986.50
38.979	1.627	10.429	3.317	995.84
47.232	1.602	10.633	3.359	1005.92
57.582	1.577	10.846	3.405	1016.78

70.978	1.552	11.067	3.455	1028.47
89.204	1.527	11.298	3.510	1041.01
116.267	1.502	11.538	3.570	1054.46
165.025	1.477	11.789	3.636	1068.85
197.710	1.476	11.791	3.637	1068.96

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 4.02

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	4.018	5.779	4.537	1568.25
78.082	3.000	5.779	3.519	1119.11

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 3.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
78.082	3.000	5.777	3.519	1119.11
80.684	2.963	5.791	3.484	1103.96
83.096	2.926	5.815	3.452	1089.75
85.396	2.890	5.846	3.421	1076.18
87.606	2.853	5.884	3.391	1063.19
89.737	2.816	5.927	3.362	1050.73
91.795	2.779	5.975	3.334	1038.79
93.785	2.743	6.028	3.307	1027.35
95.709	2.706	6.085	3.281	1016.42
97.566	2.669	6.146	3.256	1005.98
99.357	2.632	6.213	3.232	996.06
101.080	2.596	6.283	3.209	986.66
102.734	2.559	6.358	3.187	977.78
104.315	2.522	6.438	3.166	969.45
105.819	2.485	6.522	3.146	961.66
107.243	2.449	6.611	3.128	954.44
108.580	2.412	6.705	3.110	947.81
109.825	2.375	6.804	3.094	941.78
110.970	2.338	6.908	3.080	936.36
112.006	2.302	7.017	3.067	931.59
112.925	2.265	7.133	3.055	927.47
113.713	2.228	7.254	3.046	924.05
114.358	2.191	7.381	3.038	921.33
114.844	2.155	7.515	3.032	919.35
115.152	2.118	7.656	3.029	918.14
115.260	2.081	7.803	3.027	917.73
197.710	2.081	7.803	3.027	917.73

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 89.81 FEET UPSTREAM OF NODE 110.70
DOWNSTREAM DEPTH = 2.815 FEET, UPSTREAM CONJUGATE DEPTH = 1.509 FEET

NODE 110.30 : HGL = < 66.140>;EGL= < 67.087>;FLOWLINE= < 64.060>

FLOW PROCESS FROM NODE 110.30 TO NODE 110.30 IS CODE = 5

UPSTREAM NODE 110.30 ELEVATION = 64.16 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)

UPSTREAM	30.99	36.00	32.40	64.16	1.80	10.522
DOWNSTREAM	40.85	36.00	-	64.06	2.08	7.812
LATERAL #1	9.86	24.00	90.00	64.16	1.12	3.574
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01411
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00549
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00980
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.039 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.095)+(0.000) = 0.095

NODE 110.30 : HGL = < 65.463>;EGL= < 67.182>;FLOWLINE= < 64.160>

****

FLOW PROCESS FROM NODE 110.30 TO NODE 110.00 IS CODE = 1
UPSTREAM NODE 110.00 ELEVATION = 65.14 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 30.99 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 48.06 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.18 CRITICAL DEPTH(FT) = 1.80

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.80

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.804	6.975	2.560	635.23
0.044	1.779	7.093	2.561	635.42
0.182	1.754	7.216	2.563	635.99
0.424	1.729	7.343	2.567	636.96
0.780	1.704	7.475	2.572	638.34
1.263	1.679	7.612	2.579	640.14
1.889	1.654	7.754	2.588	642.39
2.673	1.629	7.902	2.599	645.10
3.636	1.604	8.057	2.612	648.28
4.801	1.579	8.217	2.628	651.96
6.198	1.554	8.384	2.646	656.17
7.861	1.529	8.559	2.667	660.91
9.832	1.503	8.740	2.690	666.22
12.164	1.478	8.930	2.717	672.12
14.923	1.453	9.128	2.748	678.64
18.195	1.428	9.335	2.782	685.81
22.094	1.403	9.551	2.820	693.66
26.771	1.378	9.777	2.863	702.24
32.443	1.353	10.014	2.911	711.57
39.424	1.328	10.262	2.964	721.70
48.060	1.303	10.518	3.022	732.48

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

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DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 3.03

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PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	3.027	4.384	3.326	936.93
1.494	3.000	4.384	3.298	924.91

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 3.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
1.494	3.000	4.383	3.298	924.91
3.992	2.952	4.398	3.253	904.75
6.377	2.904	4.425	3.209	885.43
8.695	2.857	4.461	3.166	866.77
10.955	2.809	4.504	3.124	848.70
13.165	2.761	4.553	3.083	831.23
15.327	2.713	4.607	3.043	814.34
17.441	2.665	4.668	3.004	798.05
19.507	2.617	4.735	2.966	782.37
21.524	2.570	4.807	2.929	767.32
23.490	2.522	4.885	2.893	752.92
25.403	2.474	4.968	2.858	739.20
27.258	2.426	5.059	2.824	726.16
29.050	2.378	5.155	2.791	713.85
30.776	2.331	5.258	2.760	702.29
32.427	2.283	5.368	2.730	691.51
33.998	2.235	5.486	2.702	681.54
35.478	2.187	5.611	2.676	672.42
36.858	2.139	5.745	2.652	664.18
38.124	2.091	5.888	2.630	656.86
39.263	2.044	6.041	2.611	650.52
40.256	1.996	6.203	2.594	645.20
41.082	1.948	6.377	2.580	640.94
41.716	1.900	6.563	2.569	637.82
42.125	1.852	6.762	2.563	635.89
42.272	1.804	6.975	2.560	635.23
48.060	1.804	6.975	2.560	635.23

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 35.30 FEET UPSTREAM OF NODE 110.30
DOWNSTREAM DEPTH = 2.193 FEET, UPSTREAM CONJUGATE DEPTH = 1.473 FEET

NODE 110.00 : HGL = < 66.944>;EGL= < 67.700>;FLOWLINE= < 65.140>

FLOW PROCESS FROM NODE 110.00 TO NODE 110.00 IS CODE = 5
UPSTREAM NODE 110.00 ELEVATION = 65.24 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	30.99	24.00	55.50	65.24	1.88	9.864
DOWNSTREAM	30.99	36.00	-	65.14	1.80	6.977
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01876

```
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00475
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01176
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.047 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 1.155)+( 0.000) =   1.155
--------------------------------------------------------------------------------
  NODE   110.00 : HGL = <   67.344>;EGL= <   68.855>;FLOWLINE= <   65.240>

********************************************************************************
  FLOW PROCESS FROM NODE   110.00 TO NODE   109.00 IS CODE =  1
  UPSTREAM NODE   109.00     ELEVATION =    67.20  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      30.99 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =     196.25 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     30.99)/(   226.224))**2 = 0.01877
  HF=L*SF = (    196.25)*(0.01877) =      3.683
--------------------------------------------------------------------------------
  NODE   109.00 : HGL = <   71.027>;EGL= <   72.538>;FLOWLINE= <   67.200>

********************************************************************************
  FLOW PROCESS FROM NODE   109.00 TO NODE   109.00 IS CODE =  5
  UPSTREAM NODE   109.00     ELEVATION =    67.30  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      30.99    24.00      0.00     67.30      1.88        9.864
    DOWNSTREAM     30.99    24.00       -       67.20      1.88        9.864
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01876
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01876
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01876
  JUNCTION LENGTH =   2.40 FEET
  FRICTION LOSSES =  0.045 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.045)+( 0.000) =   0.045
--------------------------------------------------------------------------------
  NODE   109.00 : HGL = <   71.072>;EGL= <   72.583>;FLOWLINE= <   67.300>

********************************************************************************
  FLOW PROCESS FROM NODE   109.00 TO NODE   108.00 IS CODE =  1
  UPSTREAM NODE   108.00     ELEVATION =    69.28  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      30.99 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =     197.60 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     30.99)/(   226.224))**2 = 0.01877
  HF=L*SF = (    197.60)*(0.01877) =      3.708
--------------------------------------------------------------------------------
  NODE   108.00 : HGL = <   74.780>;EGL= <   76.291>;FLOWLINE= <   69.280>

********************************************************************************
  FLOW PROCESS FROM NODE   108.00 TO NODE   108.00 IS CODE =  5
  UPSTREAM NODE   108.00     ELEVATION =    69.38  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
```

```
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       7.95    24.00      0.00     69.38      1.00        2.531
    DOWNSTREAM     30.99    24.00       -       69.28      1.88        9.864
    LATERAL #1     13.18    24.00     90.00     69.38      1.31        4.195
    LATERAL #2      9.86    24.00     90.00     69.38      1.12        3.139
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00123
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01876
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01000
  JUNCTION LENGTH =   2.40 FEET
  FRICTION LOSSES =  0.024 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 1.436)+( 0.000) =   1.436
--------------------------------------------------------------------------------
  NODE   108.00 : HGL = <   77.627>;EGL= <   77.727>;FLOWLINE= <   69.380>

********************************************************************************
  FLOW PROCESS FROM NODE   108.00 TO NODE   107.00 IS CODE =  1
  UPSTREAM NODE   107.00     ELEVATION =    71.56  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       7.95 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =     217.60 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((      7.95)/(   226.224))**2 = 0.00123
  HF=L*SF = (    217.60)*(0.00123) =      0.269
--------------------------------------------------------------------------------
  NODE   107.00 : HGL = <   77.896>;EGL= <   77.996>;FLOWLINE= <   71.560>

********************************************************************************
  FLOW PROCESS FROM NODE   107.00 TO NODE   107.00 IS CODE =  5
  UPSTREAM NODE   107.00     ELEVATION =    71.66  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       7.95    24.00      0.00     71.66      1.00        2.531
    DOWNSTREAM      7.95    24.00       -       71.56      1.00        2.531
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00123
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00123
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00123
  JUNCTION LENGTH =   2.40 FEET
  FRICTION LOSSES =  0.003 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.003)+( 0.000) =   0.003
--------------------------------------------------------------------------------
  NODE   107.00 : HGL = <   77.899>;EGL= <   77.999>;FLOWLINE= <   71.660>

********************************************************************************
  FLOW PROCESS FROM NODE   107.00 TO NODE   105.00 IS CODE =  1
  UPSTREAM NODE   105.00     ELEVATION =    73.41  (FLOW IS UNDER PRESSURE)
```

```
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       7.95 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =     175.25 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((      7.95)/(   226.223))**2 = 0.00123
  HF=L*SF = (    175.25)*(0.00123) =      0.216
------------------------------------------------------------------------------
  NODE   105.00 : HGL = <   78.116>;EGL= <   78.215>;FLOWLINE= <   73.410>

******************************************************************************
  FLOW PROCESS FROM NODE   105.00 TO NODE   105.00 IS CODE =  5
  UPSTREAM NODE   105.00     ELEVATION =    73.51  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       7.95    24.00     81.10     73.51      1.00        2.531
    DOWNSTREAM      7.95    24.00       -       73.41      1.00        2.531
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00123
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00123
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00123
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.005 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.173)+( 0.000) =   0.173
------------------------------------------------------------------------------
  NODE   105.00 : HGL = <   78.289>;EGL= <   78.388>;FLOWLINE= <   73.510>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   105.00           FLOWLINE ELEVATION =    73.51
  ASSUMED UPSTREAM CONTROL HGL =     74.51 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 19.1 Release Date: 08/09/2012 License ID 1261

Analysis prepared by:

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

* JN-18150 SDSU WEST *
* BASIN 100 BACKBONE SYSTEM 100B ULTIMATE CONDITION *
* 100-YR 6-HR *

****

FILE NAME: SDSW100B.PIP
TIME/DATE OF STUDY: 08:58 01/29/2019

****

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
170.00-		9.17*	3433.26	1.16 Dc	214.30
	} FRICTION				
167.00-		8.16*	2985.40	1.00	222.41
	} JUNCTION				
167.00-		8.06*	2942.00	1.16 Dc	214.30
	} FRICTION				
166.00-		7.70*	2784.12	0.84	249.48
	} JUNCTION				
166.00-		7.40*	2653.03	0.92	233.85
	} FRICTION				
165.00-		7.37*	2636.26	0.91	234.77
	} JUNCTION				
165.00-		7.21*	1896.55	1.23 Dc	223.16
	} FRICTION				
163.00-		6.18*	1580.49	1.06	231.02
	} JUNCTION				
163.00-		6.08*	1551.17	1.16	224.43
	} FRICTION				
162.00-		4.51*	1069.90	1.03	233.71
	} JUNCTION				
162.00-		4.42*	1040.57	1.09	228.26
	} FRICTION				
161.00-		4.23*	984.89	1.02	234.65
	} JUNCTION				
161.00-		4.14*	955.57	1.07	229.50
	} FRICTION				
160.00-		4.12*	950.67	1.06	230.46
	} JUNCTION				
160.00-		4.03*	921.35	1.23 Dc	223.16

MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST

CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
DESIGN MANUALS.

****

DOWNSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 170.00 FLOWLINE ELEVATION = 44.40
PIPE FLOW = 13.41 CFS PIPE DIAMETER = 36.00 INCHES
ASSUMED DOWNSTREAM CONTROL HGL = 53.572 FEET

NODE 170.00 : HGL = < 53.572>;EGL= < 53.628>;FLOWLINE= < 44.400>

****

FLOW PROCESS FROM NODE 170.00 TO NODE 167.00 IS CODE = 1
UPSTREAM NODE 167.00 ELEVATION = 45.53 (FLOW IS UNDER PRESSURE)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 13.41 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 283.54 FEET MANNING'S N = 0.01300
SF=(Q/K)**2 = ((13.41)/(666.980))**2 = 0.00040
HF=L*SF = (283.54)*(0.00040) = 0.115

NODE 167.00 : HGL = < 53.687>;EGL= < 53.743>;FLOWLINE= < 45.530>

****

FLOW PROCESS FROM NODE 167.00 TO NODE 167.00 IS CODE = 5
UPSTREAM NODE 167.00 ELEVATION = 45.63 (FLOW IS UNDER PRESSURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	13.41	36.00	0.00	45.63	1.16	1.897
DOWNSTREAM	13.41	36.00	-	45.53	1.16	1.897
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00040
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00040
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00040
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.002 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.002)+(0.000) = 0.002

NODE 167.00 : HGL = < 53.688>;EGL= < 53.744>;FLOWLINE= < 45.630>

****

FLOW PROCESS FROM NODE 167.00 TO NODE 166.00 IS CODE = 1
UPSTREAM NODE 166.00 ELEVATION = 46.06 (FLOW IS UNDER PRESSURE)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 13.41 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 178.20 FEET MANNING'S N = 0.01300
SF=(Q/K)**2 = ((13.41)/(667.004))**2 = 0.00040
HF=L*SF = (178.20)*(0.00040) = 0.072

NODE 166.00 : HGL = < 53.760>;EGL= < 53.816>;FLOWLINE= < 46.060>

****

FLOW PROCESS FROM NODE 166.00 TO NODE 166.00 IS CODE = 5
UPSTREAM NODE 166.00 ELEVATION = 46.36 (FLOW IS UNDER PRESSURE)

```
-------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      13.41    36.00      0.00     46.36      1.16        1.897
    DOWNSTREAM     13.41    36.00       -       46.06      1.16        1.897
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00040
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00040
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00040
  JUNCTION LENGTH =   7.00 FEET
  FRICTION LOSSES =  0.003 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.003)+( 0.000) =   0.003
-------------------------------------------------------------------------------
  NODE   166.00 : HGL = <   53.763>;EGL= <   53.819>;FLOWLINE= <   46.360>

*******************************************************************************
  FLOW PROCESS FROM NODE   166.00 TO NODE   165.00 IS CODE =  1
  UPSTREAM NODE   165.00     ELEVATION =    46.40  (FLOW IS UNDER PRESSURE)
-------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      13.41 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =       4.83 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     13.41)/(   666.864))**2 = 0.00040
  HF=L*SF = (      4.83)*(0.00040) =      0.002
-------------------------------------------------------------------------------
  NODE   165.00 : HGL = <   53.765>;EGL= <   53.821>;FLOWLINE= <   46.400>

*******************************************************************************
  FLOW PROCESS FROM NODE   165.00 TO NODE   165.00 IS CODE =  5
  UPSTREAM NODE   165.00     ELEVATION =    46.50  (FLOW IS UNDER PRESSURE)
-------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      13.41    30.00      0.00     46.50      1.23        2.732
    DOWNSTREAM     13.41    36.00       -       46.40      1.16        1.897
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00040
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00074
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.003 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.005)+( 0.000) =   0.005
-------------------------------------------------------------------------------
  NODE   165.00 : HGL = <   53.710>;EGL= <   53.826>;FLOWLINE= <   46.500>

*******************************************************************************
  FLOW PROCESS FROM NODE   165.00 TO NODE   163.00 IS CODE =  1
```

```
  UPSTREAM NODE   163.00     ELEVATION =    47.91  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      13.41 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     353.77 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     13.41)/(   410.174))**2 = 0.00107
  HF=L*SF = (    353.77)*(0.00107) =      0.378
--------------------------------------------------------------------------------
  NODE   163.00 : HGL = <   54.088>;EGL= <   54.204>;FLOWLINE= <   47.910>

********************************************************************************
  FLOW PROCESS FROM NODE   163.00 TO NODE   163.00 IS CODE =  5
  UPSTREAM NODE   163.00     ELEVATION =    48.01  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      13.41    30.00      0.00     48.01      1.23        2.732
    DOWNSTREAM     13.41    30.00       -       47.91      1.23        2.732
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00107
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.004 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.004)+( 0.000) =   0.004
--------------------------------------------------------------------------------
  NODE   163.00 : HGL = <   54.092>;EGL= <   54.208>;FLOWLINE= <   48.010>

********************************************************************************
  FLOW PROCESS FROM NODE   163.00 TO NODE   162.00 IS CODE =  1
  UPSTREAM NODE   162.00     ELEVATION =    49.96  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      13.41 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     354.37 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     13.41)/(   410.172))**2 = 0.00107
  HF=L*SF = (    354.37)*(0.00107) =      0.379
--------------------------------------------------------------------------------
  NODE   162.00 : HGL = <   54.471>;EGL= <   54.587>;FLOWLINE= <   49.960>

********************************************************************************
  FLOW PROCESS FROM NODE   162.00 TO NODE   162.00 IS CODE =  5
  UPSTREAM NODE   162.00     ELEVATION =    50.06  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      13.41    30.00      0.00     50.06      1.23        2.732
    DOWNSTREAM     13.41    30.00       -       49.96      1.23        2.732
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
```

```
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00107
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.004 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.004)+( 0.000) =   0.004
--------------------------------------------------------------------------------
  NODE   162.00 : HGL = <   54.475>;EGL= <   54.591>;FLOWLINE= <   50.060>

********************************************************************************
  FLOW PROCESS FROM NODE   162.00 TO NODE   161.00 IS CODE =  1
  UPSTREAM NODE   161.00     ELEVATION =    50.28  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      13.41 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =      35.75 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     13.41)/(   410.174))**2 = 0.00107
  HF=L*SF = (     35.75)*(0.00107) =      0.038
--------------------------------------------------------------------------------
  NODE   161.00 : HGL = <   54.514>;EGL= <   54.630>;FLOWLINE= <   50.280>

********************************************************************************
  FLOW PROCESS FROM NODE   161.00 TO NODE   161.00 IS CODE =  5
  UPSTREAM NODE   161.00     ELEVATION =    50.38  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      13.41    30.00      0.00     50.38      1.23        2.732
    DOWNSTREAM     13.41    30.00       -       50.28      1.23        2.732
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00107
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.004 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.004)+( 0.000) =   0.004
--------------------------------------------------------------------------------
  NODE   161.00 : HGL = <   54.518>;EGL= <   54.634>;FLOWLINE= <   50.380>

********************************************************************************
  FLOW PROCESS FROM NODE   161.00 TO NODE   160.00 IS CODE =  1
  UPSTREAM NODE   160.00     ELEVATION =    50.40  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      13.41 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =       3.75 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     13.41)/(   410.122))**2 = 0.00107
  HF=L*SF = (      3.75)*(0.00107) =      0.004
--------------------------------------------------------------------------------
  NODE   160.00 : HGL = <   54.522>;EGL= <   54.638>;FLOWLINE= <   50.400>

********************************************************************************
  FLOW PROCESS FROM NODE   160.00 TO NODE   160.00 IS CODE =  5
```

```
  UPSTREAM NODE   160.00     ELEVATION =    50.50  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      13.41    30.00      0.00     50.50      1.23        2.732
    DOWNSTREAM     13.41    30.00       -       50.40      1.23        2.732
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00107
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00107
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.004 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.004)+( 0.000) =   0.004
--------------------------------------------------------------------------------
  NODE   160.00 : HGL = <   54.526>;EGL= <   54.642>;FLOWLINE= <   50.500>

********************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   160.00           FLOWLINE ELEVATION =    50.50
  ASSUMED UPSTREAM CONTROL HGL =     51.73 FOR DOWNSTREAM RUN ANALYSIS

================================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 19.1 Release Date: 08/09/2012 License ID 1261

Analysis prepared by:

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

* JN-18150 SDSU WEST *
* BASIN 100 BACKBONE SYSTEM 100C ULTIMATE CONDITION *
* 100-YR 6-HR HGL0 = 6" ABOVE BUBBLER RIM @ 53.0 *

****

FILE NAME: SDSW100C.PIP
TIME/DATE OF STUDY: 08:50 01/29/2019

****

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
180.00-		9.40*	9188.23	2.56	2112.08
	} FRICTION				
170.00-		8.89*	8562.58	2.63 Dc	2109.53
	} JUNCTION				
170.00-		8.67*	6104.56	2.55	1884.65
	} FRICTION				
162.50-		7.38*	5091.76	2.62 Dc	1882.13
	} JUNCTION				
162.50-		7.57*	5243.31	1.76	2308.51
	} FRICTION		} HYDRAULIC JUMP		
160.50-		2.63*Dc	1882.13	2.62*Dc	1882.13
	} JUNCTION				
160.50-		4.16*	2564.06	2.26	1942.42
	} FRICTION				
155.50-		3.83*	2319.62	2.62 Dc	1882.13
	} JUNCTION				
155.50-		4.12*	2249.31	1.72	1664.22
	} FRICTION		} HYDRAULIC JUMP		
147.50-		2.37 Dc	1449.63	2.09*	1482.56
	} JUNCTION				
147.50-		2.37 Dc	1449.63	2.23*	1457.60
	} FRICTION				
145.50-		2.37*Dc	1449.63	2.37*Dc	1449.63
	} JUNCTION				
145.50-		3.18*	1408.21	1.81	1119.76
	} FRICTION		} HYDRAULIC JUMP		
137.50-		2.11 Dc	1082.01	1.64*	1185.21
	} JUNCTION				
137.50-		2.29 Dc	1189.80	1.98*	1223.94
	} FRICTION				
136.50-		2.29*Dc	1189.80	2.29*Dc	1189.80
	} JUNCTION				
136.50-		2.69*	1236.78	2.29 Dc	1189.80

```
      } FRICTION
  135.50-             2.41*          1194.42        2.29 Dc         1189.80
      } JUNCTION
  135.50-             3.00*          1164.71        1.75            1035.28
      } FRICTION        } HYDRAULIC JUMP
  132.50-             2.13 Dc         981.05        1.74*           1038.22
      } JUNCTION
  132.50-             2.13 Dc         981.05        1.77*           1030.38
      } FRICTION
  125.50-             2.13*Dc         981.05        2.13*Dc          981.06
      } JUNCTION
  125.50-             2.50*           905.77        1.83             861.79
      } FRICTION        } HYDRAULIC JUMP
  120.50-             2.04 Dc         847.27        1.80*            867.33
      } JUNCTION
  120.50-             2.05 Dc         847.27        1.84*            860.85
      } FRICTION
  115.50-             2.04*Dc         847.27        2.04*Dc          847.27
      } JUNCTION
  115.50-             4.08*          1241.22        1.89 Dc          671.33
--------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
********************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   180.00            FLOWLINE ELEVATION =    43.60
  PIPE FLOW =      86.25 CFS        PIPE DIAMETER =  60.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    53.000 FEET
--------------------------------------------------------------------------------
  NODE   180.00 : HGL = <   53.000>;EGL= <   53.300>;FLOWLINE= <   43.600>

********************************************************************************
  FLOW PROCESS FROM NODE   180.00 TO NODE   170.00 IS CODE =  1
  UPSTREAM NODE   170.00     ELEVATION =    44.30  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      86.25 CFS     PIPE DIAMETER =  60.00 INCHES
  PIPE LENGTH =     172.65 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     86.25)/(  2604.438))**2 = 0.00110
  HF=L*SF = (    172.65)*(0.00110) =      0.189
--------------------------------------------------------------------------------
  NODE   170.00 : HGL = <   53.189>;EGL= <   53.489>;FLOWLINE= <   44.300>

********************************************************************************
  FLOW PROCESS FROM NODE   170.00 TO NODE   170.00 IS CODE =  5
  UPSTREAM NODE   170.00     ELEVATION =    44.40  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      75.27    48.00     18.30     44.40      2.63        5.990
    DOWNSTREAM     86.25    60.00       -       44.30      2.63        4.393
    LATERAL #1     10.98    36.00     17.62     44.40      1.05        1.553
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00275
```

```
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00110
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00192
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.008 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.139)+( 0.000) =   0.139
--------------------------------------------------------------------------------
  NODE   170.00 : HGL = <   53.071>;EGL= <   53.628>;FLOWLINE= <   44.400>

********************************************************************************
  FLOW PROCESS FROM NODE   170.00 TO NODE   162.50 IS CODE =  1
  UPSTREAM NODE   162.50     ELEVATION =    47.20  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      75.27 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     549.34 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     75.27)/(  1436.438))**2 = 0.00275
  HF=L*SF = (    549.34)*(0.00275) =      1.508
--------------------------------------------------------------------------------
  NODE   162.50 : HGL = <   54.579>;EGL= <   55.136>;FLOWLINE= <   47.200>

********************************************************************************
  FLOW PROCESS FROM NODE   162.50 TO NODE   162.50 IS CODE =  5
  UPSTREAM NODE   162.50     ELEVATION =    47.30  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      75.27    48.00     41.70     47.30      2.63        5.990
    DOWNSTREAM     75.27    48.00       -       47.20      2.63        5.990
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00275
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00275
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00275
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.011 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.293)+( 0.000) =   0.293
--------------------------------------------------------------------------------
  NODE   162.50 : HGL = <   54.872>;EGL= <   55.430>;FLOWLINE= <   47.300>

********************************************************************************
  FLOW PROCESS FROM NODE   162.50 TO NODE   160.50 IS CODE =  1
  UPSTREAM NODE   160.50     ELEVATION =    52.92  (HYDRAULIC JUMP OCCURS)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      75.27 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     304.42 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.72          CRITICAL DEPTH(FT) =      2.63
================================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.62
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
```

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.624	8.612	3.776	1882.13
0.078	2.588	8.749	3.777	1882.71
0.309	2.552	8.892	3.780	1884.36
0.708	2.516	9.040	3.786	1887.14
1.293	2.480	9.194	3.793	1891.07
2.085	2.444	9.354	3.803	1896.21
3.106	2.408	9.521	3.816	1902.60
4.385	2.372	9.694	3.832	1910.28
5.954	2.336	9.874	3.851	1919.31
7.851	2.300	10.062	3.873	1929.74
10.122	2.264	10.258	3.899	1941.64
12.823	2.228	10.462	3.928	1955.06
16.022	2.192	10.674	3.962	1970.07
19.804	2.156	10.896	4.000	1986.76
24.275	2.120	11.127	4.044	2005.18
29.575	2.084	11.369	4.092	2025.43
35.886	2.048	11.622	4.147	2047.61
43.453	2.012	11.886	4.207	2071.80
52.626	1.976	12.163	4.274	2098.11
63.910	1.940	12.453	4.349	2126.67
78.095	1.904	12.757	4.432	2157.59
96.503	1.868	13.076	4.524	2191.00
121.611	1.832	13.410	4.626	2227.07
158.990	1.796	13.762	4.738	2265.94
226.513	1.760	14.132	4.863	2307.79
304.420	1.759	14.138	4.865	2308.51

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 7.57

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	7.572	5.990	8.130	5243.31
227.321	4.000	5.990	4.557	2441.98

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 4.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
227.321	4.000	5.988	4.557	2441.98
230.601	3.945	6.004	4.505	2401.31
233.686	3.890	6.034	4.456	2362.78
236.654	3.835	6.073	4.408	2325.82
239.526	3.780	6.120	4.362	2290.24
242.313	3.725	6.173	4.317	2255.99
245.019	3.670	6.232	4.274	2223.04
247.649	3.615	6.298	4.231	2191.38
250.203	3.560	6.369	4.190	2161.01
252.680	3.505	6.446	4.151	2131.96
255.079	3.450	6.529	4.113	2104.26
257.396	3.395	6.618	4.076	2077.93
259.629	3.340	6.712	4.040	2053.01
261.773	3.285	6.813	4.006	2029.55
263.821	3.230	6.920	3.974	2007.58
265.767	3.175	7.034	3.944	1987.16
267.602	3.120	7.154	3.916	1968.34

269.317	3.065	7.282	3.889	1951.17
270.902	3.010	7.417	3.865	1935.73
272.342	2.955	7.559	3.843	1922.07
273.624	2.900	7.710	3.824	1910.28
274.729	2.845	7.870	3.808	1900.41
275.638	2.790	8.039	3.794	1892.57
276.325	2.735	8.217	3.785	1886.85
276.763	2.680	8.406	3.778	1883.33
276.918	2.625	8.606	3.776	1882.13
304.420	2.625	8.606	3.776	1882.13

-----------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------

PRESSURE+MOMENTUM BALANCE OCCURS AT 256.91 FEET UPSTREAM OF NODE 162.50
DOWNSTREAM DEPTH = 3.407 FEET, UPSTREAM CONJUGATE DEPTH = 1.996 FEET

NODE 160.50 : HGL = < 55.544>;EGL= < 56.696>;FLOWLINE= < 52.920>

****

FLOW PROCESS FROM NODE 160.50 TO NODE 160.50 IS CODE = 5
UPSTREAM NODE 160.50 ELEVATION = 53.02 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	75.27	48.00	78.00	53.02	2.63	5.990
DOWNSTREAM	75.27	48.00	-	52.92	2.63	8.608
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00275
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00467
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00371
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.015 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.037)+(0.000) = 1.037

NODE 160.50 : HGL = < 57.176>;EGL= < 57.733>;FLOWLINE= < 53.020>

****

FLOW PROCESS FROM NODE 160.50 TO NODE 155.50 IS CODE = 1
UPSTREAM NODE 155.50 ELEVATION = 53.46 (FLOW SEALS IN REACH)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 75.27 CFS PIPE DIAMETER = 48.00 INCHES
PIPE LENGTH = 48.67 FEET MANNING'S N = 0.01300

==========

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 4.16

==========

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	4.156	5.990	4.713	2564.06
24.732	4.000	5.990	4.557	2441.98

NORMAL DEPTH(FT) = 2.12 CRITICAL DEPTH(FT) = 2.63

==========

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 4.00

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
24.732	4.000	5.988	4.557	2441.98
32.797	3.945	6.004	4.505	2401.31
40.299	3.890	6.034	4.456	2362.78
47.482	3.835	6.073	4.408	2325.82
48.670	3.826	6.081	4.400	2319.62

NODE 155.50 : HGL = < 57.286>;EGL= < 57.860>;FLOWLINE= < 53.460>

****

FLOW PROCESS FROM NODE 155.50 TO NODE 155.50 IS CODE = 5
UPSTREAM NODE 155.50 ELEVATION = 53.56 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	61.81	48.00	0.00	53.56	2.37	4.919
DOWNSTREAM	75.27	48.00	-	53.46	2.63	6.083
LATERAL #1	9.51	36.00	90.00	53.66	0.97	1.345
LATERAL #2	3.95	24.00	90.00	53.66	0.70	1.257
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00185
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00239
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00212
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.008 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.193)+(0.000) = 0.193

NODE 155.50 : HGL = < 57.677>;EGL= < 58.053>;FLOWLINE= < 53.560>

****

FLOW PROCESS FROM NODE 155.50 TO NODE 147.50 IS CODE = 1
UPSTREAM NODE 147.50 ELEVATION = 56.65 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 61.81 CFS PIPE DIAMETER = 48.00 INCHES
PIPE LENGTH = 239.09 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.71 CRITICAL DEPTH(FT) = 2.37

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.09

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.094	9.279	3.432	1482.56
1.501	2.079	9.366	3.442	1486.59
3.157	2.063	9.455	3.452	1490.89
4.981	2.047	9.546	3.463	1495.45
6.989	2.032	9.638	3.475	1500.29
9.200	2.016	9.732	3.488	1505.40
11.635	2.001	9.829	3.502	1510.80

14.320	1.985	9.927	3.516	1516.49
17.283	1.970	10.027	3.532	1522.48
20.560	1.954	10.129	3.548	1528.77
24.191	1.939	10.233	3.566	1535.36
28.227	1.923	10.339	3.584	1542.28
32.728	1.908	10.448	3.604	1549.52
37.771	1.892	10.558	3.624	1557.09
43.450	1.877	10.672	3.646	1564.99
49.888	1.861	10.787	3.669	1573.25
57.248	1.846	10.905	3.693	1581.86
65.749	1.830	11.025	3.719	1590.83
75.697	1.815	11.148	3.746	1600.18
87.543	1.799	11.274	3.774	1609.90
101.984	1.784	11.403	3.804	1620.02
120.191	1.768	11.534	3.835	1630.54
144.355	1.752	11.668	3.868	1641.47
179.402	1.737	11.806	3.903	1652.83
239.090	1.722	11.942	3.938	1664.22

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 4.12

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	4.117	4.919	4.493	2249.31
10.580	4.000	4.919	4.376	2157.45

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 4.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
10.580	4.000	4.917	4.376	2157.45
16.179	3.935	4.935	4.313	2108.47
21.526	3.870	4.966	4.253	2061.49
26.723	3.804	5.008	4.194	2016.04
31.797	3.739	5.057	4.137	1972.02
36.762	3.674	5.114	4.080	1929.40
41.625	3.609	5.178	4.025	1888.19
46.389	3.544	5.249	3.972	1848.42
51.055	3.478	5.326	3.919	1810.13
55.620	3.413	5.410	3.868	1773.36
60.080	3.348	5.501	3.818	1738.16
64.429	3.283	5.599	3.770	1704.58
68.661	3.218	5.704	3.723	1672.70
72.764	3.152	5.817	3.678	1642.56
76.729	3.087	5.937	3.635	1614.25
80.540	3.022	6.066	3.594	1587.83
84.181	2.957	6.204	3.555	1563.39
87.631	2.892	6.352	3.519	1541.02
90.865	2.826	6.510	3.485	1520.80
93.855	2.761	6.678	3.454	1502.84
96.563	2.696	6.858	3.427	1487.26
98.946	2.631	7.050	3.403	1474.17
100.949	2.566	7.256	3.384	1463.70
102.504	2.500	7.477	3.369	1456.01
103.523	2.435	7.714	3.360	1451.26
103.893	2.370	7.968	3.357	1449.63
239.090	2.370	7.968	3.357	1449.63

```
-------------------------END OF HYDRAULIC JUMP ANALYSIS-------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    71.91 FEET UPSTREAM OF NODE  155.50 |
|       DOWNSTREAM DEPTH = 3.166 FEET, UPSTREAM CONJUGATE DEPTH = 1.742 FEET |
--------------------------------------------------------------------------------
  NODE   147.50 : HGL = <   58.744>;EGL= <   60.082>;FLOWLINE= <   56.650>

********************************************************************************
  FLOW PROCESS FROM NODE   147.50 TO NODE   147.50 IS CODE =  5
  UPSTREAM NODE   147.50     ELEVATION =    56.75  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      61.81    48.00      0.00     56.75      2.37        8.580
    DOWNSTREAM     61.81    48.00       -       56.65      2.37        9.282
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00516
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00635
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00575
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.023 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.042)+( 0.000) =   0.042
--------------------------------------------------------------------------------
  NODE   147.50 : HGL = <   58.981>;EGL= <   60.124>;FLOWLINE= <   56.750>

********************************************************************************
  FLOW PROCESS FROM NODE   147.50 TO NODE   145.50 IS CODE =  1
  UPSTREAM NODE   145.50     ELEVATION =    57.49  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      61.81 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     142.24 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      2.23           CRITICAL DEPTH(FT) =      2.37
================================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.37
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          2.370      7.968          3.357          1449.63
         0.030          2.364      7.991          3.357          1449.65
         0.122          2.359      8.015          3.357          1449.69
         0.283          2.353      8.039          3.357          1449.75
         0.519          2.347      8.063          3.357          1449.85
         0.837          2.341      8.087          3.357          1449.97
         1.245          2.335      8.111          3.358          1450.11
         1.754          2.330      8.135          3.358          1450.29
         2.375          2.324      8.160          3.358          1450.49
         3.121          2.318      8.185          3.359          1450.72
         4.009          2.312      8.210          3.359          1450.97
         5.058          2.306      8.235          3.360          1451.26
         6.293          2.301      8.260          3.361          1451.57
         7.743          2.295      8.285          3.361          1451.91
         9.445          2.289      8.311          3.362          1452.28
```

11.448	2.283	8.337	3.363	1452.68
13.815	2.277	8.362	3.364	1453.11
16.633	2.272	8.389	3.365	1453.56
20.022	2.266	8.415	3.366	1454.05
24.158	2.260	8.441	3.367	1454.56
29.317	2.254	8.468	3.368	1455.10
35.956	2.248	8.495	3.370	1455.68
44.936	2.243	8.522	3.371	1456.28
58.191	2.237	8.549	3.372	1456.91
81.926	2.231	8.576	3.374	1457.57
142.240	2.231	8.577	3.374	1457.60

NODE 145.50 : HGL = < 59.860>;EGL= < 60.847>;FLOWLINE= < 57.490>

****

FLOW PROCESS FROM NODE 145.50 TO NODE 145.50 IS CODE = 5
UPSTREAM NODE 145.50 ELEVATION = 57.59 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	49.44	48.00	0.00	57.59	2.11	4.610
DOWNSTREAM	61.81	48.00	-	57.49	2.37	7.970
LATERAL #1	12.37	36.00	90.00	57.59	1.12	1.833
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00125
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00426
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00276
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.011 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.257)+(0.000) = 0.257

NODE 145.50 : HGL = < 60.774>;EGL= < 61.104>;FLOWLINE= < 57.590>

****

FLOW PROCESS FROM NODE 145.50 TO NODE 137.50 IS CODE = 1
UPSTREAM NODE 137.50 ELEVATION = 58.74 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 49.44 CFS PIPE DIAMETER = 48.00 INCHES
PIPE LENGTH = 178.23 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.83 CRITICAL DEPTH(FT) = 2.11

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.64

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.638	10.205	3.256	1185.21
4.034	1.646	10.142	3.244	1181.49
8.168	1.653	10.080	3.232	1177.86
12.411	1.661	10.018	3.220	1174.31
16.773	1.669	9.957	3.209	1170.84

21.267	1.676	9.897	3.198	1167.45
25.905	1.684	9.838	3.188	1164.14
30.704	1.692	9.779	3.177	1160.91
35.681	1.699	9.721	3.167	1157.75
40.860	1.707	9.663	3.158	1154.68
46.265	1.714	9.606	3.148	1151.68
51.929	1.722	9.550	3.139	1148.76
57.890	1.730	9.495	3.130	1145.91
64.195	1.737	9.440	3.122	1143.13
70.905	1.745	9.385	3.114	1140.43
78.098	1.753	9.332	3.106	1137.79
85.874	1.760	9.278	3.098	1135.23
94.374	1.768	9.226	3.090	1132.74
103.789	1.776	9.174	3.083	1130.32
114.405	1.783	9.122	3.076	1127.96
126.660	1.791	9.071	3.070	1125.67
141.292	1.799	9.021	3.063	1123.45
159.683	1.806	8.971	3.057	1121.30
178.230	1.812	8.935	3.052	1119.76

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 3.18

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	3.184	4.608	3.514	1408.21
6.603	3.141	4.669	3.480	1385.46
13.151	3.098	4.733	3.446	1363.35
19.640	3.055	4.799	3.413	1341.91
26.067	3.012	4.869	3.380	1321.15
32.429	2.969	4.942	3.348	1301.08
38.719	2.926	5.018	3.317	1281.73
44.933	2.883	5.097	3.287	1263.11
51.064	2.840	5.180	3.257	1245.25
57.105	2.797	5.267	3.228	1228.16
63.048	2.754	5.357	3.200	1211.87
68.881	2.711	5.452	3.173	1196.39
74.594	2.668	5.551	3.147	1181.76
80.172	2.625	5.654	3.122	1167.99
85.601	2.582	5.762	3.098	1155.11
90.860	2.539	5.875	3.075	1143.16
95.927	2.496	5.994	3.054	1132.15
100.773	2.453	6.118	3.034	1122.13
105.366	2.410	6.248	3.016	1113.13
109.663	2.367	6.384	3.000	1105.18
113.611	2.324	6.527	2.986	1098.32
117.144	2.281	6.677	2.973	1092.59
120.173	2.238	6.834	2.963	1088.05
122.581	2.195	7.000	2.956	1084.73
124.207	2.152	7.174	2.951	1082.70
124.817	2.109	7.357	2.950	1082.01
178.230	2.109	7.357	2.950	1082.01

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 94.23 FEET UPSTREAM OF NODE 145.50
DOWNSTREAM DEPTH = 2.510 FEET, UPSTREAM CONJUGATE DEPTH = 1.758 FEET

NODE 137.50 : HGL = < 60.378>;EGL= < 61.996>;FLOWLINE= < 58.740>

****

FLOW PROCESS FROM NODE 137.50 TO NODE 137.50 IS CODE = 5

UPSTREAM NODE 137.50 ELEVATION = 58.84 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	49.44	36.00	25.50	58.84	2.29	9.971
DOWNSTREAM	49.44	48.00	-	58.74	2.11	10.208
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00916
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00958
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00937
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.037 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.371)+(0.000) = 0.371

NODE 137.50 : HGL = < 60.823>;EGL= < 62.367>;FLOWLINE= < 58.840>

****

FLOW PROCESS FROM NODE 137.50 TO NODE 136.50 IS CODE = 1
UPSTREAM NODE 136.50 ELEVATION = 59.63 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 49.44 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 81.43 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.94 CRITICAL DEPTH(FT) = 2.29

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.29

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.288	8.545	3.422	1189.80
0.059	2.274	8.598	3.423	1189.87
0.230	2.260	8.651	3.423	1190.07
0.523	2.246	8.706	3.424	1190.39
0.948	2.233	8.761	3.425	1190.84
1.518	2.219	8.818	3.427	1191.43
2.249	2.205	8.875	3.429	1192.15
3.157	2.191	8.934	3.431	1193.00
4.262	2.177	8.994	3.434	1193.99
5.588	2.164	9.055	3.438	1195.12
7.164	2.150	9.117	3.441	1196.40
9.024	2.136	9.180	3.446	1197.81
11.210	2.122	9.245	3.450	1199.38
13.774	2.109	9.310	3.455	1201.09
16.783	2.095	9.377	3.461	1202.95
20.321	2.081	9.446	3.467	1204.97
24.500	2.067	9.515	3.474	1207.15
29.471	2.053	9.586	3.481	1209.48
35.447	2.040	9.658	3.489	1211.98
42.739	2.026	9.732	3.497	1214.64
51.830	2.012	9.807	3.506	1217.47
63.527	1.998	9.883	3.516	1220.47
79.347	1.984	9.961	3.526	1223.64

81.430	1.983	9.968	3.527	1223.94

NODE 136.50 : HGL = < 61.918>;EGL= < 63.052>;FLOWLINE= < 59.630>

****

FLOW PROCESS FROM NODE 136.50 TO NODE 136.50 IS CODE = 5
UPSTREAM NODE 136.50 ELEVATION = 59.73 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	49.44	36.00	25.50	59.73	2.29	7.398
DOWNSTREAM	49.44	36.00	-	59.63	2.29	8.545
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00485
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00636
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00560
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.022 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.218)+(0.000) = 0.218

NODE 136.50 : HGL = < 62.420>;EGL= < 63.270>;FLOWLINE= < 59.730>

****

FLOW PROCESS FROM NODE 136.50 TO NODE 135.50 IS CODE = 1
UPSTREAM NODE 135.50 ELEVATION = 60.32 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 49.44 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 93.21 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 2.29 CRITICAL DEPTH(FT) = 2.29

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DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.69

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.690	7.396	3.540	1236.78
5.721	2.674	7.428	3.532	1233.30
11.368	2.658	7.462	3.524	1229.93
16.944	2.643	7.496	3.516	1226.70
22.457	2.627	7.532	3.508	1223.59
27.909	2.611	7.569	3.501	1220.61
33.305	2.595	7.606	3.494	1217.75
38.650	2.579	7.645	3.487	1215.03
43.947	2.563	7.685	3.481	1212.44
49.199	2.547	7.725	3.474	1209.98
54.410	2.531	7.767	3.469	1207.65
59.583	2.515	7.810	3.463	1205.46
64.721	2.500	7.854	3.458	1203.40
69.827	2.484	7.899	3.453	1201.48
74.905	2.468	7.945	3.448	1199.70
79.959	2.452	7.992	3.444	1198.06
84.991	2.436	8.040	3.440	1196.56

90.007	2.420	8.089	1195.21
93.210	2.410	8.121	1194.42

NODE 135.50 : HGL = < 62.730>;EGL= < 63.755>;FLOWLINE= < 60.320>

****

FLOW PROCESS FROM NODE 135.50 TO NODE 135.50 IS CODE = 5
UPSTREAM NODE 135.50 ELEVATION = 60.42 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	42.92	36.00	0.00	60.42	2.13	6.073
DOWNSTREAM	49.44	36.00	-	60.32	2.29	8.124
LATERAL #1	4.91	24.00	90.00	60.42	0.78	1.563
LATERAL #2	1.61	24.00	90.00	60.42	0.44	0.512
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00401
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00571
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00486
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.019 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.233)+(0.000) = 0.233

NODE 135.50 : HGL = < 63.415>;EGL= < 63.988>;FLOWLINE= < 60.420>

****

FLOW PROCESS FROM NODE 135.50 TO NODE 132.50 IS CODE = 1
UPSTREAM NODE 132.50 ELEVATION = 62.71 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 42.92 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 228.96 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.75 CRITICAL DEPTH(FT) = 2.13

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.74

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.741	10.088	3.322	1038.22
2.711	1.741	10.085	3.321	1038.09
5.536	1.741	10.083	3.321	1037.97
8.482	1.742	10.080	3.321	1037.85
11.562	1.742	10.077	3.320	1037.72
14.790	1.743	10.074	3.320	1037.60
18.179	1.743	10.072	3.319	1037.48
21.749	1.743	10.069	3.319	1037.35
25.518	1.744	10.066	3.318	1037.23
29.511	1.744	10.064	3.318	1037.11
33.759	1.745	10.061	3.317	1036.98
38.294	1.745	10.058	3.317	1036.86
43.161	1.745	10.055	3.316	1036.74
48.412	1.746	10.053	3.316	1036.62

54.114	1.746	10.050	3.315	1036.49
60.354	1.747	10.047	3.315	1036.37
67.244	1.747	10.045	3.315	1036.25
74.939	1.747	10.042	3.314	1036.13
83.653	1.748	10.039	3.314	1036.01
93.703	1.748	10.036	3.313	1035.89
105.577	1.748	10.034	3.313	1035.77
120.094	1.749	10.031	3.312	1035.64
138.793	1.749	10.028	3.312	1035.52
165.126	1.750	10.026	3.311	1035.40
210.170	1.750	10.023	3.311	1035.28
228.960	1.750	10.023	3.311	1035.28

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 3.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.995	6.071	3.568	1164.71
5.172	2.961	6.085	3.536	1150.75
9.930	2.927	6.109	3.507	1137.62
14.427	2.892	6.140	3.478	1125.13
18.721	2.858	6.177	3.450	1113.19
22.844	2.823	6.218	3.424	1101.75
26.816	2.789	6.265	3.398	1090.81
30.649	2.754	6.315	3.374	1080.34
34.351	2.720	6.370	3.350	1070.36
37.926	2.685	6.429	3.328	1060.84
41.377	2.651	6.492	3.306	1051.81
44.703	2.616	6.559	3.285	1043.26
47.902	2.582	6.630	3.265	1035.20
50.971	2.548	6.706	3.246	1027.64
53.903	2.513	6.786	3.228	1020.59
56.692	2.479	6.870	3.212	1014.06
59.328	2.444	6.958	3.196	1008.07
61.799	2.410	7.051	3.182	1002.63
64.091	2.375	7.148	3.169	997.76
66.185	2.341	7.251	3.158	993.46
68.061	2.306	7.358	3.148	989.77
69.691	2.272	7.471	3.139	986.70
71.045	2.237	7.589	3.132	984.27
72.082	2.203	7.713	3.127	982.50
72.753	2.168	7.842	3.124	981.42
72.993	2.134	7.978	3.123	981.05
228.960	2.134	7.978	3.123	981.05

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 47.84 FEET UPSTREAM OF NODE 135.50
DOWNSTREAM DEPTH = 2.583 FEET, UPSTREAM CONJUGATE DEPTH = 1.750 FEET

NODE 132.50 : HGL = < 64.451>;EGL= < 66.032>;FLOWLINE= < 62.710>

FLOW PROCESS FROM NODE 132.50 TO NODE 132.50 IS CODE = 5
UPSTREAM NODE 132.50 ELEVATION = 62.81 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	42.92	36.00	0.00	62.81	2.13	9.914
DOWNSTREAM	42.92	36.00	-	62.71	2.13	10.091

LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00972
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01018
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00995
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.040 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.071)+(0.000) = 0.071

NODE 132.50 : HGL = < 64.576>;EGL= < 66.103>;FLOWLINE= < 62.810>

****

FLOW PROCESS FROM NODE 132.50 TO NODE 125.50 IS CODE = 1
UPSTREAM NODE 125.50 ELEVATION = 64.82 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 42.92 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 201.31 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.75 CRITICAL DEPTH(FT) = 2.13

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.13

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.133	7.984	3.123	981.06
0.061	2.117	8.046	3.123	981.14
0.231	2.102	8.109	3.124	981.37
0.521	2.087	8.174	3.125	981.76
0.941	2.072	8.241	3.127	982.30
1.506	2.056	8.308	3.129	982.99
2.229	2.041	8.377	3.132	983.84
3.128	2.026	8.448	3.135	984.86
4.223	2.011	8.520	3.138	986.04
5.540	1.995	8.593	3.143	987.38
7.105	1.980	8.669	3.148	988.90
8.955	1.965	8.745	3.153	990.60
11.132	1.950	8.824	3.159	992.47
13.689	1.934	8.904	3.166	994.52
16.692	1.919	8.985	3.174	996.76
20.228	1.904	9.069	3.182	999.19
24.409	1.889	9.154	3.191	1001.81
29.390	1.873	9.242	3.200	1004.63
35.384	1.858	9.331	3.211	1007.65
42.707	1.843	9.422	3.222	1010.88
51.847	1.828	9.515	3.234	1014.32
63.623	1.812	9.610	3.247	1017.98
79.567	1.797	9.708	3.261	1021.86
103.128	1.782	9.807	3.276	1025.96
145.364	1.767	9.909	3.292	1030.29
201.310	1.766	9.911	3.293	1030.38

NODE 125.50 : HGL = < 66.953>;EGL= < 67.943>;FLOWLINE= < 64.820>

****

FLOW PROCESS FROM NODE 125.50 TO NODE 125.50 IS CODE = 5
UPSTREAM NODE 125.50 ELEVATION = 64.92 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	36.38	30.00	0.00	64.92	2.04	7.411
DOWNSTREAM	42.92	36.00	-	64.82	2.13	7.981
LATERAL #1	4.59	24.00	90.00	65.02	0.75	1.461
LATERAL #2	1.95	24.00	90.00	65.02	0.48	0.621
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00787
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00567
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00677
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.027 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.331)+(0.000) = 0.331

NODE 125.50 : HGL = < 67.421>;EGL= < 68.274>;FLOWLINE= < 64.920>

****

FLOW PROCESS FROM NODE 125.50 TO NODE 120.50 IS CODE = 1
UPSTREAM NODE 120.50 ELEVATION = 66.55 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 36.38 CFS PIPE DIAMETER = 30.00 INCHES
PIPE LENGTH = 163.14 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.83 CRITICAL DEPTH(FT) = 2.04

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.80

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.795	9.639	3.239	867.33
2.101	1.797	9.630	3.238	867.08
4.278	1.798	9.622	3.237	866.84
6.540	1.800	9.613	3.236	866.59
8.893	1.801	9.605	3.235	866.34
11.346	1.803	9.596	3.234	866.10
13.910	1.804	9.588	3.233	865.86
16.597	1.806	9.579	3.232	865.62
19.421	1.807	9.571	3.231	865.38
22.398	1.809	9.563	3.230	865.14
25.548	1.810	9.554	3.229	864.91
28.896	1.812	9.546	3.228	864.67
32.469	1.813	9.538	3.227	864.44
36.305	1.815	9.530	3.226	864.21
40.450	1.816	9.521	3.225	863.98
44.961	1.818	9.513	3.224	863.76
49.918	1.819	9.505	3.223	863.53
55.423	1.821	9.497	3.222	863.31
61.626	1.822	9.489	3.221	863.09
68.741	1.824	9.480	3.220	862.87

77.102	1.825	9.472	3.219	862.65
87.269	1.827	9.464	3.218	862.43
100.292	1.828	9.456	3.217	862.22
118.528	1.829	9.448	3.216	862.01
149.545	1.831	9.440	3.216	861.79
163.140	1.831	9.440	3.216	861.79

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 2.50

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.501	7.411	3.354	905.77
0.601	2.500	7.411	3.353	905.38

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 2.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.601	2.500	7.409	3.353	905.38
7.324	2.482	7.417	3.336	900.35
12.726	2.464	7.431	3.322	895.79
17.509	2.445	7.450	3.308	891.53
21.861	2.427	7.472	3.294	887.54
25.881	2.409	7.497	3.282	883.77
29.628	2.391	7.524	3.270	880.22
33.142	2.372	7.555	3.259	876.87
36.451	2.354	7.587	3.249	873.71
39.574	2.336	7.622	3.239	870.73
42.526	2.318	7.659	3.229	867.94
45.317	2.300	7.699	3.220	865.32
47.953	2.281	7.740	3.212	862.88
50.440	2.263	7.783	3.204	860.61
52.779	2.245	7.829	3.197	858.52
54.970	2.227	7.876	3.191	856.60
57.011	2.208	7.926	3.184	854.86
58.898	2.190	7.977	3.179	853.29
60.625	2.172	8.031	3.174	851.90
62.182	2.154	8.087	3.170	850.69
63.560	2.135	8.144	3.166	849.66
64.743	2.117	8.204	3.163	848.81
65.713	2.099	8.266	3.161	848.14
66.447	2.081	8.330	3.159	847.66
66.916	2.063	8.396	3.158	847.37
67.082	2.044	8.464	3.157	847.27
163.140	2.044	8.464	3.157	847.27

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 48.86 FEET UPSTREAM OF NODE 125.50
DOWNSTREAM DEPTH = 2.275 FEET, UPSTREAM CONJUGATE DEPTH = 1.829 FEET

NODE 120.50 : HGL = < 68.345>;EGL= < 69.789>;FLOWLINE= < 66.550>

FLOW PROCESS FROM NODE 120.50 TO NODE 120.50 IS CODE = 5
UPSTREAM NODE 120.50 ELEVATION = 66.65 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW	DIAMETER	ANGLE	FLOWLINE	CRITICAL	VELOCITY

	(CFS)	(INCHES)	(DEGREES)	ELEVATION	DEPTH(FT.)	(FT/SEC)
UPSTREAM	36.38	30.00	0.00	66.65	2.04	9.407
DOWNSTREAM	36.38	30.00	-	66.55	2.04	9.642
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00992
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01051
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01022
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.041 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.073)+(0.000) = 0.073

NODE 120.50 : HGL = < 68.488>;EGL= < 69.862>;FLOWLINE= < 66.650>

****

FLOW PROCESS FROM NODE 120.50 TO NODE 115.50 IS CODE = 1
UPSTREAM NODE 115.50 ELEVATION = 69.00 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 36.38 CFS PIPE DIAMETER = 30.00 INCHES
PIPE LENGTH = 234.38 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.83 CRITICAL DEPTH(FT) = 2.04

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.04

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.044	8.464	3.157	847.27
0.039	2.036	8.497	3.157	847.29
0.160	2.027	8.530	3.158	847.36
0.370	2.019	8.564	3.158	847.47
0.677	2.010	8.598	3.159	847.62
1.089	2.001	8.633	3.159	847.82
1.616	1.993	8.668	3.160	848.07
2.271	1.984	8.704	3.162	848.36
3.067	1.976	8.741	3.163	848.69
4.022	1.967	8.778	3.164	849.08
5.154	1.959	8.815	3.166	849.51
6.489	1.950	8.853	3.168	849.99
8.054	1.941	8.892	3.170	850.51
9.887	1.933	8.931	3.172	851.09
12.033	1.924	8.971	3.175	851.71
14.553	1.916	9.011	3.177	852.38
17.523	1.907	9.052	3.180	853.11
21.049	1.898	9.093	3.183	853.88
25.281	1.890	9.135	3.187	854.70
30.433	1.881	9.178	3.190	855.58
36.845	1.873	9.221	3.194	856.51
45.078	1.864	9.265	3.198	857.49
56.193	1.856	9.309	3.202	858.53
72.564	1.847	9.354	3.207	859.62
101.819	1.838	9.400	3.211	860.76
234.380	1.838	9.404	3.212	860.85

```
  NODE   115.50 : HGL = <   71.044>;EGL= <   72.157>;FLOWLINE= <   69.000>

****************************************************************************
  FLOW PROCESS FROM NODE   115.50 TO NODE   115.50 IS CODE =  5
  UPSTREAM NODE   115.50     ELEVATION =    69.00  (FLOW UNSEALS IN REACH)
----------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      30.77    30.00     90.00     69.00      1.89        6.268
    DOWNSTREAM     36.38    30.00       -       69.00      2.04        8.466
    LATERAL #1      5.61    24.00      0.00     69.00      0.84        1.786
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00563
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00790
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00676
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.027 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 1.535)+( 0.000) =   1.535
----------------------------------------------------------------------------
  NODE   115.50 : HGL = <   73.082>;EGL= <   73.692>;FLOWLINE= <   69.000>

****************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   115.50            FLOWLINE ELEVATION =    69.00
  ASSUMED UPSTREAM CONTROL HGL =     70.89 FOR DOWNSTREAM RUN ANALYSIS

============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
**************************************************************************
              PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
          (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
        (c) Copyright 1982-2012 Advanced Engineering Software (aes)
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                          Analysis prepared by:

                        Rick Engineering Company
                            5620 Friars Road
                           San Diego, CA. 92110
                       Ph 619-291-0707 Fx 619-291-4165

  ************************* DESCRIPTION OF STUDY *************************
 * JN-18150       SDSU WEST                                               *
 * BASIN 200   BUBBLER HGL ANALYSIS   NODE 200-285   ULTIMATE CONDITION   *
 * 100-YR 6-HR    HGL0 = 47.0' = 10-YR WSEL OF SD RIVER                   *
  **************************************************************************

   FILE NAME: 200_18.PIP
   TIME/DATE OF STUDY: 12:52 02/01/2019

**************************************************************************
               GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                         NODAL POINT STATUS TABLE
                (Note: "*" indicates nodal point data used.)
                      UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   200.00-             4.09*          3918.05        2.90 Dc         3422.02
         } FRICTION
   285.00-             4.20*          3967.44        2.90 Dc         3422.02
         } CATCH BASIN
   285.00-             7.84*          2795.42        2.90 Dc          616.76
--------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
**************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   200.00           FLOWLINE ELEVATION =    42.91
  PIPE FLOW =     100.62 CFS       PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    47.000 FEET
--------------------------------------------------------------------------
  NODE   200.00 : HGL = <   47.000>;EGL= <   50.146>;FLOWLINE= <   42.910>

**************************************************************************
  FLOW PROCESS FROM NODE   200.00 TO NODE   285.00 IS CODE =  1
  UPSTREAM NODE   285.00     ELEVATION =    43.59  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     100.62 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      34.80 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    100.62)/(   666.986))**2 = 0.02276
  HF=L*SF = (     34.80)*(0.02276) =      0.792
--------------------------------------------------------------------------
  NODE   285.00 : HGL = <   47.792>;EGL= <   50.938>;FLOWLINE= <   43.590>

**************************************************************************
  FLOW PROCESS FROM NODE   285.00 TO NODE   285.00 IS CODE =  8
```

```
  UPSTREAM NODE   285.00     ELEVATION =    43.73  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =     100.62 CFS          PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =  14.23 FEET/SEC.    VELOCITY HEAD =  3.146 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  3.146) =  0.629
--------------------------------------------------------------------------------
  NODE   285.00 : HGL = <   51.568>;EGL= <   51.568>;FLOWLINE= <   43.730>

********************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   285.00            FLOWLINE ELEVATION =    43.73
  ASSUMED UPSTREAM CONTROL HGL =     46.63 FOR DOWNSTREAM RUN ANALYSIS

================================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 19.1 Release Date: 08/09/2012 License ID 1261

Analysis prepared by:

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Ph 619-291-0707 Fx 619-291-4165

********** DESCRIPTION OF STUDY **********
* JN-18150 SDSU WEST *
* BASIN 200 BACKBONE SYSTEM 200B ULTIMATE CONDITION *
* 100-YR 6-HR HGL0 = HGL @ BUBBLER IN NODE 285 *
****

FILE NAME: SDSW200B.PIP
TIME/DATE OF STUDY: 13:05 02/01/2019

****

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
285.00-		7.84*	5672.69	2.53	2217.29
	} FRICTION				
280.00-		7.47*	5382.46	2.78 Dc	2189.45
	} JUNCTION				
280.00-		8.28*	6016.52	1.69	2942.10
	} FRICTION				
275.00-		3.25*	2268.00	2.78 Dc	2189.45
	} JUNCTION				
275.00-		4.12	2759.19	1.79*	2789.87
	} FRICTION				
270.00-		2.78*Dc	2189.45	2.78*Dc	2189.45
	} JUNCTION				
270.00-		4.67*	1858.69	2.09 Dc	924.70
	} FRICTION				
250.50-		4.23*	1667.33	2.09 Dc	924.70
	} JUNCTION				
250.50-		4.31*	1676.00	1.84	908.00
	} FRICTION				
245.50-		4.27*	1658.30	1.74	928.07
	} JUNCTION				
245.50-		3.87*	1360.44	2.07 Dc	887.70
	} FRICTION+BEND				
235.50-		4.28*	1485.26	2.07 Dc	887.70
	} JUNCTION				
235.50-		5.13*	1462.31	1.64	548.67
	} FRICTION				
228.50-		4.67*	1322.40	1.54	557.60
	} JUNCTION				
228.50-		4.58*	1296.85	1.64	548.63
	} FRICTION				
227.50-		4.13*	1156.94	1.56	555.49
	} JUNCTION				
227.50-		4.04*	1131.39	1.75 Dc	545.34

```
        } FRICTION
   226.50-              3.97*          1109.73        1.75 Dc          545.34
        } JUNCTION
   226.50-              3.93*          1084.07        1.73 Dc          530.92
        } FRICTION
   225.50-              3.86*          1062.95        1.73 Dc          530.92
        } JUNCTION
   225.50-              4.19*          1036.02        1.31             347.45
        } FRICTION
   217.50-              3.44*           808.15        1.22             356.70
        } JUNCTION
   217.50-              3.35*           780.03        1.27             350.54
        } FRICTION
   216.50-              2.48*           512.28        1.28             349.99
        } JUNCTION
   216.50-              2.38*           485.88        1.46 Dc          341.09
        } FRICTION
   215.50-              2.17*           431.44        1.46 Dc          341.09
        } JUNCTION
   215.50-              2.03*           351.75        1.42 Dc          291.06
        } FRICTION
   205.50-              1.92*           332.40        1.42 Dc          291.06
        } JUNCTION
   205.50-              2.51*           368.33        1.18 Dc          178.01
        } FRICTION
   203.50-              2.43*           351.95        1.18 Dc          178.01
        } CATCH BASIN
   203.50-              2.65*           323.28        1.18 Dc           60.87
--------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
********************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   285.00            FLOWLINE ELEVATION =    43.73
  PIPE FLOW =      84.26 CFS        PIPE DIAMETER =  48.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    51.568 FEET
--------------------------------------------------------------------------------
  NODE   285.00 : HGL = <   51.568>;EGL= <   52.266>;FLOWLINE= <   43.730>

********************************************************************************
  FLOW PROCESS FROM NODE   285.00 TO NODE   280.00 IS CODE =  1
  UPSTREAM NODE   280.00     ELEVATION =    44.50  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      84.26 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     116.21 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     84.26)/(  1436.438))**2 = 0.00344
  HF=L*SF = (    116.21)*(0.00344) =      0.400
--------------------------------------------------------------------------------
  NODE   280.00 : HGL = <   51.968>;EGL= <   52.666>;FLOWLINE= <   44.500>

********************************************************************************
  FLOW PROCESS FROM NODE   280.00 TO NODE   280.00 IS CODE =  5
  UPSTREAM NODE   280.00     ELEVATION =    44.60  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      84.26    48.00     68.50     44.60      2.78        6.705
    DOWNSTREAM     84.26    48.00       -       44.50      2.78        6.705
```

```
   LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
   LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
      Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00344
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00344
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00344
  JUNCTION LENGTH =   7.00 FEET
  FRICTION LOSSES =  0.024 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.909)+( 0.000) =   0.909
--------------------------------------------------------------------------------
  NODE   280.00 : HGL = <   52.876>;EGL= <   53.575>;FLOWLINE= <   44.600>

********************************************************************************
  FLOW PROCESS FROM NODE   280.00 TO NODE   275.00 IS CODE =  1
  UPSTREAM NODE   275.00     ELEVATION =    50.05  (FLOW SEALS IN REACH)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      84.26 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     189.50 FEET          MANNING'S N  =  0.01300
================================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     8.28
================================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          8.276      6.705          8.975          6016.52
        168.904          4.000      6.705          4.698          2663.15
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.62           CRITICAL DEPTH(FT) =      2.78
================================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     4.00
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        168.904          4.000      6.703          4.698          2663.15
        170.695          3.951      6.718          4.653          2627.47
        172.366          3.903      6.746          4.610          2593.99
        173.963          3.854      6.783          4.569          2562.05
        175.499          3.805      6.826          4.529          2531.47
        176.981          3.756      6.875          4.491          2502.15
        178.412          3.708      6.930          4.454          2474.04
        179.795          3.659      6.991          4.418          2447.13
        181.130          3.610      7.057          4.384          2421.40
        182.417          3.561      7.128          4.351          2396.87
        183.655          3.513      7.204          4.319          2373.54
        184.844          3.464      7.285          4.289          2351.43
        185.982          3.415      7.371          4.259          2330.56
        187.066          3.367      7.463          4.232          2310.96
        188.094          3.318      7.559          4.206          2292.66
        189.063          3.269      7.661          4.181          2275.70
        189.500          3.246      7.713          4.170          2268.00
--------------------------------------------------------------------------------
  NODE   275.00 : HGL = <   53.296>;EGL= <   54.220>;FLOWLINE= <   50.050>

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

FLOW PROCESS FROM NODE 275.00 TO NODE 275.00 IS CODE = 5
UPSTREAM NODE 275.00 ELEVATION = 50.15 (FLOW UNSEALS IN REACH)
(NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	84.26	48.00	59.60	50.15	2.78	15.528
DOWNSTREAM	84.26	48.00	-	50.05	2.78	7.715
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.02041
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00351
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01196
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.048 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.460)+(0.000) = 1.460

NODE 275.00 : HGL = < 51.935>;EGL= < 55.679>;FLOWLINE= < 50.150>

****

FLOW PROCESS FROM NODE 275.00 TO NODE 270.00 IS CODE = 1
UPSTREAM NODE 270.00 ELEVATION = 54.44 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 84.26 CFS PIPE DIAMETER = 48.00 INCHES
PIPE LENGTH = 180.15 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.71 CRITICAL DEPTH(FT) = 2.78

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.78

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.782	9.030	4.049	2189.45
0.071	2.739	9.186	4.050	2190.22
0.295	2.696	9.349	4.054	2192.56
0.686	2.653	9.520	4.061	2196.53
1.262	2.610	9.698	4.072	2202.21
2.045	2.567	9.884	4.085	2209.65
3.059	2.525	10.080	4.103	2218.94
4.332	2.482	10.284	4.125	2230.17
5.897	2.439	10.498	4.151	2243.42
7.794	2.396	10.722	4.182	2258.78
10.070	2.353	10.957	4.218	2276.36
12.784	2.310	11.203	4.260	2296.27
16.006	2.267	11.462	4.309	2318.64
19.825	2.224	11.734	4.364	2343.58
24.352	2.182	12.019	4.426	2371.26
29.731	2.139	12.320	4.497	2401.82
36.153	2.096	12.636	4.577	2435.44
43.876	2.053	12.969	4.666	2472.29
53.262	2.010	13.321	4.767	2512.59
64.842	1.967	13.692	4.880	2556.55
79.443	1.924	14.085	5.007	2604.43

98.448	1.881	14.500	5.148	2656.49
124.452	1.839	14.940	5.307	2713.04
163.289	1.796	15.407	5.484	2774.41
180.150	1.785	15.523	5.529	2789.87

NODE 270.00 : HGL = < 57.222>;EGL= < 58.489>;FLOWLINE= < 54.440>

****

FLOW PROCESS FROM NODE 270.00 TO NODE 270.00 IS CODE = 5
UPSTREAM NODE 270.00 ELEVATION = 54.54 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	41.08	36.00	0.00	54.54	2.09	5.812
DOWNSTREAM	84.26	48.00	-	54.44	2.78	9.032
LATERAL #1	39.30	36.00	90.00	54.54	2.04	5.560
LATERAL #2	3.88	24.00	45.00	54.54	0.69	1.235
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00379
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00499
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00439
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.018 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.241)+(0.000) = 1.241

NODE 270.00 : HGL = < 59.205>;EGL= < 59.730>;FLOWLINE= < 54.540>

****

FLOW PROCESS FROM NODE 270.00 TO NODE 250.50 IS CODE = 1
UPSTREAM NODE 250.50 ELEVATION = 56.33 (FLOW IS UNDER PRESSURE)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 41.08 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 357.50 FEET MANNING'S N = 0.01300
SF=(Q/K)**2 = ((41.08)/(666.986))**2 = 0.00379
HF=L*SF = (357.50)*(0.00379) = 1.356

NODE 250.50 : HGL = < 60.561>;EGL= < 61.086>;FLOWLINE= < 56.330>

****

FLOW PROCESS FROM NODE 250.50 TO NODE 250.50 IS CODE = 5
UPSTREAM NODE 250.50 ELEVATION = 56.43 (FLOW IS UNDER PRESSURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	39.99	36.00	0.00	56.43	2.06	5.657
DOWNSTREAM	41.08	36.00	-	56.33	2.09	5.812
LATERAL #1	0.55	24.00	90.00	56.53	0.25	0.175
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.54===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00359
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00379

```
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00369
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.015 FEET         ENTRANCE LOSSES =  0.105 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.042)+( 0.105) =   0.147
--------------------------------------------------------------------------------
  NODE   250.50 : HGL = <   60.736>;EGL= <   61.233>;FLOWLINE= <   56.430>

********************************************************************************
  FLOW PROCESS FROM NODE   250.50 TO NODE   245.50 IS CODE =  1
  UPSTREAM NODE   245.50     ELEVATION =    56.56  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      39.99 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      25.00 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     39.99)/(   666.980))**2 = 0.00359
  HF=L*SF = (     25.00)*(0.00359) =      0.090
--------------------------------------------------------------------------------
  NODE   245.50 : HGL = <   60.826>;EGL= <   61.323>;FLOWLINE= <   56.560>

********************************************************************************
  FLOW PROCESS FROM NODE   245.50 TO NODE   245.50 IS CODE =  5
  UPSTREAM NODE   245.50     ELEVATION =    56.66  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      37.60    30.00      0.00     56.66      2.07        7.660
    DOWNSTREAM     39.99    36.00       -       56.56      2.06        5.657
    LATERAL #1      2.39    24.00     90.00     56.76      0.54        0.761
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00840
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00359
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00600
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.024 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.118)+( 0.000) =   0.118
--------------------------------------------------------------------------------
  NODE   245.50 : HGL = <   60.529>;EGL= <   61.440>;FLOWLINE= <   56.660>

********************************************************************************
  FLOW PROCESS FROM NODE   245.50 TO NODE   235.50 IS CODE =  3
  UPSTREAM NODE   235.50     ELEVATION =    57.05  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE PIPE-BEND LOSSES(OCEMA):
  PIPE FLOW =      37.60 CFS            PIPE DIAMETER =  30.00 INCHES
  CENTRAL ANGLE = 31.800 DEGREES        MANNING'S N = 0.01300
  PIPE LENGTH =      78.79 FEET         BEND COEFFICIENT(KB) = 0.14860
  FLOW VELOCITY =   7.66 FEET/SEC.      VELOCITY HEAD =  0.911 FEET
  HB=KB*(VELOCITY HEAD) = ( 0.149)*( 0.911) =   0.135
  SF=(Q/K)**2 = ((     37.60)/(   410.172))**2 = 0.00840
  HF=L*SF = (     78.79)*(0.00840) =  0.662
  TOTAL HEAD LOSSES = HB + HF = ( 0.135)+( 0.662) =  0.797
--------------------------------------------------------------------------------
  NODE   235.50 : HGL = <   61.327>;EGL= <   62.238>;FLOWLINE= <   57.050>

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

```
 FLOW PROCESS FROM NODE   235.50 TO NODE   235.50 IS CODE =  5
 UPSTREAM NODE   235.50     ELEVATION =    57.15  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM      26.41    30.00      0.00     57.15      1.75        5.380
   DOWNSTREAM     37.60    30.00       -       57.05      2.07        7.660
   LATERAL #1      7.84    24.00     90.00     57.25      1.00        2.496
   LATERAL #2      3.35    24.00     90.00     57.25      0.64        1.066
      Q5           0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00415
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00840
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00627
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  0.025 FEET         ENTRANCE LOSSES =  0.000 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 0.487)+( 0.000) =   0.487
------------------------------------------------------------------------------
 NODE   235.50 : HGL = <   62.275>;EGL= <   62.725>;FLOWLINE= <   57.150>

******************************************************************************
 FLOW PROCESS FROM NODE   235.50 TO NODE   228.50 IS CODE =  1
 UPSTREAM NODE   228.50     ELEVATION =    58.27  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =      26.41 CFS     PIPE DIAMETER =  30.00 INCHES
 PIPE LENGTH =     159.98 FEET          MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((     26.41)/(   410.172))**2 = 0.00415
 HF=L*SF = (    159.98)*(0.00415) =      0.663
------------------------------------------------------------------------------
 NODE   228.50 : HGL = <   62.938>;EGL= <   63.388>;FLOWLINE= <   58.270>

******************************************************************************
 FLOW PROCESS FROM NODE   228.50 TO NODE   228.50 IS CODE =  5
 UPSTREAM NODE   228.50     ELEVATION =    58.37  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM      26.41    30.00      0.00     58.37      1.75        5.380
   DOWNSTREAM     26.41    30.00       -       58.27      1.75        5.380
   LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
   LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
      Q5           0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00415
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00415
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00415
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  0.017 FEET         ENTRANCE LOSSES =  0.000 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 0.017)+( 0.000) =   0.017
------------------------------------------------------------------------------
 NODE   228.50 : HGL = <   62.955>;EGL= <   63.404>;FLOWLINE= <   58.370>
```

```
**************************************************************************
  FLOW PROCESS FROM NODE   228.50 TO NODE   227.50 IS CODE =  1
  UPSTREAM NODE   227.50     ELEVATION =    59.49  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      26.41 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     159.98 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     26.41)/(   410.171))**2 = 0.00415
  HF=L*SF = (    159.98)*(0.00415) =      0.663
--------------------------------------------------------------------------
  NODE   227.50 : HGL = <   63.618>;EGL= <   64.068>;FLOWLINE= <   59.490>

**************************************************************************
  FLOW PROCESS FROM NODE   227.50 TO NODE   227.50 IS CODE =  5
  UPSTREAM NODE   227.50     ELEVATION =    59.59  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      26.41    30.00      0.00     59.59      1.75        5.380
    DOWNSTREAM     26.41    30.00       -       59.49      1.75        5.380
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00415
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00415
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00415
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.017 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.017)+( 0.000) =   0.017
--------------------------------------------------------------------------
  NODE   227.50 : HGL = <   63.635>;EGL= <   64.084>;FLOWLINE= <   59.590>

**************************************************************************
  FLOW PROCESS FROM NODE   227.50 TO NODE   226.50 IS CODE =  1
  UPSTREAM NODE   226.50     ELEVATION =    59.98  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      26.41 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =      77.01 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     26.41)/(   410.171))**2 = 0.00415
  HF=L*SF = (     77.01)*(0.00415) =      0.319
--------------------------------------------------------------------------
  NODE   226.50 : HGL = <   63.954>;EGL= <   64.403>;FLOWLINE= <   59.980>

**************************************************************************
  FLOW PROCESS FROM NODE   226.50 TO NODE   226.50 IS CODE =  5
  UPSTREAM NODE   226.50     ELEVATION =    60.08  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      25.89    30.00      0.00     60.08      1.73        5.274
    DOWNSTREAM     26.41    30.00       -       59.98      1.75        5.380
    LATERAL #1      0.52    24.00     90.00     60.18      0.25        0.166
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===
```

```
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00398
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00415
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00406
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.016 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.034)+( 0.000) =   0.034
--------------------------------------------------------------------------------
  NODE   226.50 : HGL = <   64.005>;EGL= <   64.437>;FLOWLINE= <   60.080>

********************************************************************************
  FLOW PROCESS FROM NODE   226.50 TO NODE   225.50 IS CODE =  1
  UPSTREAM NODE   225.50     ELEVATION =    60.40  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      25.89 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =      63.01 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     25.89)/(   410.173))**2 = 0.00398
  HF=L*SF = (     63.01)*(0.00398) =      0.251
--------------------------------------------------------------------------------
  NODE   225.50 : HGL = <   64.256>;EGL= <   64.688>;FLOWLINE= <   60.400>

********************************************************************************
  FLOW PROCESS FROM NODE   225.50 TO NODE   225.50 IS CODE =  5
  UPSTREAM NODE   225.50     ELEVATION =    60.50  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      18.56    30.00      0.00     60.50      1.46        3.781
    DOWNSTREAM     25.89    30.00       -       60.40      1.73        5.274
    LATERAL #1      3.93    24.00     90.00     60.60      0.69        1.251
    LATERAL #2      3.40    24.00     90.00     60.60      0.64        1.082
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00205
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00398
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00302
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.012 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.222)+( 0.000) =   0.222
--------------------------------------------------------------------------------
  NODE   225.50 : HGL = <   64.688>;EGL= <   64.910>;FLOWLINE= <   60.500>

********************************************************************************
  FLOW PROCESS FROM NODE   225.50 TO NODE   217.50 IS CODE =  1
  UPSTREAM NODE   217.50     ELEVATION =    61.55  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      18.56 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     149.49 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     18.56)/(   410.170))**2 = 0.00205
  HF=L*SF = (    149.49)*(0.00205) =      0.306
--------------------------------------------------------------------------------
  NODE   217.50 : HGL = <   64.994>;EGL= <   65.216>;FLOWLINE= <   61.550>
```

```
**************************************************************************
  FLOW PROCESS FROM NODE   217.50 TO NODE   217.50 IS CODE =  5
  UPSTREAM NODE   217.50     ELEVATION =    61.65  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      18.56    30.00      0.00     61.65      1.46        3.781
    DOWNSTREAM     18.56    30.00       -       61.55      1.46        3.781
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00205
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00205
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00205
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.008 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.008)+( 0.000) =   0.008
--------------------------------------------------------------------------
  NODE   217.50 : HGL = <   65.003>;EGL= <   65.225>;FLOWLINE= <   61.650>

**************************************************************************
  FLOW PROCESS FROM NODE   217.50 TO NODE   216.50 IS CODE =  1
  UPSTREAM NODE   216.50     ELEVATION =    62.84  (FLOW SEALS IN REACH)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      18.56 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     154.60 FEET          MANNING'S N  =  0.01300
==========================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     3.35
==========================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000           3.353      3.781          3.575           780.03
       150.907           2.500      3.781          2.722           518.87
--------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.27           CRITICAL DEPTH(FT) =      1.46
==========================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     2.50
==========================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
       150.907           2.500      3.780          2.722           518.87
       154.600           2.478      3.785          2.700           512.28
--------------------------------------------------------------------------
  NODE   216.50 : HGL = <   65.318>;EGL= <   65.540>;FLOWLINE= <   62.840>

**************************************************************************
  FLOW PROCESS FROM NODE   216.50 TO NODE   216.50 IS CODE =  5
  UPSTREAM NODE   216.50     ELEVATION =    62.94  (FLOW IS SUBCRITICAL)
--------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
```

UPSTREAM	18.56	30.00	0.00	62.94	1.46	3.845
DOWNSTREAM	18.56	30.00	-	62.84	1.46	3.786
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00178
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00189
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00184
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.007 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.013)+(0.000) = 0.013

NODE 216.50 : HGL = < 65.324>;EGL= < 65.554>;FLOWLINE= < 62.940>

****

FLOW PROCESS FROM NODE 216.50 TO NODE 215.50 IS CODE = 1
UPSTREAM NODE 215.50 ELEVATION = 63.27 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 18.56 CFS PIPE DIAMETER = 30.00 INCHES
PIPE LENGTH = 79.90 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.55 CRITICAL DEPTH(FT) = 1.46

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.38

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.384	3.844	2.614	485.88
12.661	2.350	3.874	2.584	476.92
25.101	2.317	3.908	2.554	468.18
37.372	2.284	3.946	2.525	459.67
49.514	2.250	3.987	2.497	451.39
61.559	2.217	4.032	2.469	443.33
73.533	2.183	4.080	2.442	435.51
79.900	2.165	4.107	2.427	431.44

NODE 215.50 : HGL = < 65.435>;EGL= < 65.697>;FLOWLINE= < 63.270>

****

FLOW PROCESS FROM NODE 215.50 TO NODE 215.50 IS CODE = 5
UPSTREAM NODE 215.50 ELEVATION = 63.41 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	15.59	24.00	0.00	63.41	1.42	4.962
DOWNSTREAM	18.56	30.00	-	63.27	1.46	4.109
LATERAL #1	1.49	24.00	90.00	63.41	0.42	0.474
LATERAL #2	1.48	24.00	90.00	63.41	0.42	0.471
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00475

```
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00188
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00331
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.013 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.125)+( 0.000) =   0.125
--------------------------------------------------------------------------------
  NODE   215.50 : HGL = <   65.440>;EGL= <   65.822>;FLOWLINE= <   63.410>

********************************************************************************
  FLOW PROCESS FROM NODE   215.50 TO NODE   205.50 IS CODE =  1
  UPSTREAM NODE   205.50     ELEVATION =    63.80  (FLOW SEALS IN REACH)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      15.59 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =      65.01 FEET          MANNING'S N  =  0.01300
================================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     2.03
================================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          2.030      4.962          2.412           351.75
        23.625          2.000      4.962          2.382           345.96
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.47           CRITICAL DEPTH(FT) =      1.42
================================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     2.00
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        23.625          2.000      4.961          2.382           345.96
        36.987          1.979      4.970          2.363           342.08
        47.942          1.958      4.987          2.344           338.44
        57.881          1.936      5.009          2.326           334.97
        65.010          1.920      5.028          2.313           332.40
--------------------------------------------------------------------------------
  NODE   205.50 : HGL = <   65.720>;EGL= <   66.113>;FLOWLINE= <   63.800>

********************************************************************************
  FLOW PROCESS FROM NODE   205.50 TO NODE   205.50 IS CODE =  5
  UPSTREAM NODE   205.50     ELEVATION =    64.00  (FLOW UNSEALS IN REACH)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       10.78    24.00     90.00     64.00      1.18        3.431
    DOWNSTREAM      15.59    24.00       -       63.80      1.42        5.030
    LATERAL #1       4.81    24.00     90.00     64.00      0.77        1.531
    LATERAL #2       0.00     0.00      0.00      0.00      0.00        0.000
       Q5            0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00227
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00414
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00320
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.013 FEET         ENTRANCE LOSSES =  0.000 FEET
```

```
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.583)+( 0.000) =   0.583
--------------------------------------------------------------------------------
  NODE   205.50 : HGL = <   66.513>;EGL= <   66.696>;FLOWLINE= <   64.000>

********************************************************************************
  FLOW PROCESS FROM NODE   205.50 TO NODE   203.50 IS CODE =  1
  UPSTREAM NODE   203.50     ELEVATION =    64.15  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      10.78 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =      29.26 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     10.78)/(   226.218))**2 = 0.00227
  HF=L*SF = (     29.26)*(0.00227) =      0.066
--------------------------------------------------------------------------------
  NODE   203.50 : HGL = <   66.580>;EGL= <   66.763>;FLOWLINE= <   64.150>

********************************************************************************
  FLOW PROCESS FROM NODE   203.50 TO NODE   203.50 IS CODE =  8
  UPSTREAM NODE   203.50     ELEVATION =    64.15  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =      10.78 CFS          PIPE DIAMETER =  24.00 INCHES
  FLOW VELOCITY =   3.43 FEET/SEC.    VELOCITY HEAD =  0.183 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.183) =  0.037
--------------------------------------------------------------------------------
  NODE   203.50 : HGL = <   66.799>;EGL= <   66.799>;FLOWLINE= <   64.150>

********************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   203.50            FLOWLINE ELEVATION =    64.15
  ASSUMED UPSTREAM CONTROL HGL =     65.33 FOR DOWNSTREAM RUN ANALYSIS

================================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
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PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 19.1 Release Date: 08/09/2012 License ID 1261

Analysis prepared by:

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

* JN-18150 SDSU WEST *
* BASIN 200 BACKBONE SYSTEM 200A ULTIMATE CONDITION *
* 100-YR 6-HR *

****

FILE NAME: SDSW200A.PIP
TIME/DATE OF STUDY: 15:34 01/28/2019

****

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
270.00-		4.67*	1857.05	2.08 Dc	918.94
	} FRICTION				
265.00-		4.32*	1702.65	2.08 Dc	918.94
	} JUNCTION				
265.00-		5.22*	1906.96	1.77	637.24
	} FRICTION				
257.00-		4.72*	1686.57	1.60	651.09
	} JUNCTION				
257.00-		4.63*	1646.29	1.77	637.20
	} FRICTION				
256.00-		4.13*	1425.90	1.66	643.17
	} JUNCTION				
256.00-		4.06*	1385.56	1.69	628.53
	} FRICTION				
255.00-		3.91*	1318.28	1.79 Dc	625.25
	} JUNCTION				
255.00-		3.90*	1277.62	1.72 Dc	565.25
	} FRICTION				
245.00-		3.72*	1200.36	1.72 Dc	565.25
	} JUNCTION				
245.00-		3.77*	940.12	1.54 Dc	392.39
	} FRICTION				
237.00-		3.27*	787.81	1.36	401.77
	} JUNCTION				
237.00-		3.18*	760.28	1.54 Dc	392.39
	} FRICTION				
235.00-		2.68*	604.86	1.46	394.01
	} JUNCTION				
235.00-		2.43*	489.73	1.55 Dc	365.84
	} FRICTION				
225.00-		2.53*	508.98	1.55 Dc	365.84
	} JUNCTION				
225.00-		3.23*	492.66	1.10 Dc	148.94

```
      } FRICTION
  218.00-             2.75*           396.85        0.95              153.74
      } JUNCTION
  218.00-             2.65*           378.60        1.10 Dc           148.94
      } FRICTION
  217.00-             2.15*           280.83        0.95              153.74
      } JUNCTION
  217.00-             2.06*           262.59        1.10 Dc           148.94
      } FRICTION
  215.00-             1.71*           201.05        1.10 Dc           148.94
      } JUNCTION
  215.00-             1.75*           184.86        0.97 Dc           109.33
      } FRICTION
  205.00-             1.56*           156.41        0.97 Dc           109.34
      } JUNCTION
  205.00-             1.61*           156.87        0.89               96.89
      } FRICTION
  203.00-             1.56*           148.65        0.92 Dc            96.74
      } CATCH BASIN
  203.00-             1.68*           126.62        0.92 Dc            34.25
--------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
********************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   270.00            FLOWLINE ELEVATION =    54.54
  PIPE FLOW =      40.89 CFS        PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    59.211 FEET
--------------------------------------------------------------------------------
  NODE   270.00 : HGL = <   59.211>;EGL= <   59.731>;FLOWLINE= <   54.540>

********************************************************************************
  FLOW PROCESS FROM NODE   270.00 TO NODE   265.00 IS CODE =  1
  UPSTREAM NODE   265.00     ELEVATION =    55.93  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      40.89 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     276.70 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     40.89)/(   666.986))**2 = 0.00376
  HF=L*SF = (    276.70)*(0.00376) =      1.040
--------------------------------------------------------------------------------
  NODE   265.00 : HGL = <   60.251>;EGL= <   60.771>;FLOWLINE= <   55.930>

********************************************************************************
  FLOW PROCESS FROM NODE   265.00 TO NODE   265.00 IS CODE =  5
  UPSTREAM NODE   265.00     ELEVATION =    56.03  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      31.05    36.00     90.00     56.03      1.81        4.393
    DOWNSTREAM     40.89    36.00       -       55.93      2.08        5.785
    LATERAL #1      4.92    24.00     45.00     56.13      0.78        1.566
    LATERAL #2      4.92    24.00     45.00     56.13      0.78        1.566
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00217
```

```
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00376
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00296
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.012 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.783)+( 0.000) =   0.783
--------------------------------------------------------------------------------
  NODE   265.00 : HGL = <   61.254>;EGL= <   61.554>;FLOWLINE= <   56.030>

********************************************************************************
  FLOW PROCESS FROM NODE   265.00 TO NODE   257.00 IS CODE =  1
  UPSTREAM NODE   257.00     ELEVATION =    56.91  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      31.05 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     175.50 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     31.05)/(   666.985))**2 = 0.00217
  HF=L*SF = (    175.50)*(0.00217) =      0.380
--------------------------------------------------------------------------------
  NODE   257.00 : HGL = <   61.634>;EGL= <   61.934>;FLOWLINE= <   56.910>

********************************************************************************
  FLOW PROCESS FROM NODE   257.00 TO NODE   257.00 IS CODE =  5
  UPSTREAM NODE   257.00     ELEVATION =    57.01  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      31.05    36.00      0.00     57.01      1.81        4.393
    DOWNSTREAM     31.05    36.00       -       56.91      1.81        4.393
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00217
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00217
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00217
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.009 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.009)+( 0.000) =   0.009
--------------------------------------------------------------------------------
  NODE   257.00 : HGL = <   61.643>;EGL= <   61.943>;FLOWLINE= <   57.010>

********************************************************************************
  FLOW PROCESS FROM NODE   257.00 TO NODE   256.00 IS CODE =  1
  UPSTREAM NODE   256.00     ELEVATION =    57.89  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      31.05 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     175.50 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     31.05)/(   666.985))**2 = 0.00217
  HF=L*SF = (    175.50)*(0.00217) =      0.380
--------------------------------------------------------------------------------
  NODE   256.00 : HGL = <   62.023>;EGL= <   62.323>;FLOWLINE= <   57.890>

********************************************************************************
  FLOW PROCESS FROM NODE   256.00 TO NODE   256.00 IS CODE =  5
  UPSTREAM NODE   256.00     ELEVATION =    57.99  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
```

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	30.62	36.00	0.00	57.99	1.79	4.332
DOWNSTREAM	31.05	36.00	-	57.89	1.81	4.393
LATERAL #1	0.22	24.00	90.00	58.09	0.16	0.070
LATERAL #2	0.21	24.00	90.00	58.09	0.16	0.067
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00211
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00217
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00214
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.009 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.017)+(0.000) = 0.017

NODE 256.00 : HGL = < 62.049>;EGL= < 62.340>;FLOWLINE= < 57.990>

****

FLOW PROCESS FROM NODE 256.00 TO NODE 255.00 IS CODE = 1
UPSTREAM NODE 255.00 ELEVATION = 58.23 (FLOW IS UNDER PRESSURE)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 30.62 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 41.50 FEET MANNING'S N = 0.01300
SF=(Q/K)**2 = ((30.62)/(666.985))**2 = 0.00211
HF=L*SF = (41.50)*(0.00211) = 0.087

NODE 255.00 : HGL = < 62.136>;EGL= < 62.427>;FLOWLINE= < 58.230>

****

FLOW PROCESS FROM NODE 255.00 TO NODE 255.00 IS CODE = 5
UPSTREAM NODE 255.00 ELEVATION = 58.33 (FLOW IS UNDER PRESSURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	28.36	36.00	0.00	58.33	1.72	4.012
DOWNSTREAM	30.62	36.00	-	58.23	1.79	4.332
LATERAL #1	1.13	24.00	90.00	58.43	0.37	0.360
LATERAL #2	1.13	24.00	90.00	58.43	0.37	0.360
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00181
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00211
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00196
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.008 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.049)+(0.000) = 0.049

NODE 255.00 : HGL = < 62.227>;EGL= < 62.477>;FLOWLINE= < 58.330>

****

FLOW PROCESS FROM NODE 255.00 TO NODE 245.00 IS CODE = 1
UPSTREAM NODE 245.00 ELEVATION = 58.62 (FLOW IS UNDER PRESSURE)

```
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      28.36 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      63.51 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     28.36)/(   666.982))**2 = 0.00181
  HF=L*SF = (     63.51)*(0.00181) =      0.115
------------------------------------------------------------------------------
  NODE   245.00 : HGL = <   62.341>;EGL= <   62.591>;FLOWLINE= <   58.620>

******************************************************************************
  FLOW PROCESS FROM NODE   245.00 TO NODE   245.00 IS CODE =  5
  UPSTREAM NODE   245.00     ELEVATION =    58.72  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      20.64    30.00      0.00     58.72      1.54        4.205
    DOWNSTREAM     28.36    36.00       -       58.62      1.72        4.012
    LATERAL #1      4.79    24.00     90.00     58.82      0.77        1.525
    LATERAL #2      2.93    24.00     90.00     58.82      0.60        0.933
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00253
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00181
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00217
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.009 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.173)+( 0.000) =   0.173
------------------------------------------------------------------------------
  NODE   245.00 : HGL = <   62.490>;EGL= <   62.765>;FLOWLINE= <   58.720>

******************************************************************************
  FLOW PROCESS FROM NODE   245.00 TO NODE   237.00 IS CODE =  1
  UPSTREAM NODE   237.00     ELEVATION =    59.73  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      20.64 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     202.49 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     20.64)/(   410.173))**2 = 0.00253
  HF=L*SF = (    202.49)*(0.00253) =      0.513
------------------------------------------------------------------------------
  NODE   237.00 : HGL = <   63.003>;EGL= <   63.277>;FLOWLINE= <   59.730>

******************************************************************************
  FLOW PROCESS FROM NODE   237.00 TO NODE   237.00 IS CODE =  5
  UPSTREAM NODE   237.00     ELEVATION =    59.83  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      20.64    30.00      0.00     59.83      1.54        4.205
    DOWNSTREAM     20.64    30.00       -       59.73      1.54        4.205
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
```

```
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00253
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00253
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00253
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.010 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.010)+( 0.000) =   0.010
--------------------------------------------------------------------------------
  NODE   237.00 : HGL = <   63.013>;EGL= <   63.288>;FLOWLINE= <   59.830>

********************************************************************************
  FLOW PROCESS FROM NODE   237.00 TO NODE   235.00 IS CODE =  1
  UPSTREAM NODE   235.00     ELEVATION =    60.84  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      20.64 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     198.49 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     20.64)/(   410.171))**2 = 0.00253
  HF=L*SF = (    198.49)*(0.00253) =      0.503
--------------------------------------------------------------------------------
  NODE   235.00 : HGL = <   63.516>;EGL= <   63.790>;FLOWLINE= <   60.840>

********************************************************************************
  FLOW PROCESS FROM NODE   235.00 TO NODE   235.00 IS CODE =  5
  UPSTREAM NODE   235.00     ELEVATION =    60.94  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      18.43    24.00      0.00     60.94      1.55        5.866
    DOWNSTREAM     20.64    30.00       -       60.84      1.54        4.205
    LATERAL #1      1.11    24.00     90.00     61.04      0.36        0.353
    LATERAL #2      1.10    24.00     90.00     61.04      0.36        0.350
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00664
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00253
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00458
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.018 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.114)+( 0.000) =   0.114
--------------------------------------------------------------------------------
  NODE   235.00 : HGL = <   63.369>;EGL= <   63.904>;FLOWLINE= <   60.940>

********************************************************************************
  FLOW PROCESS FROM NODE   235.00 TO NODE   225.00 IS CODE =  1
  UPSTREAM NODE   225.00     ELEVATION =    61.26  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      18.43 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =      63.01 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     18.43)/(   226.223))**2 = 0.00664
  HF=L*SF = (     63.01)*(0.00664) =      0.418
--------------------------------------------------------------------------------
  NODE   225.00 : HGL = <   63.788>;EGL= <   64.322>;FLOWLINE= <   61.260>

********************************************************************************
  FLOW PROCESS FROM NODE   225.00 TO NODE   225.00 IS CODE =  5
  UPSTREAM NODE   225.00     ELEVATION =    61.36  (FLOW IS UNDER PRESSURE)
```

```
-------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       9.41    24.00      0.00     61.36      1.10        2.995
    DOWNSTREAM     18.43    24.00       -       61.26      1.55        5.866
    LATERAL #1      5.56    24.00     90.00     61.46      0.83        1.770
    LATERAL #2      3.46    24.00     90.00     61.46      0.65        1.101
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00173
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00664
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00418
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.017 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.412)+( 0.000) =   0.412
-------------------------------------------------------------------------------
  NODE   225.00 : HGL = <   64.594>;EGL= <   64.734>;FLOWLINE= <   61.360>

*******************************************************************************
  FLOW PROCESS FROM NODE   225.00 TO NODE   218.00 IS CODE =  1
  UPSTREAM NODE   218.00     ELEVATION =    62.11  (FLOW IS UNDER PRESSURE)
-------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       9.41 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =     151.00 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((      9.41)/(   226.225))**2 = 0.00173
  HF=L*SF = (    151.00)*(0.00173) =      0.261
-------------------------------------------------------------------------------
  NODE   218.00 : HGL = <   64.856>;EGL= <   64.995>;FLOWLINE= <   62.110>

*******************************************************************************
  FLOW PROCESS FROM NODE   218.00 TO NODE   218.00 IS CODE =  5
  UPSTREAM NODE   218.00     ELEVATION =    62.21  (FLOW IS UNDER PRESSURE)
-------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       9.41    24.00      0.00     62.21      1.10        2.995
    DOWNSTREAM      9.41    24.00       -       62.11      1.10        2.995
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00173
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00173
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00173
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.007 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.007)+( 0.000) =   0.007
-------------------------------------------------------------------------------
  NODE   218.00 : HGL = <   64.863>;EGL= <   65.002>;FLOWLINE= <   62.210>

*******************************************************************************
  FLOW PROCESS FROM NODE   218.00 TO NODE   217.00 IS CODE =  1
```

```
  UPSTREAM NODE   217.00     ELEVATION =    62.97  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       9.41 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =     151.00 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((      9.41)/(   226.225))**2 = 0.00173
  HF=L*SF = (    151.00)*(0.00173) =      0.261
--------------------------------------------------------------------------------
  NODE   217.00 : HGL = <   65.124>;EGL= <   65.263>;FLOWLINE= <   62.970>

********************************************************************************
  FLOW PROCESS FROM NODE   217.00 TO NODE   217.00 IS CODE =  5
  UPSTREAM NODE   217.00     ELEVATION =    63.07  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       9.41    24.00      0.00     63.07      1.10        2.995
    DOWNSTREAM      9.41    24.00       -       62.97      1.10        2.995
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00173
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00173
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00173
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.007 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.007)+( 0.000) =   0.007
--------------------------------------------------------------------------------
  NODE   217.00 : HGL = <   65.131>;EGL= <   65.270>;FLOWLINE= <   63.070>

********************************************************************************
  FLOW PROCESS FROM NODE   217.00 TO NODE   215.00 IS CODE =  1
  UPSTREAM NODE   215.00     ELEVATION =    63.54  (FLOW SEALS IN REACH)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       9.41 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =      93.00 FEET          MANNING'S N  =  0.01300
================================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     2.06
================================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          2.061      2.995          2.200           262.59
        18.310          2.000      2.995          2.139           250.66
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.10           CRITICAL DEPTH(FT) =      1.10
================================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     2.00
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        18.310          2.000      2.994          2.139           250.66
        28.472          1.964      3.007          2.104           243.83
```

38.101	1.928	3.029	2.071	237.23
47.465	1.892	3.059	2.037	230.82
56.645	1.856	3.094	2.005	224.58
65.688	1.820	3.134	1.972	218.53
74.623	1.784	3.180	1.941	212.66
83.472	1.748	3.230	1.910	206.98
92.250	1.712	3.286	1.880	201.51
93.000	1.709	3.291	1.877	201.05

NODE 215.00 : HGL = < 65.249>;EGL= < 65.417>;FLOWLINE= < 63.540>

****

FLOW PROCESS FROM NODE 215.00 TO NODE 215.00 IS CODE = 5
UPSTREAM NODE 215.00 ELEVATION = 63.64 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	7.42	24.00	0.00	63.64	0.97	2.547
DOWNSTREAM	9.41	24.00	-	63.54	1.10	3.292
LATERAL #1	1.99	24.00	90.00	63.74	0.49	0.748
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00098
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00162
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00130
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.005 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.073)+(0.000) = 0.073

NODE 215.00 : HGL = < 65.389>;EGL= < 65.490>;FLOWLINE= < 63.640>

****

FLOW PROCESS FROM NODE 215.00 TO NODE 205.00 IS CODE = 1
UPSTREAM NODE 205.00 ELEVATION = 63.87 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 7.42 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 62.00 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.05 CRITICAL DEPTH(FT) = 0.97

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.75

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.749	2.546	1.850	184.86
9.342	1.721	2.580	1.824	180.26
18.676	1.692	2.616	1.799	175.77
28.008	1.664	2.655	1.774	171.38
37.347	1.636	2.696	1.749	167.10
46.701	1.608	2.740	1.725	162.94
56.076	1.580	2.787	1.701	158.90
62.000	1.562	2.817	1.686	156.41

NODE 205.00 : HGL = < 65.432>;EGL= < 65.556>;FLOWLINE= < 63.870>

```
****************************************************************************
  FLOW PROCESS FROM NODE   205.00 TO NODE   205.00 IS CODE =  5
  UPSTREAM NODE   205.00     ELEVATION =    64.07  (FLOW IS SUBCRITICAL)
----------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       6.75    24.00     90.00     64.07      0.92        2.486
    DOWNSTREAM      7.42    24.00       -       63.87      0.97        2.818
    LATERAL #1      0.67    24.00     90.00     64.07      0.28        0.267
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00092
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00118
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00105
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.004 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.223)+( 0.000) =   0.223
----------------------------------------------------------------------------
  NODE   205.00 : HGL = <   65.683>;EGL= <   65.779>;FLOWLINE= <   64.070>

****************************************************************************
  FLOW PROCESS FROM NODE   205.00 TO NODE   203.00 IS CODE =  1
  UPSTREAM NODE   203.00     ELEVATION =    64.13  (FLOW IS SUBCRITICAL)
----------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       6.75 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =      11.25 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.89           CRITICAL DEPTH(FT) =      0.92
============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.61
============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
----------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.613      2.486          1.709           156.87
         5.559          1.585      2.527          1.684           152.76
        11.104          1.558      2.571          1.660           148.76
        11.250          1.557      2.572          1.660           148.65
----------------------------------------------------------------------------
  NODE   203.00 : HGL = <   65.687>;EGL= <   65.790>;FLOWLINE= <   64.130>

****************************************************************************
  FLOW PROCESS FROM NODE   203.00 TO NODE   203.00 IS CODE =  8
  UPSTREAM NODE   203.00     ELEVATION =    64.13  (FLOW IS SUBCRITICAL)
----------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       6.75 CFS          PIPE DIAMETER =  24.00 INCHES
  FLOW VELOCITY =   2.57 FEET/SEC.    VELOCITY HEAD =  0.103 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.103) =  0.021
----------------------------------------------------------------------------
  NODE   203.00 : HGL = <   65.810>;EGL= <   65.810>;FLOWLINE= <   64.130>

****************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
```

SDSW200A.RES

NODE NUMBER = 203.00 FLOWLINE ELEVATION = 64.13

ASSUMED UPSTREAM CONTROL HGL = 65.05 FOR DOWNSTREAM RUN ANALYSIS

==========

END OF GRADUALLY VARIED FLOW ANALYSIS

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**************************************************************************
              PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
          (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                          Analysis prepared by:

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                            5620 Friars Road
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  ************************* DESCRIPTION OF STUDY *************************
 * JN-18150      SDSU WEST                                                *
 * BASIN 300   BUBBLER HGL ANALYSIS   NODE 300-394.5   ULTIMATE CONDITION   *
 * 100-YR 6-HR     HGL0 = 48.0' = 10-YR WSEL OF SD RIVER                  *
  ************************************************************************

   FILE NAME: 300_18.PIP
   TIME/DATE OF STUDY: 12:58 02/01/2019

**************************************************************************
               GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                         NODAL POINT STATUS TABLE
                (Note: "*" indicates nodal point data used.)
                      UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   300.00-             2.21 Dc         1079.17        1.98*           1098.14
         } FRICTION
   394.50-             2.21*Dc         1079.17        2.21*Dc         1079.17
         } CATCH BASIN
   394.50-             3.38*            828.20        2.21 Dc          343.32
--------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
**************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   300.00           FLOWLINE ELEVATION =    45.97
  PIPE FLOW =      46.04 CFS       PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    48.000 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  2.03 FT.)
         IS LESS THAN CRITICAL DEPTH(  2.21 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
--------------------------------------------------------------------------
  NODE   300.00 : HGL = <   47.947>;EGL= <   49.295>;FLOWLINE= <   45.970>

**************************************************************************
  FLOW PROCESS FROM NODE   300.00 TO NODE   394.50 IS CODE =  1
  UPSTREAM NODE   394.50     ELEVATION =    46.50  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      46.04 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      62.89 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.94          CRITICAL DEPTH(FT) =      2.21
==========================================================================
```

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.21

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.210	8.245	3.266	1079.17
0.044	2.199	8.287	3.267	1079.21
0.181	2.189	8.330	3.267	1079.32
0.420	2.178	8.373	3.267	1079.50
0.769	2.167	8.417	3.268	1079.77
1.239	2.157	8.462	3.269	1080.10
1.843	2.146	8.508	3.270	1080.52
2.596	2.135	8.554	3.272	1081.02
3.513	2.124	8.600	3.274	1081.59
4.615	2.114	8.648	3.276	1082.24
5.925	2.103	8.696	3.278	1082.98
7.473	2.092	8.744	3.280	1083.80
9.294	2.081	8.794	3.283	1084.70
11.431	2.071	8.844	3.286	1085.69
13.940	2.060	8.895	3.289	1086.77
16.890	2.049	8.947	3.293	1087.93
20.377	2.038	8.999	3.297	1089.18
24.526	2.028	9.053	3.301	1090.52
29.514	2.017	9.107	3.306	1091.95
35.602	2.006	9.162	3.310	1093.47
43.191	1.996	9.217	3.316	1095.08
52.958	1.985	9.274	3.321	1096.79
62.890	1.977	9.317	3.325	1098.14

NODE 394.50 : HGL = < 48.710>;EGL= < 49.766>;FLOWLINE= < 46.500>

FLOW PROCESS FROM NODE 394.50 TO NODE 394.50 IS CODE = 8
UPSTREAM NODE 394.50 ELEVATION = 46.60 (FLOW UNSEALS IN REACH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 46.04 CFS PIPE DIAMETER = 36.00 INCHES
FLOW VELOCITY = 8.25 FEET/SEC. VELOCITY HEAD = 1.056 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(1.056) = 0.211

NODE 394.50 : HGL = < 49.978>;EGL= < 49.978>;FLOWLINE= < 46.600>

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 394.50 FLOWLINE ELEVATION = 46.60
ASSUMED UPSTREAM CONTROL HGL = 48.81 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS
♀

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PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 19.1 Release Date: 08/09/2012 License ID 1261

Analysis prepared by:

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

* JN-18150 SDSU WEST *
* BASIN 300 BACKBONE SYSTEM 300A ULTIMATE CONDITION *
* 100-YR 6-HR HGL0 = HGL @ BUBBLER IN NODE 394.5 *

****

FILE NAME: SDSW300A.PIP
TIME/DATE OF STUDY: 13:11 02/01/2019

****

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
394.50-		3.38*	1249.16	1.46	823.57
	} FRICTION				
394.00-		2.88*	1000.74	1.46	825.30
	} JUNCTION				
394.00-		2.77*	953.77	1.48	817.98
	} FRICTION		} HYDRAULIC JUMP		
393.00-		1.88*Dc	754.43	1.87*Dc	754.43
	} JUNCTION				
393.00-		2.47*	783.18	1.40	711.70
	} FRICTION		} HYDRAULIC JUMP		
391.00-		1.77*Dc	656.43	1.77*Dc	656.43
	} JUNCTION				
391.00-		2.75*	885.61	1.15	841.31
	} FRICTION+BEND		} HYDRAULIC JUMP		
390.00-		1.77 Dc	656.43	1.49*	687.76
	} JUNCTION				
390.00-		1.82 Dc	645.26	1.43*	699.71
	} FRICTION+BEND				
385.00-		1.82*Dc	645.26	1.82*Dc	645.26
	} JUNCTION				
385.00-		2.91*	629.70	1.30	322.08
	} FRICTION				
337.00-		2.55*	519.25	1.42 Dc	318.11
	} JUNCTION				
337.00-		2.53*	502.64	1.21	306.81
	} FRICTION		} HYDRAULIC JUMP		
336.00-		1.39*Dc	299.07	1.39*Dc	299.07
	} JUNCTION				
336.00-		2.11*	380.03	1.20	285.97
	} FRICTION		} HYDRAULIC JUMP		
330.00-		1.35*Dc	280.35	1.35*Dc	280.35
	} JUNCTION				
330.00-		2.03*	284.38	0.88	139.40

```
      } FRICTION        } HYDRAULIC JUMP
  322.00-             1.01*Dc          135.72        1.01*Dc          135.72
      } JUNCTION
  322.00-             1.14*            139.09        1.01 Dc          135.72
      } FRICTION        } HYDRAULIC JUMP
  321.00-             1.15             139.93        0.81*            145.52
      } JUNCTION
  321.00-             1.01 Dc          135.72        0.84*            142.33
      } FRICTION
  320.00-             1.01*Dc          135.72        1.01*Dc          135.72
      } JUNCTION
  320.00-             1.18             126.06        0.72*            128.47
      } FRICTION
  315.00-             0.94*Dc          115.65        0.94*Dc          115.65
      } JUNCTION
  315.00-             1.39*            104.54        0.28               9.64
      } FRICTION        } HYDRAULIC JUMP
  307.00-             0.34 Dc            9.08        0.27*              9.98
      } JUNCTION
  307.00-             0.34 Dc            9.08        0.28*              9.68
      } FRICTION
  306.00-             0.34*Dc            9.08        0.34*Dc            9.08
      } JUNCTION
  306.00-             0.39               9.51        0.30*              9.90
      } FRICTION
  305.00-             0.36*Dc            9.39        0.36*Dc            9.39
      } CATCH BASIN
  305.00-             0.51*              4.96        0.36 Dc            3.47
--------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
--------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
********************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   394.50            FLOWLINE ELEVATION =    46.60
  PIPE FLOW =      36.51 CFS        PIPE DIAMETER =  42.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    49.978 FEET
--------------------------------------------------------------------------------
  NODE   394.50 : HGL = <   49.978>;EGL= <   50.207>;FLOWLINE= <   46.600>

********************************************************************************
  FLOW PROCESS FROM NODE   394.50 TO NODE   394.00 IS CODE =  1
  UPSTREAM NODE   394.00     ELEVATION =    47.10  (FLOW IS SUBCRITICAL)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.51 CFS     PIPE DIAMETER =  42.00 INCHES
  PIPE LENGTH =      51.12 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.47           CRITICAL DEPTH(FT) =      1.88
================================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     3.38
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000         3.378      3.836          3.607          1249.16
         6.479         3.318      3.870          3.551          1216.08
        12.853         3.258      3.912          3.496          1183.84
        19.135         3.198      3.960          3.441          1152.43
        25.333         3.138      4.013          3.388          1121.88
```

31.450	3.077	4.073	3.335	1092.22
37.487	3.017	4.138	3.283	1063.48
43.443	2.957	4.209	3.232	1035.69
49.315	2.897	4.286	3.182	1008.90
51.120	2.878	4.311	3.167	1000.74

NODE 394.00 : HGL = < 49.978>;EGL= < 50.267>;FLOWLINE= < 47.100>

****

FLOW PROCESS FROM NODE 394.00 TO NODE 394.00 IS CODE = 5
UPSTREAM NODE 394.00 ELEVATION = 47.20 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	36.51	42.00	0.00	47.20	1.88	4.478
DOWNSTREAM	36.51	42.00	-	47.10	1.88	4.313
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00141
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00131
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00136
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.005 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.009)+(0.000) = 0.009

NODE 394.00 : HGL = < 49.965>;EGL= < 50.277>;FLOWLINE= < 47.200>

****

FLOW PROCESS FROM NODE 394.00 TO NODE 393.00 IS CODE = 1
UPSTREAM NODE 393.00 ELEVATION = 49.20 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 36.51 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 202.09 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.46 CRITICAL DEPTH(FT) = 1.88

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.87

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.875	6.956	2.627	754.43
0.052	1.858	7.034	2.627	754.52
0.209	1.842	7.113	2.628	754.80
0.483	1.825	7.193	2.629	755.27
0.884	1.809	7.276	2.631	755.93
1.425	1.792	7.361	2.634	756.79
2.121	1.776	7.448	2.638	757.85
2.990	1.759	7.536	2.642	759.12
4.053	1.743	7.627	2.647	760.60
5.333	1.726	7.720	2.652	762.30
6.860	1.710	7.816	2.659	764.22

8.668	1.693	7.914	2.666	766.36
10.801	1.677	8.014	2.675	768.74
13.311	1.660	8.117	2.684	771.35
16.266	1.644	8.222	2.694	774.21
19.752	1.627	8.330	2.705	777.33
23.881	1.611	8.441	2.718	780.70
28.809	1.594	8.555	2.731	784.33
34.751	1.578	8.672	2.746	788.24
42.022	1.561	8.792	2.762	792.42
51.114	1.545	8.915	2.780	796.90
62.846	1.528	9.041	2.798	801.67
78.758	1.512	9.171	2.819	806.75
102.309	1.495	9.305	2.841	812.14
144.595	1.479	9.443	2.864	817.86
202.090	1.479	9.445	2.865	817.98

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.77

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.765	4.477	3.077	953.77
3.265	2.730	4.534	3.049	939.80
6.491	2.694	4.593	3.022	926.23
9.677	2.658	4.655	2.995	913.08
12.821	2.623	4.720	2.969	900.35
15.918	2.587	4.787	2.943	888.05
18.967	2.551	4.857	2.918	876.20
21.964	2.516	4.930	2.894	864.80
24.904	2.480	5.006	2.870	853.87
27.782	2.445	5.086	2.847	843.42
30.595	2.409	5.169	2.824	833.46
33.336	2.373	5.255	2.803	824.01
35.997	2.338	5.345	2.782	815.08
38.573	2.302	5.439	2.762	806.68
41.054	2.267	5.537	2.743	798.83
43.430	2.231	5.639	2.725	791.54
45.691	2.195	5.745	2.708	784.85
47.822	2.160	5.857	2.693	778.75
49.809	2.124	5.973	2.679	773.28
51.634	2.089	6.095	2.666	768.45
53.275	2.053	6.222	2.655	764.29
54.707	2.017	6.355	2.645	760.82
55.900	1.982	6.495	2.637	758.07
56.816	1.946	6.641	2.631	756.07
57.409	1.911	6.794	2.628	754.84
57.622	1.875	6.955	2.627	754.43
202.090	1.875	6.955	2.627	754.43

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 35.15 FEET UPSTREAM OF NODE 394.00
DOWNSTREAM DEPTH = 2.349 FEET, UPSTREAM CONJUGATE DEPTH = 1.479 FEET

NODE 393.00 : HGL = < 51.075>;EGL= < 51.827>;FLOWLINE= < 49.200>

FLOW PROCESS FROM NODE 393.00 TO NODE 393.00 IS CODE = 5
UPSTREAM NODE 393.00 ELEVATION = 49.30 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW	DIAMETER	ANGLE	FLOWLINE	CRITICAL	VELOCITY

	(CFS)	(INCHES)	(DEGREES)	ELEVATION	DEPTH(FT.)	(FT/SEC)
UPSTREAM	32.81	42.00	40.40	49.30	1.77	4.516
DOWNSTREAM	36.51	42.00	-	49.20	1.88	6.957
LATERAL #1	3.70	18.00	45.00	49.30	0.73	2.094
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00148
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00418
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00283
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.011 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.263)+(0.000) = 0.263

NODE 393.00 : HGL = < 51.773>;EGL= < 52.089>;FLOWLINE= < 49.300>

****

FLOW PROCESS FROM NODE 393.00 TO NODE 391.00 IS CODE = 1
UPSTREAM NODE 391.00 ELEVATION = 50.30 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 32.81 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 98.04 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.37 CRITICAL DEPTH(FT) = 1.77

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.77

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.772	6.710	2.472	656.43
0.052	1.756	6.788	2.472	656.53
0.205	1.740	6.869	2.473	656.80
0.467	1.724	6.951	2.474	657.25
0.852	1.708	7.036	2.477	657.88
1.369	1.691	7.122	2.479	658.70
2.035	1.675	7.211	2.483	659.72
2.865	1.659	7.302	2.487	660.93
3.880	1.643	7.395	2.492	662.34
5.101	1.627	7.490	2.498	663.96
6.558	1.610	7.588	2.505	665.79
8.284	1.594	7.688	2.513	667.84
10.319	1.578	7.791	2.521	670.11
12.714	1.562	7.897	2.531	672.60
15.534	1.546	8.005	2.541	675.34
18.860	1.530	8.117	2.553	678.31
22.801	1.513	8.231	2.566	681.53
27.504	1.497	8.348	2.580	685.01
33.176	1.481	8.469	2.595	688.75
40.117	1.465	8.593	2.612	692.75
48.798	1.449	8.721	2.630	697.04
60.000	1.432	8.852	2.650	701.61
75.197	1.416	8.987	2.671	706.48
97.692	1.400	9.126	2.694	711.66
98.040	1.400	9.127	2.694	711.70

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.47

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.473	4.514	2.789	783.18
2.304	2.445	4.571	2.769	774.15
4.577	2.417	4.629	2.750	765.40
6.818	2.389	4.689	2.730	756.93
9.025	2.361	4.751	2.711	748.75
11.196	2.333	4.815	2.693	740.85
13.327	2.305	4.882	2.675	733.26
15.416	2.277	4.950	2.657	725.97
17.460	2.249	5.021	2.640	719.00
19.456	2.221	5.095	2.624	712.34
21.399	2.193	5.171	2.608	706.01
23.285	2.165	5.249	2.593	700.01
25.110	2.137	5.330	2.578	694.36
26.869	2.109	5.415	2.564	689.05
28.554	2.081	5.502	2.551	684.11
30.161	2.053	5.592	2.539	679.53
31.680	2.025	5.686	2.527	675.32
33.103	1.997	5.783	2.516	671.51
34.422	1.969	5.884	2.507	668.10
35.623	1.941	5.988	2.498	665.09
36.694	1.913	6.097	2.490	662.51
37.621	1.885	6.209	2.484	660.36
38.384	1.857	6.326	2.479	658.67
38.964	1.829	6.448	2.475	657.44
39.334	1.801	6.575	2.473	656.69
39.465	1.773	6.706	2.472	656.43
98.040	1.773	6.706	2.472	656.43

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 21.13 FEET UPSTREAM OF NODE 393.00
DOWNSTREAM DEPTH = 2.197 FEET, UPSTREAM CONJUGATE DEPTH = 1.415 FEET

NODE 391.00 : HGL = < 52.072>;EGL= < 52.772>;FLOWLINE= < 50.300>

****

FLOW PROCESS FROM NODE 391.00 TO NODE 391.00 IS CODE = 5
UPSTREAM NODE 391.00 ELEVATION = 50.40 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	32.81	42.00	90.00	50.40	1.77	4.049
DOWNSTREAM	32.81	42.00	-	50.30	1.77	6.708
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00116
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00407
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00261
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.010 FEET ENTRANCE LOSSES = 0.000 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.631)+(0.000) = 0.631

NODE 391.00 : HGL = < 53.148>;EGL= < 53.402>;FLOWLINE= < 50.400>

****

FLOW PROCESS FROM NODE 391.00 TO NODE 390.00 IS CODE = 3
UPSTREAM NODE 390.00 ELEVATION = 54.44 (HYDRAULIC JUMP OCCURS)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 32.81 CFS PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 16.800 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 195.78 FEET

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.13 CRITICAL DEPTH(FT) = 1.77

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.49

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.485	8.438	2.591	687.76
1.092	1.471	8.545	2.606	691.17
2.289	1.457	8.654	2.621	694.78
3.604	1.443	8.766	2.637	698.61
5.045	1.429	8.881	2.654	702.65
6.628	1.415	8.999	2.673	706.92
8.367	1.401	9.119	2.693	711.42
10.280	1.387	9.243	2.714	716.16
12.387	1.373	9.370	2.737	721.14
14.714	1.359	9.500	2.761	726.38
17.289	1.345	9.634	2.787	731.87
20.147	1.331	9.771	2.814	737.64
23.333	1.317	9.912	2.843	743.67
26.899	1.302	10.057	2.874	749.99
30.914	1.288	10.205	2.907	756.61
35.465	1.274	10.358	2.941	763.53
40.666	1.260	10.515	2.978	770.76
46.673	1.246	10.677	3.017	778.31
53.705	1.232	10.843	3.059	786.20
62.081	1.218	11.014	3.103	794.43
72.297	1.204	11.189	3.149	803.03
85.183	1.190	11.371	3.199	811.99
102.296	1.176	11.557	3.251	821.34
127.135	1.162	11.749	3.307	831.09
170.924	1.148	11.947	3.366	841.25
195.780	1.148	11.948	3.366	841.31

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

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DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.75

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.748	4.048	3.002	885.61
1.631	2.709	4.105	2.971	869.67
3.241	2.670	4.165	2.939	854.19
4.830	2.631	4.228	2.909	839.16

6.396	2.592	4.294	2.878	824.61
7.938	2.553	4.362	2.849	810.55
9.453	2.514	4.434	2.819	796.98
10.940	2.475	4.510	2.791	783.92
12.396	2.436	4.589	2.763	771.38
13.820	2.397	4.671	2.736	759.39
15.207	2.358	4.757	2.710	747.95
16.556	2.319	4.848	2.684	737.07
17.862	2.280	4.942	2.659	726.79
19.122	2.241	5.041	2.636	717.11
20.331	2.202	5.145	2.613	708.05
21.484	2.163	5.254	2.592	699.63
22.576	2.124	5.369	2.572	691.88
23.600	2.085	5.489	2.553	684.81
24.549	2.046	5.615	2.536	678.45
25.415	2.007	5.748	2.520	672.84
26.187	1.968	5.887	2.506	667.99
26.855	1.929	6.034	2.495	663.94
27.406	1.890	6.189	2.485	660.72
27.823	1.851	6.352	2.478	658.37
28.090	1.812	6.524	2.473	656.92
28.184	1.773	6.706	2.472	656.43
195.780	1.773	6.706	2.472	656.43

----------END OF HYDRAULIC JUMP ANALYSIS----------

PRESSURE+MOMENTUM BALANCE OCCURS AT 4.60 FEET UPSTREAM OF NODE 391.00
DOWNSTREAM DEPTH = 2.636 FEET, UPSTREAM CONJUGATE DEPTH = 1.148 FEET

NODE 390.00 : HGL = < 55.925>;EGL= < 57.031>;FLOWLINE= < 54.440>

****

FLOW PROCESS FROM NODE 390.00 TO NODE 390.00 IS CODE = 5
UPSTREAM NODE 390.00 ELEVATION = 54.54 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	31.36	36.00	20.30	54.54	1.82	9.461
DOWNSTREAM	32.81	42.00	-	54.44	1.77	8.440
LATERAL #1	1.45	24.00	44.28	54.64	0.42	0.667
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01050
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00756
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00903
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.036 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.325)+(0.000) = 0.325

NODE 390.00 : HGL = < 55.967>;EGL= < 57.357>;FLOWLINE= < 54.540>

****

FLOW PROCESS FROM NODE 390.00 TO NODE 385.00 IS CODE = 3
UPSTREAM NODE 385.00 ELEVATION = 55.80 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 31.36 CFS PIPE DIAMETER = 36.00 INCHES
CENTRAL ANGLE = 7.700 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 112.53 FEET

NORMAL DEPTH(FT) = 1.40 CRITICAL DEPTH(FT) = 1.82

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.82

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.816	7.007	2.578	645.26
0.047	1.799	7.084	2.579	645.34
0.192	1.782	7.163	2.580	645.59
0.446	1.766	7.244	2.581	646.01
0.818	1.749	7.327	2.583	646.60
1.322	1.733	7.412	2.586	647.37
1.971	1.716	7.500	2.590	648.32
2.781	1.699	7.589	2.594	649.46
3.771	1.683	7.681	2.600	650.79
4.965	1.666	7.775	2.606	652.32
6.390	1.650	7.872	2.612	654.05
8.078	1.633	7.971	2.620	655.98
10.069	1.616	8.073	2.629	658.12
12.413	1.600	8.178	2.639	660.49
15.174	1.583	8.285	2.650	663.07
18.431	1.567	8.396	2.662	665.89
22.291	1.550	8.509	2.675	668.94
26.899	1.533	8.626	2.689	672.23
32.457	1.517	8.745	2.705	675.78
39.261	1.500	8.869	2.722	679.58
47.770	1.484	8.995	2.741	683.65
58.755	1.467	9.126	2.761	687.99
73.658	1.450	9.260	2.783	692.62
95.724	1.434	9.398	2.806	697.54
112.530	1.427	9.458	2.817	699.71

NODE 385.00 : HGL = < 57.616>;EGL= < 58.378>;FLOWLINE= < 55.800>

****

FLOW PROCESS FROM NODE 385.00 TO NODE 385.00 IS CODE = 5
UPSTREAM NODE 385.00 ELEVATION = 56.00 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	17.60	30.00	90.00	56.00	1.42	3.585
DOWNSTREAM	31.36	36.00	-	55.80	1.82	7.009
LATERAL #1	13.76	36.00	0.00	56.00	1.18	2.407
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00184
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00477
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00331
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.013 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.728)+(0.000) = 0.728

NODE 385.00 : HGL = < 58.907>;EGL= < 59.106>;FLOWLINE= < 56.000>

```
**************************************************************************
  FLOW PROCESS FROM NODE   385.00 TO NODE   337.00 IS CODE =  1
  UPSTREAM NODE   337.00     ELEVATION =    56.50  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      17.60 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =      75.71 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     17.60)/(   410.175))**2 = 0.00184
  HF=L*SF = (     75.71)*(0.00184) =      0.139
--------------------------------------------------------------------------
  NODE   337.00 : HGL = <   59.046>;EGL= <   59.246>;FLOWLINE= <   56.500>

**************************************************************************
  FLOW PROCESS FROM NODE   337.00 TO NODE   337.00 IS CODE =  5
  UPSTREAM NODE   337.00     ELEVATION =    56.60  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      16.79    30.00     11.80     56.60      1.39        3.420
    DOWNSTREAM     17.60    30.00       -       56.50      1.42        3.585
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.81===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00168
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00184
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00176
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.007 FEET         ENTRANCE LOSSES =  0.040 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.024)+( 0.040) =   0.064
--------------------------------------------------------------------------
  NODE   337.00 : HGL = <   59.128>;EGL= <   59.309>;FLOWLINE= <   56.600>

**************************************************************************
  FLOW PROCESS FROM NODE   337.00 TO NODE   336.00 IS CODE =  1
  UPSTREAM NODE   336.00     ELEVATION =    58.54  (HYDRAULIC JUMP OCCURS)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      16.79 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     258.19 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
--------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.21           CRITICAL DEPTH(FT) =      1.39
==========================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.39
==========================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.385      6.012          1.947           299.07
         0.026          1.378      6.050          1.947           299.08
         0.106          1.371      6.089          1.947           299.11
         0.245          1.364      6.128          1.947           299.18
         0.449          1.357      6.167          1.948           299.26
         0.725          1.350      6.207          1.949           299.37
         1.079          1.343      6.248          1.949           299.51
```

1.521	1.336	6.289	1.950	299.67
2.060	1.329	6.331	1.952	299.86
2.708	1.322	6.373	1.953	300.07
3.480	1.315	6.416	1.954	300.31
4.393	1.308	6.460	1.956	300.58
5.468	1.301	6.504	1.958	300.87
6.731	1.294	6.548	1.960	301.20
8.215	1.286	6.594	1.962	301.55
9.962	1.279	6.640	1.964	301.93
12.029	1.272	6.686	1.967	302.34
14.491	1.265	6.734	1.970	302.78
17.453	1.258	6.782	1.973	303.24
21.071	1.251	6.830	1.976	303.74
25.586	1.244	6.880	1.980	304.27
31.402	1.237	6.930	1.983	304.83
39.273	1.230	6.980	1.987	305.42
50.900	1.223	7.032	1.991	306.05
71.734	1.216	7.084	1.996	306.70
258.190	1.215	7.093	1.997	306.81

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 2.53

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.528	3.420	2.709	502.64
4.734	2.500	3.420	2.682	494.17

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 2.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
4.734	2.500	3.419	2.682	494.17
11.994	2.455	3.433	2.639	480.99
18.939	2.411	3.459	2.597	468.25
25.711	2.366	3.492	2.556	455.89
32.351	2.322	3.531	2.515	443.87
38.880	2.277	3.577	2.476	432.21
45.312	2.232	3.628	2.437	420.91
51.654	2.188	3.685	2.399	409.99
57.909	2.143	3.747	2.361	399.45
64.078	2.099	3.815	2.325	389.31
70.160	2.054	3.889	2.289	379.59
76.152	2.009	3.969	2.254	370.31
82.048	1.965	4.056	2.220	361.47
87.840	1.920	4.149	2.188	353.11
93.518	1.876	4.249	2.156	345.25
99.066	1.831	4.356	2.126	337.89
104.468	1.787	4.472	2.097	331.08
109.699	1.742	4.596	2.070	324.82
114.729	1.697	4.730	2.045	319.16
119.517	1.653	4.874	2.022	314.12
124.011	1.608	5.029	2.001	309.73
128.134	1.564	5.196	1.983	306.04
131.782	1.519	5.377	1.968	303.07
134.799	1.474	5.572	1.957	300.89
136.940	1.430	5.783	1.949	299.53
137.795	1.385	6.012	1.947	299.07

```
       258.190          1.385      6.012          1.947          299.07
-----------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT   127.35 FEET UPSTREAM OF NODE  337.00 |
|       DOWNSTREAM DEPTH = 1.572 FEET, UPSTREAM CONJUGATE DEPTH = 1.216 FEET |
--------------------------------------------------------------------------------
  NODE   336.00 : HGL = <   59.925>;EGL= <   60.487>;FLOWLINE= <   58.540>

********************************************************************************
  FLOW PROCESS FROM NODE   336.00 TO NODE   336.00 IS CODE =  5
  UPSTREAM NODE   336.00     ELEVATION =    58.64  (FLOW IS SUBCRITICAL)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      15.98    30.00     63.40     58.64      1.35        3.616
    DOWNSTREAM     16.79    30.00       -       58.54      1.39        6.014
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.81===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00145
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00477
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00311
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.012 FEET         ENTRANCE LOSSES =  0.112 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.353)+( 0.112) =   0.465
--------------------------------------------------------------------------------
  NODE   336.00 : HGL = <   60.749>;EGL= <   60.952>;FLOWLINE= <   58.640>

********************************************************************************
  FLOW PROCESS FROM NODE   336.00 TO NODE   330.00 IS CODE =  1
  UPSTREAM NODE   330.00     ELEVATION =    59.40  (HYDRAULIC JUMP OCCURS)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      15.98 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =     108.00 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.20           CRITICAL DEPTH(FT) =      1.35
================================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.35
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.350      5.909          1.892          280.35
         0.023          1.344      5.942          1.892          280.36
         0.095          1.338      5.976          1.892          280.38
         0.221          1.332      6.010          1.893          280.43
         0.405          1.325      6.045          1.893          280.49
         0.653          1.319      6.080          1.894          280.57
         0.972          1.313      6.115          1.894          280.67
         1.370          1.307      6.151          1.895          280.79
         1.855          1.301      6.187          1.896          280.93
         2.439          1.295      6.224          1.897          281.09
         3.133          1.289      6.261          1.898          281.27
         3.955          1.283      6.299          1.899          281.47
```

4.922	1.277	6.337	1.901	281.68
6.058	1.270	6.376	1.902	281.92
7.393	1.264	6.415	1.904	282.18
8.964	1.258	6.454	1.906	282.46
10.822	1.252	6.494	1.908	282.76
13.035	1.246	6.535	1.910	283.08
15.697	1.240	6.576	1.912	283.43
18.948	1.234	6.617	1.914	283.79
23.004	1.228	6.659	1.917	284.18
28.228	1.222	6.702	1.920	284.59
35.296	1.216	6.745	1.923	285.02
45.736	1.209	6.789	1.926	285.47
64.437	1.203	6.833	1.929	285.95
108.000	1.203	6.835	1.929	285.97

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.11

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.109	3.615	2.312	380.03
4.508	2.079	3.662	2.287	373.15
8.979	2.048	3.711	2.262	366.45
13.412	2.018	3.763	2.238	359.95
17.806	1.988	3.817	2.214	353.65
22.158	1.957	3.874	2.191	347.55
26.468	1.927	3.935	2.168	341.66
30.732	1.897	3.998	2.145	335.99
34.946	1.866	4.065	2.123	330.55
39.107	1.836	4.135	2.102	325.33
43.210	1.805	4.209	2.081	320.35
47.249	1.775	4.286	2.060	315.62
51.217	1.745	4.367	2.041	311.13
55.105	1.714	4.452	2.022	306.91
58.905	1.684	4.542	2.005	302.95
62.604	1.654	4.636	1.988	299.28
66.188	1.623	4.736	1.972	295.89
69.638	1.593	4.840	1.957	292.80
72.931	1.562	4.950	1.943	290.01
76.040	1.532	5.066	1.931	287.55
78.926	1.502	5.188	1.920	285.43
81.541	1.471	5.317	1.911	283.65
83.818	1.441	5.452	1.903	282.23
85.663	1.411	5.596	1.897	281.20
86.938	1.380	5.748	1.894	280.56
87.431	1.350	5.909	1.892	280.35
108.000	1.350	5.909	1.892	280.35

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 80.21 FEET UPSTREAM OF NODE 336.00
DOWNSTREAM DEPTH = 1.487 FEET, UPSTREAM CONJUGATE DEPTH = 1.222 FEET

NODE 330.00 : HGL = < 60.750>;EGL= < 61.292>;FLOWLINE= < 59.400>

****

FLOW PROCESS FROM NODE 330.00 TO NODE 330.00 IS CODE = 5
UPSTREAM NODE 330.00 ELEVATION = 59.50 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)

UPSTREAM	9.12	30.00	0.00	59.50	1.01	2.136
DOWNSTREAM	15.98	30.00	-	59.40	1.35	5.911
LATERAL #1	2.60	18.00	45.00	59.50	0.61	1.471
LATERAL #2	2.17	18.00	45.00	59.50	0.56	1.228
Q5	2.09===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00050
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00470
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00260
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.010 FEET ENTRANCE LOSSES = 0.108 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.200)+(0.108) = 0.309

NODE 330.00 : HGL = < 61.530>;EGL= < 61.601>;FLOWLINE= < 59.500>

****

FLOW PROCESS FROM NODE 330.00 TO NODE 322.00 IS CODE = 1
UPSTREAM NODE 322.00 ELEVATION = 61.00 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 9.12 CFS PIPE DIAMETER = 30.00 INCHES
PIPE LENGTH = 213.94 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 0.88 CRITICAL DEPTH(FT) = 1.01

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.01

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.007	4.928	1.384	135.72
0.018	1.002	4.961	1.384	135.72
0.076	0.997	4.995	1.384	135.74
0.175	0.992	5.029	1.385	135.77
0.321	0.986	5.064	1.385	135.81
0.518	0.981	5.099	1.385	135.86
0.771	0.976	5.135	1.386	135.93
1.087	0.971	5.171	1.387	136.00
1.472	0.966	5.208	1.387	136.09
1.935	0.961	5.245	1.388	136.20
2.487	0.956	5.282	1.389	136.31
3.139	0.951	5.320	1.391	136.44
3.907	0.946	5.359	1.392	136.58
4.809	0.941	5.398	1.393	136.73
5.868	0.936	5.438	1.395	136.90
7.116	0.930	5.478	1.397	137.08
8.591	0.925	5.519	1.399	137.27
10.348	0.920	5.560	1.401	137.48
12.462	0.915	5.602	1.403	137.70
15.044	0.910	5.644	1.405	137.94
18.265	0.905	5.688	1.408	138.19
22.413	0.900	5.731	1.410	138.46
28.026	0.895	5.776	1.413	138.74
36.317	0.890	5.821	1.416	139.03
51.169	0.885	5.866	1.419	139.34
213.940	0.884	5.875	1.420	139.40

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.03

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.030	2.135	2.101	284.38
5.872	1.989	2.177	2.063	274.30
11.724	1.948	2.221	2.025	264.50
17.555	1.907	2.269	1.987	254.96
23.362	1.867	2.320	1.950	245.71
29.145	1.826	2.374	1.913	236.74
34.900	1.785	2.432	1.877	228.07
40.626	1.744	2.494	1.840	219.71
46.318	1.703	2.560	1.805	211.67
51.973	1.662	2.631	1.769	203.95
57.586	1.621	2.707	1.735	196.56
63.151	1.580	2.789	1.701	189.52
68.661	1.539	2.876	1.667	182.84
74.107	1.498	2.969	1.635	176.52
79.479	1.457	3.070	1.604	170.58
84.762	1.416	3.178	1.573	165.04
89.941	1.375	3.295	1.544	159.91
94.993	1.334	3.421	1.516	155.20
99.891	1.293	3.558	1.490	150.93
104.597	1.252	3.705	1.466	147.13
109.061	1.212	3.866	1.444	143.82
113.211	1.171	4.041	1.424	141.03
116.943	1.130	4.233	1.408	138.78
120.094	1.089	4.443	1.395	137.11
122.395	1.048	4.673	1.387	136.08
123.347	1.007	4.928	1.384	135.72
213.940	1.007	4.928	1.384	135.72

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 115.98 FEET UPSTREAM OF NODE 330.00
DOWNSTREAM DEPTH = 1.140 FEET, UPSTREAM CONJUGATE DEPTH = 0.884 FEET

NODE 322.00 : HGL = < 62.007>;EGL= < 62.384>;FLOWLINE= < 61.000>

****

FLOW PROCESS FROM NODE 322.00 TO NODE 322.00 IS CODE = 5
UPSTREAM NODE 322.00 ELEVATION = 61.00 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	9.12	30.00	0.00	61.00	1.01	4.203
DOWNSTREAM	9.12	30.00	-	61.00	1.01	4.929
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00275
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00425
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00350
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.014 FEET ENTRANCE LOSSES = 0.000 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.026)+(0.000) = 0.026

NODE 322.00 : HGL = < 62.136>;EGL= < 62.410>;FLOWLINE= < 61.000>

****

FLOW PROCESS FROM NODE 322.00 TO NODE 321.00 IS CODE = 1
UPSTREAM NODE 321.00 ELEVATION = 61.56 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 9.12 CFS PIPE DIAMETER = 30.00 INCHES
PIPE LENGTH = 213.94 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.15 CRITICAL DEPTH(FT) = 1.01

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.81

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.813	6.589	1.487	145.52
1.444	0.820	6.503	1.478	144.68
2.864	0.828	6.420	1.469	143.89
4.259	0.836	6.338	1.460	143.14
5.628	0.844	6.258	1.452	142.43
6.969	0.851	6.180	1.445	141.76
8.280	0.859	6.104	1.438	141.13
9.560	0.867	6.030	1.432	140.54
10.805	0.875	5.957	1.426	139.99
12.015	0.883	5.885	1.421	139.48
13.187	0.890	5.816	1.416	139.00
14.317	0.898	5.747	1.411	138.56
15.405	0.906	5.681	1.407	138.15
16.445	0.914	5.615	1.404	137.77
17.435	0.921	5.551	1.400	137.44
18.372	0.929	5.489	1.397	137.13
19.251	0.937	5.427	1.395	136.85
20.067	0.945	5.367	1.392	136.61
20.815	0.952	5.308	1.390	136.40
21.491	0.960	5.250	1.389	136.21
22.087	0.968	5.194	1.387	136.06
22.596	0.976	5.139	1.386	135.93
23.010	0.984	5.084	1.385	135.84
23.320	0.991	5.031	1.385	135.77
23.515	0.999	4.979	1.384	135.73
23.584	1.007	4.928	1.384	135.72
213.940	1.007	4.928	1.384	135.72

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.14

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.136	4.202	1.410	139.09
1.839	1.137	4.199	1.411	139.12
3.766	1.137	4.196	1.411	139.16
5.790	1.138	4.192	1.411	139.19

7.918	1.139	4.189	1.411	139.22
10.162	1.139	4.186	1.412	139.26
12.532	1.140	4.183	1.412	139.29
15.044	1.141	4.180	1.412	139.32
17.712	1.141	4.177	1.412	139.36
20.556	1.142	4.174	1.413	139.39
23.600	1.143	4.170	1.413	139.43
26.869	1.143	4.167	1.413	139.46
30.398	1.144	4.164	1.413	139.50
34.228	1.145	4.161	1.414	139.53
38.412	1.145	4.158	1.414	139.57
43.018	1.146	4.155	1.414	139.60
48.134	1.147	4.152	1.414	139.64
53.880	1.147	4.149	1.415	139.67
60.426	1.148	4.146	1.415	139.71
68.020	1.149	4.142	1.415	139.74
77.043	1.149	4.139	1.415	139.78
88.140	1.150	4.136	1.416	139.82
102.515	1.150	4.133	1.416	139.85
122.876	1.151	4.130	1.416	139.89
157.907	1.152	4.127	1.416	139.92
213.940	1.152	4.127	1.416	139.93

----------END OF HYDRAULIC JUMP ANALYSIS----------

PRESSURE+MOMENTUM BALANCE OCCURS AT 202.98 FEET UPSTREAM OF NODE 322.00
DOWNSTREAM DEPTH = 1.152 FEET, UPSTREAM CONJUGATE DEPTH = 0.876 FEET

NODE 321.00 : HGL = < 62.373>;EGL= < 63.047>;FLOWLINE= < 61.560>

****

FLOW PROCESS FROM NODE 321.00 TO NODE 321.00 IS CODE = 5
UPSTREAM NODE 321.00 ELEVATION = 61.66 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	9.12	30.00	0.00	61.66	1.01	6.249
DOWNSTREAM	9.12	30.00	-	61.56	1.01	6.591
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00817
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00947
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00882
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.035 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.064)+(0.000) = 0.064

NODE 321.00 : HGL = < 62.505>;EGL= < 63.111>;FLOWLINE= < 61.660>

****

FLOW PROCESS FROM NODE 321.00 TO NODE 320.00 IS CODE = 1
UPSTREAM NODE 320.00 ELEVATION = 62.35 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 9.12 CFS PIPE DIAMETER = 30.00 INCHES
PIPE LENGTH = 82.00 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.84 CRITICAL DEPTH(FT) = 1.01

```
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.01
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.007      4.928          1.384            135.72
          0.021          1.000      4.972          1.384            135.73
          0.088          0.993      5.017          1.384            135.76
          0.204          0.987      5.063          1.385            135.81
          0.375          0.980      5.110          1.386            135.88
          0.605          0.973      5.157          1.386            135.97
          0.901          0.966      5.206          1.387            136.09
          1.270          0.960      5.255          1.389            136.23
          1.721          0.953      5.305          1.390            136.39
          2.263          0.946      5.356          1.392            136.57
          2.910          0.939      5.408          1.394            136.77
          3.675          0.933      5.461          1.396            137.00
          4.576          0.926      5.515          1.398            137.25
          5.635          0.919      5.570          1.401            137.53
          6.879          0.912      5.626          1.404            137.83
          8.346          0.906      5.682          1.407            138.16
         10.081          0.899      5.740          1.411            138.51
         12.149          0.892      5.799          1.415            138.89
         14.639          0.885      5.860          1.419            139.30
         17.682          0.879      5.921          1.423            139.73
         21.481          0.872      5.983          1.428            140.19
         26.376          0.865      6.047          1.433            140.68
         33.006          0.858      6.112          1.439            141.20
         42.802          0.852      6.178          1.445            141.74
         60.365          0.845      6.246          1.451            142.32
         82.000          0.845      6.247          1.451            142.33
------------------------------------------------------------------------------
  NODE   320.00 : HGL = <   63.357>;EGL= <   63.734>;FLOWLINE= <   62.350>

******************************************************************************
  FLOW PROCESS FROM NODE   320.00 TO NODE   320.00 IS CODE =  5
  UPSTREAM NODE   320.00     ELEVATION =    62.45  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE          FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                     (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM         8.05     30.00      0.00     62.45      0.94        6.829
    DOWNSTREAM        9.12     30.00       -       62.35      1.01        4.929
    LATERAL #1        0.54     24.00     90.00     62.55      0.25        0.535
    LATERAL #2        0.53     24.00     90.00     62.55      0.25        0.525
       Q5             0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01153
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00425
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00789
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.032 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.164)+( 0.000) =   0.164
------------------------------------------------------------------------------
  NODE   320.00 : HGL = <   63.174>;EGL= <   63.898>;FLOWLINE= <   62.450>
```

```
**************************************************************************
  FLOW PROCESS FROM NODE   320.00 TO NODE   315.00 IS CODE =  1
  UPSTREAM NODE   315.00     ELEVATION =    63.25  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       8.05 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =      66.00 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.71           CRITICAL DEPTH(FT) =      0.94
==========================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.94
==========================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.944      4.745          1.293           115.65
         0.022          0.934      4.808          1.294           115.67
         0.092          0.925      4.873          1.294           115.72
         0.213          0.916      4.939          1.295           115.82
         0.390          0.907      5.006          1.296           115.95
         0.631          0.898      5.076          1.298           116.12
         0.941          0.889      5.147          1.300           116.33
         1.328          0.879      5.220          1.303           116.58
         1.801          0.870      5.295          1.306           116.88
         2.372          0.861      5.372          1.309           117.22
         3.053          0.852      5.451          1.314           117.60
         3.860          0.843      5.532          1.318           118.03
         4.812          0.834      5.616          1.324           118.51
         5.934          0.824      5.702          1.330           119.04
         7.255          0.815      5.790          1.336           119.61
         8.814          0.806      5.880          1.343           120.24
        10.662          0.797      5.974          1.351           120.92
        12.869          0.788      6.070          1.360           121.65
        15.530          0.779      6.169          1.370           122.44
        18.789          0.770      6.270          1.380           123.29
        22.864          0.760      6.375          1.392           124.20
        28.127          0.751      6.483          1.404           125.17
        35.266          0.742      6.594          1.418           126.20
        45.838          0.733      6.709          1.432           127.30
        64.827          0.724      6.828          1.448           128.47
        66.000          0.724      6.827          1.448           128.47
--------------------------------------------------------------------------
  NODE   315.00 : HGL = <   64.194>;EGL= <   64.543>;FLOWLINE= <   63.250>

**************************************************************************
  FLOW PROCESS FROM NODE   315.00 TO NODE   315.00 IS CODE =  5
  UPSTREAM NODE   315.00     ELEVATION =    63.35  (FLOW IS SUBCRITICAL)
--------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.08     30.00      0.00     63.35      0.34        0.386
    DOWNSTREAM      8.05     30.00         -     63.25      0.94        4.747
    LATERAL #1      3.36     24.00     90.00     63.45      0.64        2.098
    LATERAL #2      3.61     24.00     90.00     63.45      0.67        2.254
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00002
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00420
```

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00211
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.008 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.196)+(0.000) = 0.196

NODE 315.00 : HGL = < 64.737>;EGL= < 64.740>;FLOWLINE= < 63.350>

****

FLOW PROCESS FROM NODE 315.00 TO NODE 307.00 IS CODE = 1
UPSTREAM NODE 307.00 ELEVATION = 65.29 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 1.08 CFS PIPE DIAMETER = 30.00 INCHES
PIPE LENGTH = 194.00 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 0.28 CRITICAL DEPTH(FT) = 0.34

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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.27

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GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.265	3.880	0.499	9.98
0.375	0.266	3.868	0.498	9.97
0.762	0.266	3.855	0.497	9.95
1.164	0.267	3.843	0.496	9.93
1.580	0.267	3.831	0.495	9.92
2.014	0.268	3.819	0.495	9.90
2.466	0.268	3.808	0.494	9.89
2.938	0.269	3.796	0.493	9.88
3.433	0.270	3.784	0.492	9.86
3.953	0.270	3.772	0.491	9.85
4.503	0.271	3.761	0.490	9.83
5.085	0.271	3.749	0.490	9.82
5.704	0.272	3.738	0.489	9.80
6.368	0.272	3.726	0.488	9.79
7.082	0.273	3.715	0.487	9.78
7.858	0.274	3.704	0.487	9.76
8.708	0.274	3.692	0.486	9.75
9.649	0.275	3.681	0.485	9.74
10.706	0.275	3.670	0.485	9.72
11.915	0.276	3.659	0.484	9.71
13.332	0.276	3.648	0.483	9.70
15.048	0.277	3.637	0.482	9.69
17.241	0.278	3.626	0.482	9.67
20.300	0.278	3.615	0.481	9.66
25.487	0.279	3.604	0.481	9.65
194.000	0.279	3.597	0.480	9.64

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.39

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.387	0.386	1.390	104.54
4.191	1.345	0.401	1.348	97.38

8.380	1.303	0.417	1.306	90.50
12.568	1.261	0.435	1.264	83.89
16.754	1.219	0.454	1.222	77.56
20.938	1.177	0.475	1.181	71.51
25.119	1.135	0.498	1.139	65.74
29.297	1.093	0.523	1.097	60.25
33.471	1.051	0.551	1.056	55.03
37.640	1.009	0.582	1.014	50.10
41.804	0.967	0.616	0.973	45.44
45.961	0.925	0.654	0.932	41.05
50.109	0.883	0.696	0.891	36.95
54.247	0.841	0.744	0.850	33.11
58.370	0.799	0.798	0.809	29.55
62.476	0.757	0.860	0.769	26.27
66.558	0.715	0.931	0.729	23.25
70.609	0.673	1.014	0.689	20.51
74.619	0.631	1.110	0.650	18.04
78.569	0.589	1.223	0.612	15.85
82.437	0.547	1.358	0.576	13.93
86.180	0.505	1.522	0.541	12.30
89.730	0.463	1.724	0.509	10.98
92.959	0.421	1.977	0.482	9.97
95.592	0.379	2.302	0.461	9.32
96.873	0.337	2.730	0.453	9.08
194.000	0.337	2.730	0.453	9.08

----------END OF HYDRAULIC JUMP ANALYSIS----------

PRESSURE+MOMENTUM BALANCE OCCURS AT 94.27 FEET UPSTREAM OF NODE 315.00
DOWNSTREAM DEPTH = 0.400 FEET, UPSTREAM CONJUGATE DEPTH = 0.279 FEET

NODE 307.00 : HGL = < 65.555>;EGL= < 65.789>;FLOWLINE= < 65.290>

****

FLOW PROCESS FROM NODE 307.00 TO NODE 307.00 IS CODE = 5

UPSTREAM NODE 307.00 ELEVATION = 65.39 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	1.08	30.00	0.00	65.39	0.34	3.634
DOWNSTREAM	1.08	30.00	-	65.29	0.34	3.881
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES

UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01032

DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01245

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01139

JUNCTION LENGTH = 4.00 FEET

FRICTION LOSSES = 0.046 FEET ENTRANCE LOSSES = 0.000 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (0.083)+(0.000) = 0.083

NODE 307.00 : HGL = < 65.667>;EGL= < 65.872>;FLOWLINE= < 65.390>

****

FLOW PROCESS FROM NODE 307.00 TO NODE 306.00 IS CODE = 1

UPSTREAM NODE 306.00 ELEVATION = 67.17 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):

PIPE FLOW = 1.08 CFS PIPE DIAMETER = 30.00 INCHES

PIPE LENGTH = 169.75 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.28 CRITICAL DEPTH(FT) = 0.34

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.34

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.337	2.730	0.453	9.08
0.006	0.335	2.759	0.453	9.09
0.025	0.332	2.788	0.453	9.09
0.058	0.330	2.819	0.453	9.09
0.106	0.327	2.849	0.453	9.10
0.171	0.325	2.880	0.454	9.11
0.254	0.322	2.912	0.454	9.12
0.358	0.320	2.945	0.455	9.13
0.485	0.318	2.978	0.455	9.14
0.638	0.315	3.011	0.456	9.16
0.821	0.313	3.046	0.457	9.18
1.036	0.310	3.081	0.458	9.19
1.290	0.308	3.117	0.459	9.22
1.588	0.305	3.153	0.460	9.24
1.939	0.303	3.190	0.461	9.27
2.351	0.300	3.228	0.462	9.29
2.840	0.298	3.267	0.464	9.32
3.422	0.296	3.306	0.465	9.36
4.122	0.293	3.346	0.467	9.39
4.978	0.291	3.388	0.469	9.43
6.046	0.288	3.430	0.471	9.47
7.421	0.286	3.473	0.473	9.51
9.284	0.283	3.516	0.476	9.56
12.035	0.281	3.561	0.478	9.60
16.966	0.279	3.607	0.481	9.65
169.750	0.277	3.633	0.482	9.68

NODE 306.00 : HGL = < 67.507>;EGL= < 67.623>;FLOWLINE= < 67.170>

****

FLOW PROCESS FROM NODE 306.00 TO NODE 306.00 IS CODE = 5

UPSTREAM NODE 306.00 ELEVATION = 67.37 (FLOW IS SUBCRITICAL)

(NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	1.08	24.00	90.00	67.37	0.36	3.658
DOWNSTREAM	1.08	30.00	-	67.17	0.34	2.731
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES

UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00967

DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00456

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00711

JUNCTION LENGTH = 4.00 FEET

FRICTION LOSSES = 0.028 FEET ENTRANCE LOSSES = 0.000 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (0.255)+(0.000) = 0.255

```
------------------------------------------------------------------------------
  NODE   306.00 : HGL = <   67.670>;EGL= <   67.878>;FLOWLINE= <   67.370>

******************************************************************************
  FLOW PROCESS FROM NODE   306.00 TO NODE   305.00 IS CODE =  1
  UPSTREAM NODE   305.00     ELEVATION =    67.78  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.08 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =      41.14 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.30           CRITICAL DEPTH(FT) =      0.36
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.36
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.358      2.830          0.482              9.39
         0.006          0.356      2.857          0.482              9.39
         0.026          0.353      2.886          0.483              9.40
         0.059          0.351      2.914          0.483              9.40
         0.109          0.348      2.943          0.483              9.40
         0.175          0.346      2.973          0.483              9.41
         0.261          0.344      3.003          0.484              9.42
         0.368          0.341      3.034          0.484              9.43
         0.498          0.339      3.065          0.485              9.44
         0.655          0.336      3.097          0.485              9.46
         0.842          0.334      3.130          0.486              9.47
         1.063          0.331      3.163          0.487              9.49
         1.324          0.329      3.196          0.488              9.51
         1.630          0.327      3.230          0.489              9.53
         1.989          0.324      3.265          0.490              9.55
         2.412          0.322      3.301          0.491              9.58
         2.913          0.319      3.337          0.492              9.60
         3.510          0.317      3.374          0.494              9.63
         4.227          0.315      3.411          0.495              9.66
         5.104          0.312      3.450          0.497              9.70
         6.199          0.310      3.489          0.499              9.73
         7.608          0.307      3.529          0.501              9.77
         9.516          0.305      3.569          0.503              9.81
        12.334          0.302      3.611          0.505              9.85
        17.384          0.300      3.653          0.507              9.89
        41.140          0.300      3.656          0.508              9.90
------------------------------------------------------------------------------
  NODE   305.00 : HGL = <   68.138>;EGL= <   68.262>;FLOWLINE= <   67.780>

******************************************************************************
  FLOW PROCESS FROM NODE   305.00 TO NODE   305.00 IS CODE =  8
  UPSTREAM NODE   305.00     ELEVATION =    67.78  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.08 CFS          PIPE DIAMETER =  24.00 INCHES
  FLOW VELOCITY =   2.83 FEET/SEC.    VELOCITY HEAD =  0.124 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.124) =  0.025
------------------------------------------------------------------------------
  NODE   305.00 : HGL = <   68.287>;EGL= <   68.287>;FLOWLINE= <   67.780>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   305.00           FLOWLINE ELEVATION =    67.78
  ASSUMED UPSTREAM CONTROL HGL =     68.14 FOR DOWNSTREAM RUN ANALYSIS
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================================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 19.1 Release Date: 08/09/2012 License ID 1261

Analysis prepared by:

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

* JN-18150 SDSU WEST *
* BASIN 300 BACKBONE SYSTEM 300B ULTIMATE CONDITION *
* 100-YR 6-HR *

****

FILE NAME: SDSW300B.PIP
TIME/DATE OF STUDY: 16:44 01/28/2019

****

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
385.00-		3.02*	746.35	1.25	283.47
	} FRICTION				
380.00-		2.44*	514.25	1.30 Dc	282.78
	} JUNCTION				
380.00-		2.50*	424.24	0.88	163.26
	} FRICTION+BEND	} HYDRAULIC JUMP			
370.00-		1.06*Dc	154.35	1.06*Dc	154.35
	} JUNCTION				
370.00-		1.24	135.64	0.83*	137.86
	} FRICTION+BEND				
360.00-		1.03*Dc	128.44	1.03*Dc	128.44
	} JUNCTION				
360.00-		1.58*	170.61	1.03 Dc	128.44
	} FRICTION	} HYDRAULIC JUMP			
355.00-		1.03*Dc	128.44	1.03*Dc	128.44
	} JUNCTION				
355.00-		1.50*	152.07	0.98 Dc	115.90
	} FRICTION				
350.00-		1.17*	121.19	0.99 Dc	115.87
	} JUNCTION				
350.00-		1.52*	109.39	0.21 Dc	2.52
	} FRICTION				
344.00-		0.91*	33.61	0.17	2.74
	} JUNCTION				
344.00-		0.81*	25.54	0.21 Dc	2.52
	} FRICTION+BEND				
343.00-		0.21*Dc	2.52	0.20*Dc	2.55
	} JUNCTION				
343.00-		0.21*Dc	2.52	0.21*Dc	2.52
	} FRICTION				
342.00-		0.21*Dc	2.52	0.21*Dc	2.52
	} CATCH BASIN				
342.00-		0.30*	1.34	0.21 Dc	0.94

MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 385.00 FLOWLINE ELEVATION = 56.00
PIPE FLOW = 16.64 CFS PIPE DIAMETER = 36.00 INCHES
ASSUMED DOWNSTREAM CONTROL HGL = 59.020 FEET

NODE 385.00 : HGL = < 59.020>;EGL= < 59.106>;FLOWLINE= < 56.000>

FLOW PROCESS FROM NODE 385.00 TO NODE 380.00 IS CODE = 1
UPSTREAM NODE 380.00 ELEVATION = 56.63 (FLOW SEALS IN REACH)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 16.64 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 134.12 FEET MANNING'S N = 0.01300

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 3.02

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	3.020	2.354	3.106	746.35
4.908	3.000	2.354	3.086	737.53

NORMAL DEPTH(FT) = 1.25 CRITICAL DEPTH(FT) = 1.30

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 3.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
4.908	3.000	2.353	3.086	737.53
21.147	2.932	2.367	3.019	708.10
37.050	2.864	2.392	2.953	679.29
52.779	2.796	2.425	2.888	651.09
68.383	2.729	2.464	2.823	623.54
83.891	2.661	2.510	2.759	596.68
99.318	2.593	2.562	2.695	570.57
114.676	2.525	2.620	2.632	545.25
129.972	2.457	2.684	2.569	520.77
134.120	2.439	2.703	2.552	514.25

NODE 380.00 : HGL = < 59.069>;EGL= < 59.182>;FLOWLINE= < 56.630>

FLOW PROCESS FROM NODE 380.00 TO NODE 380.00 IS CODE = 5
UPSTREAM NODE 380.00 ELEVATION = 56.73 (FLOW UNSEALS IN REACH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	10.08	30.00	39.52	56.73	1.06	2.053
DOWNSTREAM	16.64	36.00	-	56.63	1.30	2.704
LATERAL #1	6.56	24.00	90.00	56.83	0.91	2.088
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000

Q5 0.00===Q5 EQUALS BASIN INPUT===

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00060
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00063
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00062
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.002 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.117)+(0.000) = 0.117

NODE 380.00 : HGL = < 59.234>;EGL= < 59.300>;FLOWLINE= < 56.730>

****

FLOW PROCESS FROM NODE 380.00 TO NODE 370.00 IS CODE = 3
UPSTREAM NODE 370.00 ELEVATION = 59.89 (HYDRAULIC JUMP OCCURS)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 10.08 CFS PIPE DIAMETER = 30.00 INCHES
CENTRAL ANGLE = 73.570 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 353.90 FEET

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 0.87 CRITICAL DEPTH(FT) = 1.06

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.06

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.061	5.082	1.462	154.35
0.023	1.053	5.130	1.462	154.36
0.096	1.045	5.180	1.462	154.40
0.223	1.038	5.231	1.463	154.47
0.409	1.030	5.282	1.464	154.56
0.660	1.023	5.335	1.465	154.68
0.984	1.015	5.388	1.466	154.83
1.387	1.007	5.443	1.468	155.01
1.880	1.000	5.498	1.469	155.22
2.473	0.992	5.555	1.471	155.46
3.180	0.984	5.613	1.474	155.72
4.016	0.977	5.671	1.477	156.02
5.002	0.969	5.731	1.480	156.35
6.161	0.962	5.793	1.483	156.72
7.523	0.954	5.855	1.487	157.11
9.129	0.946	5.919	1.491	157.54
11.030	0.939	5.984	1.495	158.01
13.296	0.931	6.050	1.500	158.51
16.024	0.923	6.118	1.505	159.04
19.360	0.916	6.187	1.510	159.61
23.525	0.908	6.258	1.516	160.22
28.895	0.900	6.330	1.523	160.86
36.168	0.893	6.403	1.530	161.55
46.920	0.885	6.478	1.537	162.27
66.201	0.878	6.555	1.545	163.04
353.900	0.875	6.577	1.548	163.26

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

==========

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 2.50

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.504	2.053	2.570	424.24
0.560	2.500	2.053	2.565	422.99

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 2.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.560	2.500	2.053	2.565	422.99
7.350	2.442	2.065	2.509	405.64
14.032	2.385	2.087	2.453	388.63
20.652	2.327	2.117	2.397	371.98
27.223	2.270	2.152	2.342	355.71
33.750	2.212	2.193	2.287	339.85
40.237	2.155	2.240	2.233	324.42
46.682	2.097	2.292	2.179	309.46
53.086	2.039	2.350	2.125	295.00
59.446	1.982	2.415	2.072	281.06
65.759	1.924	2.485	2.020	267.66
72.019	1.867	2.563	1.969	254.84
78.219	1.809	2.649	1.918	242.62
84.352	1.752	2.743	1.868	231.02
90.405	1.694	2.846	1.820	220.08
96.364	1.636	2.960	1.773	209.82
102.211	1.579	3.084	1.727	200.27
107.921	1.521	3.222	1.683	191.48
113.464	1.464	3.375	1.641	183.48
118.796	1.406	3.544	1.601	176.31
123.858	1.349	3.731	1.565	170.02
128.569	1.291	3.941	1.532	164.67
132.805	1.233	4.176	1.504	160.34
136.379	1.176	4.441	1.482	157.10
138.983	1.118	4.740	1.467	155.06
140.055	1.061	5.082	1.462	154.35
353.900	1.061	5.082	1.462	154.35

----------END OF HYDRAULIC JUMP ANALYSIS----------

PRESSURE+MOMENTUM BALANCE OCCURS AT 130.05 FEET UPSTREAM OF NODE 380.00
DOWNSTREAM DEPTH = 1.271 FEET, UPSTREAM CONJUGATE DEPTH = 0.876 FEET

NODE 370.00 : HGL = < 60.951>;EGL= < 61.352>;FLOWLINE= < 59.890>

****

FLOW PROCESS FROM NODE 370.00 TO NODE 370.00 IS CODE = 5
UPSTREAM NODE 370.00 ELEVATION = 59.99 (FLOW IS SUBCRITICAL)
(NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	8.40	24.00	0.00	59.99	1.03	6.835
DOWNSTREAM	10.08	30.00	-	59.89	1.06	5.083
LATERAL #1	1.68	24.00	79.32	60.09	0.45	1.445
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01070
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00429
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00750
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.030 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.192)+(0.000) = 0.192

NODE 370.00 : HGL = < 60.818>;EGL= < 61.544>;FLOWLINE= < 59.990>

****

FLOW PROCESS FROM NODE 370.00 TO NODE 360.00 IS CODE = 3
UPSTREAM NODE 360.00 ELEVATION = 63.55 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 8.40 CFS PIPE DIAMETER = 24.00 INCHES
CENTRAL ANGLE = 22.630 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 323.71 FEET

NORMAL DEPTH(FT) = 0.82 CRITICAL DEPTH(FT) = 1.03

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.03

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.033	5.132	1.442	128.44
0.022	1.024	5.186	1.442	128.46
0.092	1.016	5.240	1.443	128.50
0.213	1.007	5.296	1.443	128.57
0.392	0.999	5.353	1.444	128.66
0.632	0.991	5.411	1.445	128.79
0.942	0.982	5.470	1.447	128.94
1.329	0.974	5.531	1.449	129.13
1.802	0.965	5.593	1.451	129.35
2.372	0.957	5.657	1.454	129.60
3.051	0.948	5.722	1.457	129.88
3.856	0.940	5.788	1.460	130.19
4.804	0.932	5.856	1.464	130.54
5.920	0.923	5.925	1.469	130.92
7.234	0.915	5.996	1.473	131.33
8.782	0.906	6.069	1.479	131.79
10.616	0.898	6.144	1.484	132.28
12.804	0.889	6.220	1.491	132.80
15.441	0.881	6.298	1.497	133.37
18.667	0.873	6.378	1.505	133.98
22.698	0.864	6.460	1.513	134.62
27.898	0.856	6.544	1.521	135.31
34.947	0.847	6.630	1.530	136.04
45.376	0.839	6.718	1.540	136.82
64.092	0.830	6.809	1.551	137.64
323.710	0.828	6.832	1.554	137.86

NODE 360.00 : HGL = < 64.583>;EGL= < 64.992>;FLOWLINE= < 63.550>

****

FLOW PROCESS FROM NODE 360.00 TO NODE 360.00 IS CODE = 5
UPSTREAM NODE 360.00 ELEVATION = 63.65 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	8.40	24.00	90.00	63.65	1.03	3.150
DOWNSTREAM	8.40	24.00	-	63.55	1.03	5.134
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00147
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00495
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00321
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.013 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.395)+(0.000) = 0.395

NODE 360.00 : HGL = < 65.233>;EGL= < 65.387>;FLOWLINE= < 63.650>

****

FLOW PROCESS FROM NODE 360.00 TO NODE 355.00 IS CODE = 1
UPSTREAM NODE 355.00 ELEVATION = 64.32 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 8.40 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 134.73 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.03 CRITICAL DEPTH(FT) = 1.03

==========

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.03

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.032	5.140	1.442	128.44
0.011	1.032	5.140	1.442	128.44
0.023	1.031	5.140	1.442	128.44
0.035	1.031	5.140	1.442	128.44
0.048	1.031	5.140	1.442	128.44
0.062	1.031	5.140	1.442	128.44
0.077	1.031	5.140	1.442	128.44
0.093	1.031	5.140	1.442	128.44
0.110	1.031	5.140	1.442	128.44
0.128	1.031	5.141	1.442	128.44
0.148	1.031	5.141	1.442	128.44
0.169	1.031	5.141	1.442	128.44
0.192	1.031	5.141	1.442	128.44
0.217	1.031	5.141	1.442	128.44
0.245	1.031	5.141	1.442	128.44
0.275	1.031	5.141	1.442	128.44
0.309	1.031	5.141	1.442	128.44
0.348	1.031	5.141	1.442	128.44
0.392	1.031	5.141	1.442	128.44
0.444	1.031	5.141	1.442	128.44
0.505	1.031	5.142	1.442	128.44
0.581	1.031	5.142	1.442	128.44
0.681	1.031	5.142	1.442	128.44
0.821	1.031	5.142	1.442	128.44

1.064	1.031	5.142	1.442	128.44
4.899	1.031	5.142	1.442	128.44
134.730	1.031	5.142	1.442	128.44

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.58

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.583	3.149	1.737	170.61
5.106	1.561	3.192	1.719	167.67
10.203	1.539	3.237	1.702	164.82
15.292	1.517	3.284	1.685	162.06
20.374	1.495	3.334	1.668	159.38
25.449	1.473	3.386	1.651	156.79
30.518	1.451	3.440	1.635	154.29
35.581	1.429	3.497	1.619	151.88
40.638	1.407	3.556	1.603	149.58
45.691	1.385	3.618	1.588	147.37
50.739	1.363	3.682	1.574	145.26
55.783	1.341	3.750	1.559	143.26
60.822	1.319	3.821	1.546	141.37
65.857	1.297	3.895	1.533	139.59
70.888	1.275	3.973	1.520	137.92
75.915	1.253	4.055	1.508	136.37
80.937	1.231	4.140	1.497	134.95
85.954	1.209	4.230	1.487	133.65
90.965	1.187	4.324	1.477	132.48
95.968	1.165	4.422	1.469	131.45
100.961	1.143	4.526	1.461	130.56
105.940	1.121	4.635	1.455	129.82
110.897	1.099	4.750	1.449	129.23
115.815	1.077	4.871	1.445	128.80
120.637	1.055	4.998	1.443	128.53
124.380	1.033	5.132	1.442	128.44
134.730	1.033	5.132	1.442	128.44

END OF HYDRAULIC JUMP ANALYSIS

PRESSURE+MOMENTUM BALANCE OCCURS AT 134.68 FEET UPSTREAM OF NODE 360.00
DOWNSTREAM DEPTH = 1.033 FEET, UPSTREAM CONJUGATE DEPTH = 1.031 FEET

NODE 355.00 : HGL = < 65.352>;EGL= < 65.762>;FLOWLINE= < 64.320>

FLOW PROCESS FROM NODE 355.00 TO NODE 355.00 IS CODE = 5
UPSTREAM NODE 355.00 ELEVATION = 64.52 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	7.76	24.00	90.00	64.52	0.99	3.070
DOWNSTREAM	8.40	24.00	-	64.32	1.03	5.134
LATERAL #1	0.64	24.00	0.00	64.62	0.27	0.376
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00141
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00495

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00318
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.013 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.405)+(0.000) = 0.405

NODE 355.00 : HGL = < 66.020>;EGL= < 66.167>;FLOWLINE= < 64.520>

****

FLOW PROCESS FROM NODE 355.00 TO NODE 350.00 IS CODE = 1
UPSTREAM NODE 350.00 ELEVATION = 64.88 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 7.76 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 71.08 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.98 CRITICAL DEPTH(FT) = 0.99

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.50

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.500	3.069	1.647	152.07
4.460	1.480	3.113	1.630	149.53
8.912	1.459	3.158	1.614	147.07
13.356	1.439	3.206	1.599	144.69
17.793	1.419	3.255	1.583	142.38
22.223	1.398	3.307	1.568	140.15
26.644	1.378	3.361	1.553	138.00
31.057	1.358	3.417	1.539	135.93
35.462	1.337	3.475	1.525	133.95
39.857	1.317	3.537	1.511	132.06
44.242	1.296	3.600	1.498	130.25
48.615	1.276	3.667	1.485	128.53
52.976	1.256	3.736	1.473	126.91
57.322	1.235	3.808	1.461	125.39
61.652	1.215	3.884	1.449	123.96
65.962	1.195	3.963	1.439	122.64
70.248	1.174	4.046	1.428	121.42
71.080	1.170	4.063	1.427	121.19

NODE 350.00 : HGL = < 66.050>;EGL= < 66.307>;FLOWLINE= < 64.880>

****

FLOW PROCESS FROM NODE 350.00 TO NODE 350.00 IS CODE = 5
UPSTREAM NODE 350.00 ELEVATION = 64.98 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	0.38	24.00	0.00	64.98	0.21	0.149
DOWNSTREAM	7.76	24.00	-	64.88	0.99	4.064
LATERAL #1	3.84	24.00	90.00	65.08	0.69	1.959
LATERAL #2	3.54	24.00	90.00	65.08	0.66	1.806
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00000
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00282

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00141
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.006 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.195)+(0.000) = 0.195

NODE 350.00 : HGL = < 66.501>;EGL= < 66.502>;FLOWLINE= < 64.980>

****

FLOW PROCESS FROM NODE 350.00 TO NODE 344.00 IS CODE = 1
UPSTREAM NODE 344.00 ELEVATION = 65.59 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 0.38 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 122.43 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.21 CRITICAL DEPTH(FT) = 0.21

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.52

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.521	0.148	1.522	109.39
10.508	1.469	0.154	1.469	101.16
21.015	1.417	0.160	1.417	93.24
31.522	1.364	0.166	1.365	85.63
42.029	1.312	0.174	1.313	78.34
52.536	1.260	0.182	1.260	71.38
63.043	1.207	0.192	1.208	64.74
73.549	1.155	0.202	1.156	58.44
84.055	1.103	0.214	1.103	52.48
94.561	1.050	0.227	1.051	46.86
105.066	0.998	0.242	0.999	41.58
115.571	0.946	0.260	0.947	36.65
122.430	0.911	0.273	0.913	33.61

NODE 344.00 : HGL = < 66.501>;EGL= < 66.503>;FLOWLINE= < 65.590>

****

FLOW PROCESS FROM NODE 344.00 TO NODE 344.00 IS CODE = 5
UPSTREAM NODE 344.00 ELEVATION = 65.69 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	0.38	24.00	0.00	65.69	0.21	0.318
DOWNSTREAM	0.38	24.00	-	65.59	0.21	0.272
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00002
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00002
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00002
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.000 FEET ENTRANCE LOSSES = 0.000 FEET
** CAUTION: TOTAL ENERGY LOSS COMPUTED USING (PRESSURE+MOMENTUM) IS NEGATIVE.
** COMPUTER CHOOSES ZERO ENERGY LOSS FOR TOTAL JUNCTION LOSS.

NODE 344.00 : HGL = < 66.501>;EGL= < 66.503>;FLOWLINE= < 65.690>

****

FLOW PROCESS FROM NODE 344.00 TO NODE 343.00 IS CODE = 3
UPSTREAM NODE 343.00 ELEVATION = 66.69 (FLOW IS SUBCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 0.38 CFS PIPE DIAMETER = 24.00 INCHES
CENTRAL ANGLE = 23.620 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 200.34 FEET

NORMAL DEPTH(FT) = 0.21 CRITICAL DEPTH(FT) = 0.21

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.81

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.811	0.318	0.813	25.54
4.793	0.787	0.331	0.789	23.80
9.586	0.763	0.345	0.765	22.13
14.378	0.739	0.360	0.741	20.53
19.170	0.715	0.376	0.718	19.00
23.961	0.692	0.394	0.694	17.54
28.751	0.668	0.414	0.670	16.15
33.541	0.644	0.435	0.647	14.83
38.329	0.620	0.458	0.623	13.58
43.117	0.596	0.484	0.599	12.39
47.902	0.572	0.512	0.576	11.27
52.687	0.548	0.544	0.552	10.22
57.469	0.524	0.579	0.529	9.23
62.249	0.500	0.618	0.506	8.31
67.026	0.476	0.663	0.483	7.46
71.800	0.452	0.713	0.460	6.67
76.570	0.428	0.771	0.437	5.95
81.335	0.404	0.837	0.415	5.29
86.095	0.380	0.913	0.393	4.70
90.849	0.356	1.002	0.372	4.17
95.597	0.332	1.108	0.352	3.71
100.339	0.309	1.234	0.332	3.31
105.078	0.285	1.388	0.315	2.99
109.827	0.261	1.577	0.299	2.75
114.640	0.237	1.815	0.288	2.59
200.340	0.213	2.122	0.283	2.52

NODE 343.00 : HGL = < 66.903>;EGL= < 66.973>;FLOWLINE= < 66.690>

****

FLOW PROCESS FROM NODE 343.00 TO NODE 343.00 IS CODE = 5
UPSTREAM NODE 343.00 ELEVATION = 66.89 (FLOW IS AT CRITICAL DEPTH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	0.38	24.00	90.00	66.89	0.21	2.147
DOWNSTREAM	0.38	24.00	-	66.69	0.21	2.123
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00516
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00499
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00507
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.020 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.200)+(0.000) = 0.200

NODE 343.00 : HGL = < 67.101>;EGL= < 67.173>;FLOWLINE= < 66.890>

****

FLOW PROCESS FROM NODE 343.00 TO NODE 342.00 IS CODE = 1
UPSTREAM NODE 342.00 ELEVATION = 67.03 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 0.38 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 27.70 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.21 CRITICAL DEPTH(FT) = 0.21

==========

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.21

==========

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.211	2.146	0.283	2.52
0.003	0.211	2.145	0.283	2.52
0.006	0.211	2.145	0.283	2.52
0.010	0.211	2.144	0.283	2.52
0.014	0.211	2.144	0.283	2.52
0.018	0.211	2.143	0.283	2.52
0.024	0.211	2.142	0.283	2.52
0.030	0.211	2.142	0.283	2.52
0.037	0.211	2.141	0.283	2.52
0.044	0.211	2.141	0.283	2.52
0.053	0.212	2.140	0.283	2.52
0.063	0.212	2.139	0.283	2.52
0.074	0.212	2.139	0.283	2.52
0.086	0.212	2.138	0.283	2.52
0.101	0.212	2.138	0.283	2.52
0.117	0.212	2.137	0.283	2.52
0.136	0.212	2.136	0.283	2.52
0.158	0.212	2.136	0.283	2.52
0.184	0.212	2.135	0.283	2.52
0.215	0.212	2.135	0.283	2.52
0.253	0.212	2.134	0.283	2.52
0.301	0.212	2.133	0.283	2.52
0.366	0.212	2.133	0.283	2.52
0.459	0.212	2.132	0.283	2.52
0.626	0.212	2.132	0.283	2.52
17.928	0.212	2.131	0.283	2.52
27.700	0.212	2.131	0.283	2.52

NODE 342.00 : HGL = < 67.242>;EGL= < 67.313>;FLOWLINE= < 67.030>

****

FLOW PROCESS FROM NODE 342.00 TO NODE 342.00 IS CODE = 8
UPSTREAM NODE 342.00 ELEVATION = 67.03 (FLOW IS SUBCRITICAL)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):

```
  PIPE FLOW =       0.38 CFS          PIPE DIAMETER =  24.00 INCHES
  FLOW VELOCITY =   2.13 FEET/SEC.    VELOCITY HEAD =  0.071 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.071) =  0.014
--------------------------------------------------------------------------------
  NODE   342.00 : HGL = <   67.327>;EGL= <   67.327>;FLOWLINE= <   67.030>

********************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   342.00            FLOWLINE ELEVATION =    67.03
  ASSUMED UPSTREAM CONTROL HGL =     67.24 FOR DOWNSTREAM RUN ANALYSIS

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  END OF GRADUALLY VARIED FLOW ANALYSIS
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APPENDIX F

Channel Sizing (Normal Depth)

Hydraulic Analysis Report

Project Data

Project Title: SDSU Mission Valley Campus

Designer:

Project Date: Wednesday, January 16, 2019

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel to Convey Bubbler overflow_Q25overflow_b=20_n=0.035

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 20.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0350

Flow: 60.0000 cfs

Result Parameters

Depth: 0.9713 ft

Area of Flow: 22.2563 ft^2

Wetted Perimeter: 26.1430 ft

Hydraulic Radius: 0.8513 ft

Average Velocity: 2.6959 ft/s

Top Width: 25.8278 ft

Froude Number: 0.5118

Critical Depth: 0.6330 ft

Critical Velocity: 4.3286 ft/s

Critical Slope: 0.0216 ft/ft

Critical Top Width: 23.80 ft

Calculated Max Shear Stress: 0.3030 lb/ft^2

Calculated Avg Shear Stress: 0.2656 lb/ft^2

Channel Analysis: Channel to Convey Bubbler overflow_Q25overflow_b=20_n=0.06

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 20.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0600

Flow: 60.0000 cfs

Result Parameters

Depth: 1.3251 ft

Area of Flow: 31.7688 ft^2

Wetted Perimeter: 28.3805 ft

Hydraulic Radius: 1.1194 ft

Average Velocity: 1.8886 ft/s

Top Width: 27.9504 ft

Froude Number: 0.3122

Critical Depth: 0.6329 ft

Critical Velocity: 4.3288 ft/s

Critical Slope: 0.0635 ft/ft

Critical Top Width: 23.80 ft

Calculated Max Shear Stress: 0.4134 lb/ft^2

Calculated Avg Shear Stress: 0.3492 lb/ft^2

Channel Analysis: Channel to Convey Bubbler overflow_Q25overflow_b=20_n=0.1

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 20.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.1000

Flow: 60.0000 cfs

Result Parameters

Depth: 1.7716 ft

Area of Flow: 44.8474 ft^2

Wetted Perimeter: 31.2045 ft

Hydraulic Radius: 1.4372 ft

Average Velocity: 1.3379 ft/s

Top Width: 30.6295 ft

Froude Number: 0.1948

Critical Depth: 0.6329 ft

Critical Velocity: 4.3291 ft/s

Critical Slope: 0.1765 ft/ft

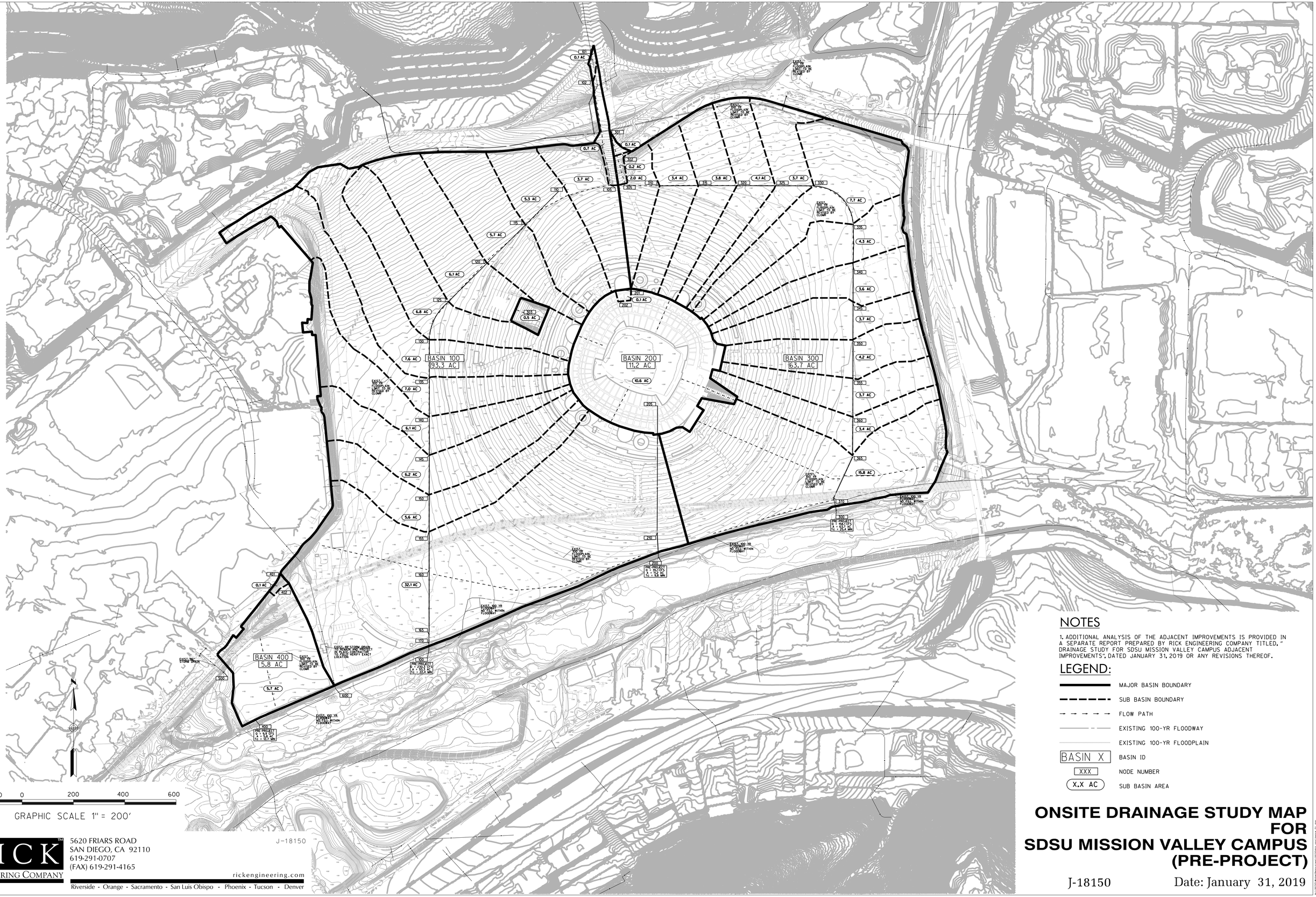
Critical Top Width: 23.80 ft

Calculated Max Shear Stress: 0.5527 lb/ft^2

Calculated Avg Shear Stress: 0.4484 lb/ft^2

MAP POCKET 1

Onsite Drainage Study Map
For
SDSU Mission Valley Campus
[Pre-Project]



NOTES

1. ADDITIONAL ANALYSIS OF THE ADJACENT IMPROVEMENTS IS PROVIDED IN A SEPARATE REPORT PREPARED BY RICK ENGINEERING COMPANY TITLED, " DRAINAGE STUDY FOR SDSU MISSION VALLEY CAMPUS ADJACENT IMPROVEMENTS", DATED JANUARY 31, 2019 OR ANY REVISIONS THEREOF.

LEGEND:

- MAJOR BASIN BOUNDARY
- SUB BASIN BOUNDARY
- FLOW PATH
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- BASIN X — BASIN ID
- XXX — NODE NUMBER
- X.X AC — SUB BASIN AREA

ONSITE DRAINAGE STUDY MAP FOR SDSU MISSION VALLEY CAMPUS (PRE-PROJECT)

J-18150 Date: January 31, 2019

RICK ENGINEERING COMPANY
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SAN DIEGO, CA 92110
619-291-0707
(FAX) 619-291-4165
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Riverside - Orange - Sacramento - San Luis Obispo - Phoenix - Tucson - Denver

J-18150

MAP POCKET 2

Onsite Drainage Study Map
For
SDSU Mission Valley Campus
[Post-Project/Ultimate]

200 100 0 200 400 600

GRAPHIC SCALE 1" = 200'

NOTES

1. ADDITIONAL ANALYSIS OF THE ADJACENT IMPROVEMENTS IS PROVIDED IN A SEPRATE REPORT PREPARED BY RICK ENGINEERING COMPANY TITLED, "DRAINAGE STUDY FOR SDSU MISSION VALLEY CAMPUS ADJACENT IMPROVEMENTS", DATED JANUARY 31, 2019 OR ANY REVISIONS THEREOF.

LEGEND:

- MAJOR BASIN BOUNDARY
- SUB BASIN BOUNDARY
- FLOW PATH
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- BASIN X — BASIN ID
- XXX — NODE NUMBER
- X.X AC — SUB BASIN AREA
- PROPOSED BIOFILTRATION BMP

ONSITE DRAINAGE STUDY MAP FOR SDSU MISSION VALLEY CAMPUS (POST-PROJECT)

J-18150 Date: February 12, 2019

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NOT FOR CONSTRUCTION - EXHIBIT FOR DRAINAGE STUDY REPORT ONLY