DRAINAGE STUDY
FOR
JAMUL RETAIL CENTER

(PRELIMINARY ENGINEERING)

County of San Diego Record ID:
PDS2018-MUP-18-008 & PDS2018-TPM-21262

Job Number 18145

March 26, 2018
Revised: July 10, 2018
Revised: October 10, 2018

RICK
ENGINEERING COMPANY

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Job Number 18145

Brendan Hastie
R.C.E #65809, Exp. 9/19

Prepared For:

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March 26, 2018
Revised: July 10, 2018
Revised: October 10, 2018

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DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the Engineer of Work for this Project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current standards.

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

Brendan Hastie, R.C.E #65809, Exp. 9/19

10/9/18
Date

DRAINAGE STUDY
FOR
JAMUL RETAIL CENTER

REVISION PAGE
October 10, 2018

Pursuant to the Comments provided by the County of San Diego received September 11, 2018, this letter presents a revision to the report titled, "Drainage Study for Jamul Retail Center (Preliminary Engineering)" dated July 10, 2018, prepared by Rick Engineering Company. The following text identifies the review comments in italics, followed by Rick Engineering Company's response in bold.

5-4: In the narrative of the report please provide a summary table of: pre- and post-development C, Tc, I, A, V100, Q100 without mitigation and Q100 with mitigation for each area (or point) where drainage discharges from the project. Peak runoff rates (cfs), velocities (fps) and identification of all erosive velocities (at all points of discharge) calculations for pre-development and post-development.

The comparisons should be made about the same discharge points for each drainage basin affecting the site and adjacent properties.

Based on the analysis, it seems like the project may cause minor diversion of flow; node 160 in existing conditions receives drainage from .8 acres but in proposed conditions this area increases to about 1.7 acres.
Provide comparison of flows at both nodes 150 and 160 to show no impacts is caused by the development.

8/28/2018 Update:
The project is showing diversion of the flow and an increase of runoff by 15 cfs at POI1. Please provide supporting calculation showing that there is no impacts downstream of the two POI at a ultimate point of discharge.

In the existing condition, there is no contributing area to POI 1 (node 150) from the project site, and there is 9.9 acres of contributing area to POI 2 (node 160). In order to minimize the impacts to the Biological Open Space and to mitigate existing adverse drainage conditions on the adjacent mobile home community, the outfall for the project is located at post-project node 150 (POI 1); therefore, there is a decrease in total area contributing to Node 160 in the post-project condition. Please refer to Tables 1, 2, and 3 for Hydrologic results for the pre-project, post-project (un-detained), and post-project (detained), respectively. Stormwater conveyed into POI 1 from the site is being detained from 47.3 cfs to 15.1 cfs to minimize the potential

for erosion and flooding. The outfall will include a rip-rap that will be designed during final engineering. Tables 1, 2, and 3 have been updated to include additional information as requested and narrative in Section 2.3 has been added to clarify the drainage conditions.

5-6: Revise Table 2 and the conclusion section of the report based on comments provided above.

8/28/2018 Update:
Revise Table 2 and the conclusion section of the report based on comment 5-4 above.

Tables 1, 2, and 3 and the conclusion have been updated based on Comment 5-4. Refer to response to 5-4 for additional information.

5-8: Discuss whether or not the proposed project would substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site? Provide reasons and mitigations proposed.

8/28/2018 Update:
Revise based on comment 5-4 above. Clearly discuss how there is no impacts from the increase of runoff at POI 1.

Narrative has been added to Section 2.3 the Detention Section (Section 3), and the Conclusion to better explain the drainage patterns and detention. It should be noted that the total runoff from the site has been decreased in the post-project condition when compared to the existing condition. Refer to the response to Comment 5-4 for additional information.

5-13: New Comment: Clarify how the runoff from the street is routed to the proposed BMP's. See comment 4-6 above for more clarification.

Runoff from Jefferson Road is conveyed into the proposed inlets on the west half of Jefferson Road via street flow and curb and gutter. Stormwater is then conveyed into the proposed BMPs through the proposed on-site storm drain. Please refer to the TM Plans, specifically Jefferson Rd Cross Sections A-A and B-B for typical roadway cross sections. Additionally, refer to the Post-Project Drainage Exhibit located in Map Pocket 2 for drainage patterns, proposed storm drain, and BMP locations.

DRAINAGE STUDY
FOR
JAMUL RETAIL CENTER

REVISION PAGE

July 10, 2018

Pursuant to the Comments provided by the County of San Diego received June 15, 2018, this letter presents a revision to the report titled, "Drainage Study for Jamul Retail Center (Preliminary Engineering)" dated March 26, 2018, prepared by Rick Engineering Company. The following text identifies the review comments in italics, followed by Rick Engineering Company's response in bold.

1. *Provide DECLARATION OF RESPONSIBLE CHARGE – see San Diego County Hydrology Manual, Figure 1-9.*

   Declaration of Responsible Charge has been provided in as requested.

2. *The final CEQA Drainage report shall be signed, stamped and dated by the responsible California Registered Civil Engineer.*

   The final CEQA Drainage report has been signed, stamped and dated appropriately.

3. *Include the project number on the title sheet.*

   The project number has been added to the title sheet.

4. *In the narrative of the report please provide a summary table of: pre- and post-development C, Tc, I, A, V_{100}, $Q_{100\ without\ mitigation}$ and $Q_{100\ with\ mitigation}$ for each area (or point) where drainage discharges from the project. Peak runoff rates (cfs), velocities (fps) and identification of all erosive velocities (at all points of discharge) calculations for pre-development and post-development.*

   The comparisons should be made about the same discharge points for each drainage basin affecting the site and adjacent properties.

   Based on the analysis, it seems like the project may cause minor diversion of flow; node 160 in existing conditions receives drainage from .8 acres but in proposed conditions this area increases to about 1.7 acres.

Provide comparison of flows at both nodes 150 and 160 to show no impacts is caused by the development.

The results and summary tables in Section 2.3 have been updated to show the comparison at each Point of Interest (POI) and where drainage discharges from the project. Rainfall intensity (I) and additional information for each node and sub-area can be found in the AES analysis in Appendix A. Node 160 now referenced as POI 2, receives storm water runoff from 9.9 acres in the pre-project condition and decreases to 1.2 acres in the post-project condition (from landscaped slopes).

5. *Existing and Proposed Hydrology Maps:*
   **The limits of overall DMA between existing and proposed conditions should be the same and should include the entire project site. Currently the existing exhibit shows the entire 9.8 acres; while the proposed exhibit is only addressing the areas tributary to node 150.*

   Clearly show how the runoff in node 160 is impacted from the proposed development. As mentioned in the previous comment, the project is causing a minor diversion of flow. Clearly show how the runoff is impacted at each POC as a result of development.

   **Show discharge point with A & Q information for each node and discharge of sub-basins on the existing and proposed drainage exhibits.*

   The hydrologic maps have been updated to show the same major watershed boundary for the project site. Two Points of Interest (POIs) (discharge points from the site) showing peak flow rate, time of concentration, and watershed areas, have been added to clearly show the impacts between the pre- and post- project conditions. Peak flow rates for individual sub-basins can be found in the AES analysis in Appendix A.

6. *Revise Table 2 and the conclusion section of the report based on comments provided above.*

   Table 2 has been modified to reflect the latest site plan and calculations. Additionally, refer to responses for comments 4 and 5 for more information regarding changes to maps and calculations.

7. *Summary/Conclusion:*
   Please discuss whether or not the proposed project would substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site? Provide reasons and mitigations proposed.

   The proposed project is not anticipated to alter the existing drainage pattern in a manner which would result in substantial erosion or siltation on- or off-site. Additional discussion has been added to Section 5.0.

8. *Discuss whether or not the proposed project would substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site? Provide reasons and mitigations proposed.*

   The proposed project is not anticipated to alter the existing drainage pattern in a manner which would result in flooding on- or off-site. Additional discussion has been added to Section 5.0.

9. *Discuss whether or not the proposed project would create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems? Provide reasons and mitigations proposed.*

   The proposed project is not expected to create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems. Additional discussion has been added to Section 5.0.

10. *Discuss whether or not the proposed project would place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps? Provide reasons and mitigations proposed.*

    The proposed project is not anticipated to place housing within a 100-year flood hazard area. The FEMA FIRM provided in Appendix D shows that the project is located in a Zone X, which is an area of minimal flooding. Additional discussion has been added to Section 5.0.

11. *Discuss whether or not the proposed project would place structures within a 100-year flood hazard area which would impede or redirect flood flows?*

    The proposed project is not anticipated to place structures within a 100-year flood hazard area. Additional discussion has been added to Section 5.0.

12. *Discuss whether or not the proposed project would expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam?*

    No levees or dams are located within the vicinity of the project site. Therefore, the proposed project is not anticipated to expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam. Additional discussion has been added to Section 5.0.

1.0 INTRODUCTION

This drainage report supports preliminary design of the Jamul Retail Center project (herein referred to as the Project). The project site is located along the western side of Jefferson Road between Olive Vista Drive and Campo Road, within the County of San Diego. The project is located approximately 200 feet east of Steele Canyon Creek. The vicinity map is shown in Figure 1, located at the end of this section.

The project proposes to develop the site into a tractor supply and self-storage center. The project will also improve and widen the west side of Jefferson Road for the length adjacent to the project site. The area within the project footprint is approximately 9.9 acres, and the parcel area is approximately 19.4 acres.

1.1 Existing Drainage Characteristics

The Project in its existing condition is comprised of a moderately steep, undeveloped hillside with dirt trails and scattered vegetation, as well as the west side of Jefferson Road. Runoff consists of unconcentrated drainage across the undeveloped hillside that flows through an existing mobile home community downstream and adjacent to the project site. There is no existing drainage system that conveys this unconcentrated flow from the project site around the mobile home community; therefore, much of this storm water runoff is conveyed through the yards or various localized ditches. Drainage along Jefferson Road is conveyed northerly along an existing asphalt dike that enters a natural unnamed channel and ultimately confluences with Steele Canyon Creek.

A large, mostly undeveloped off-site area east of the project drains westerly onto Jefferson Road as well as under the road through two 24-inch corrugated metal pipe (CMP) culverts into the natural unnamed tributary channel north of the project site. The portion of this off-site area that drains onto Jefferson Road is conveyed northerly through a natural eroded channel adjacent to the road as well as the asphalt dike before entering the unnamed channel, bypassing the project site.

Refer to the Existing Condition Drainage Study Map located in Map Pocket 1 for more information.

1.2 Proposed Drainage Characteristics

In the proposed condition the Project will develop the site into two lots; the southern lot associated with the tractor supply center, and the northern lot associated with the self-storage center. These two lots contain approximately 5.5 acres of impervious surface along with 0.7 acres associated with the Jefferson Road widening and improvements. The remaining 3.7 acres of the project site will be various landscape features, including fill slopes and areas reserved for three biofiltration basins. Each lot will have a localized storm drain system consisting of ribbon gutters, catch basins, and curb inlets.

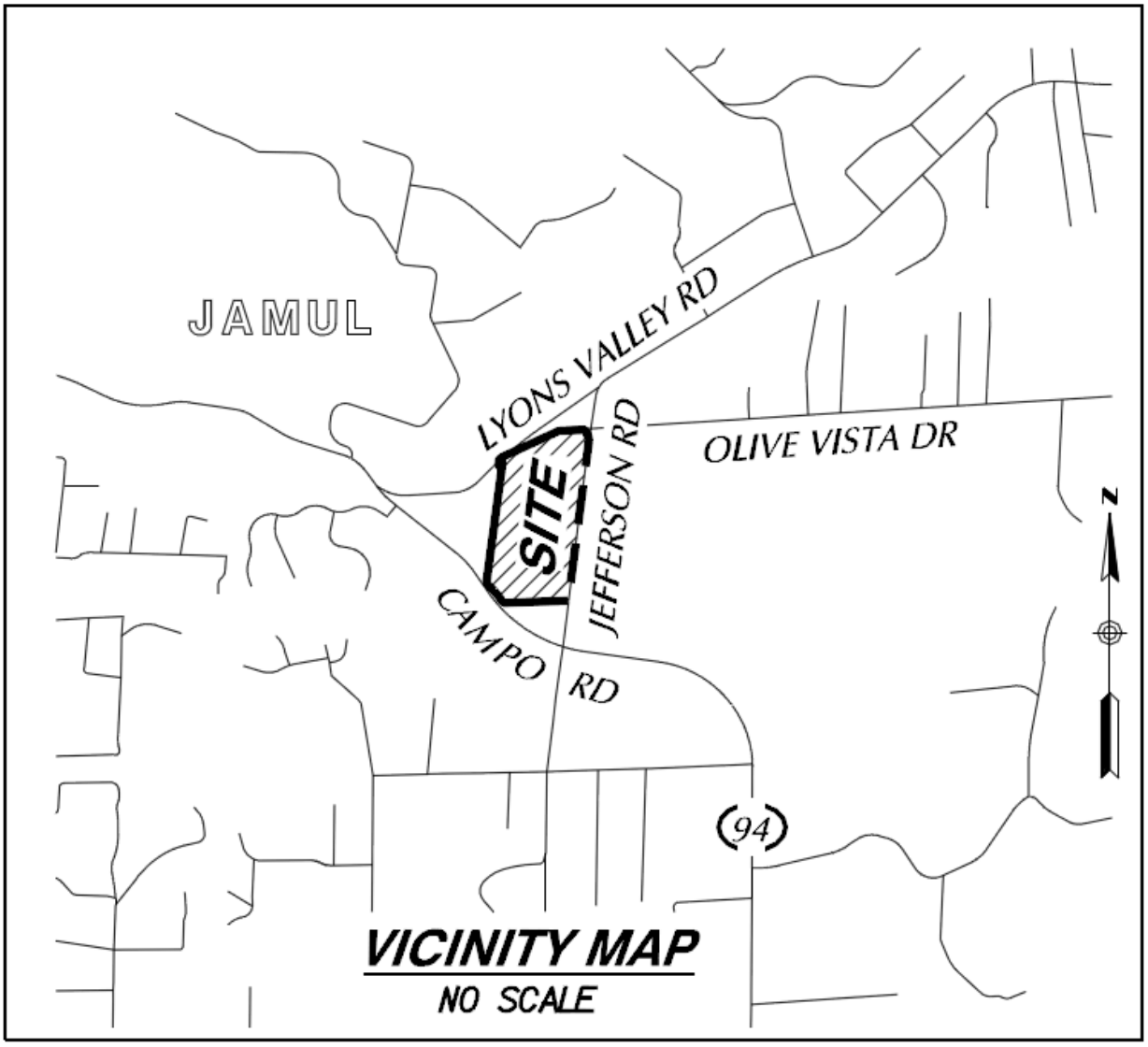
The drainage from Jefferson road will be split between the two lots and will enter the storm drain system through three curb inlets with each curb inlet ultimately leading to a separate biofiltration basin. Two of the three biofiltration basins will capture runoff from the southern lot as well as approximately 400 linear feet of the west side of Jefferson road. The third biofiltration basin will capture runoff from the northern lot and approximately 400 linear feet of Jefferson Road. Runoff from approximately 0.7 acres of landscaped area within the project site will be conveyed via brow ditch directly into the storm drain system, bypassing the biofiltration basins.

Storm drains conveying drainage from each lot and adjacent portion of Jefferson Road will confluence within the northern lot before leading to the single proposed outfall along the natural unnamed channel located north of the project site. The outfall is located in an area that directs flows away from the mobile home community. Pursuant to coordination with the project's environmental consultant, the current proposed storm drain layout would result in the least impact to riparian zones and existing trees/vegetation.

Off-site drainage that is conveyed along the east side of Jefferson Road will continue to be conveyed into the natural unnamed channel prior to the two 24-inch CMP culverts and is not included in the analyses.

Refer to Section 2.3 and the Proposed Condition Drainage Study Map within Map Pocket 2 for more information.

Figure 1 Vicinity Map



2.0 HYDROLOGY

2.1 Criteria

The hydrologic conditions were analyzed in accordance with the County of San Diego's design criteria.

Design Storm:	100-year, 6-hour
100-Year 6-Hour Precip (inches):	P = 3.3 inches

June 2003 San Diego County *Hydrology Manual* Criteria (unit-less)

Soil Type: C (See Appendix A.3)

Intensity-Duration-Frequency (I-D-F) Curves within the June 2003 County of San Diego *Hydrology Manual* (inches per hour)

2.2 Modified Rational Method

To calculate the flow rates for Basin 100 in pre-project and post-project condition, a Modified Rational Method analysis was performed in accordance with the methodology presented in the June 2003 County of San Diego *Hydrology Manual* to determine pre- and post-project 100-year peak discharge rates for watersheds less than 1 square-mile. The Advanced Engineering Software (AES) Rational Method computer program was used to perform these calculations. The 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 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:

Code 1: Confluence analysis at a node
Code 2: Initial subarea analysis
Code 3: Pipe flow travel time (computer-estimated 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 thru subarea
Code 10: Copy main-stream data onto a memory bank
Code 11: Confluence a memory bank with the main-stream memory
Code 12: Clear a memory bank
Code 13: Clear the main-stream memory
Code 14: Copy a memory bank onto the main-stream memory
Code 15: Hydrologic data bank storage functions

In order for the program to perform the hydrologic analysis; base information for the study area is required. This information includes the land uses, drainage facility locations, flow patterns, drainage basin boundaries, and topographic elevations. The rainfall data, runoff coefficients, and soils information were obtained from the June 2003, County of San Diego *Hydrology Manual*.

2.3 Hydrologic Results

In the pre-project condition, the entire project site drains to the west toward the mobile home community and is represented by a single Point of Interest (POI), referred to as POI 2. In the post-project condition, the majority of the stormwater generated from the site will be directed to a single outfall being proposed along the natural unnamed channel located north of the project site at POI 1 (Node 150). As a result, the total area tributary to POI 2 has decreased from 9.9 acres to 1.2 acres. Stormwater that is tributary to POI 2 will continue to sheet flow from the site similar to existing conditions; however, the tributary area and peak flow rate have decreased. The 100-year peak discharge rate at POI 2 (Node 160) has decreased from 19.4 cfs in the pre-project condition to 3.1 cfs in the post-project condition.

POI 1 (approximately 550 feet upstream of the existing condition confluence with Steele Canyon Creek (POI 3)) was selected as the project's outfall through coordination with the project's biologist in order to minimize the impacts to riparian areas and biological open space and also to mitigate flooding issues that the mobile home community currently experiences. The total area tributary to POI 1 has increased from 0.0 acres in the pre-project condition to 8.7 acres. A summary of the pre- and post-project hydrologic results are provided below in Tables 1, 2, and 3.

Table 1 – Hydrologic Summary Table (Pre-project)

POI[1]/Drainage Node	Watershed Area (acres)	Runoff Coefficient	Time of Concentration (min)	100-Year Peak Flow Rate (cfs)	100-Year Peak Flow Velocity (fps)
POI 1/150	0.0	N/A	N/A	0.0	0.0
POI 2/160	9.9	0.32	8.8	19.4	Sheet Flow
POI 3 (Total Site)	9.9	0.32	8.8	19.4	Sheet Flow

Table 2 – Hydrologic Summary Table (Post-project, Un-detained)

POI[1]/Drainage Node	Watershed Area (acres)	Runoff Coefficient	Time of Concentration (min)	Un-detained 100-Year Peak Flow Rate (cfs)
106 (BMP2)	2.4	0.83	5.7	15.9
126 (BMP1)	1.3	0.68	5.9	6.9
146 (BMP3)	3.5	0.89	6.0	24.2
POI 1/150[a]	8.7	0.74	6.9	47.3
POI 2/160	1.2	0.30	4.6	3.1
POI 3 (Total Site)	9.9	0.69	6.9	49.7

a. POI 1 includes areas from nodes 106, 126, and 146.

It can be observed that there is an increase in the peak discharge rate for the site as a whole at POI 3 due to the increase in imperviousness and decrease in time of concentration. However, detention is being provided within the proposed BMPs to route the un-detained post-project peak flow rate back to pre-project conditions for the site as a whole. The 100-year modified rational method calculations for pre- and post-project conditions are provided in Appendix A1 through A3, while the associated hydrologic drainage exhibits are located in Map Pockets 1 and 2.

3.0 DETENTION

Detention is provided within BMPs-1, 2 & 3 to route the un-detained 100-year peak discharge for Basin 100 back to pre-project conditions for the site as a whole. As mentioned in section 2.3, POI 1 was selected as the project's outfall through coordination with the project's biologist in order to minimize the impacts to riparian areas and biological open space and also to mitigate existing adverse drainage conditions that the mobile home community currently experiences. In order to mitigate the potential for flooding downstream of Steele Canyon Creek (POI 3), the peak discharge from the site is being detained within the proposed BMPs. The detention analysis utilizes the AES Modified Rational Method hydrologic analysis for the post-project (un-detained) condition that is tributary to each proposed BMP (Nodes 106, 126, and 146). To determine the pre-project 100-year peak flow rate that each BMP must detain to, the pre-project 100-year peak flow rate was prorated based on a fraction of tributary acreage to each BMP to the total tributary acreage of Basin 100.

The sizing of a detention facility requires an inflow hydrograph to obtain the necessary storage volume. The modified rational method only yields a peak discharge and time of concentration, and does not yield a hydrograph. In order to convert the peak discharge and time of concentration into a hydrograph, a modified rational method hydrograph synthesizing procedure was used. The modified rational method hydrograph synthesizing procedure methodology and criteria that were used are based on the Rational Method Hydrograph Procedure and Detention Basin Design, of the *San Diego County Hydrology Manual 2003*.

The 100-year hydrographs and preliminary elevation-storage-outflow rating curves were used in the HEC-1 hydrologic model to perform routing calculations for the detention basin, and to determine the preliminary 100-year detention volumes required for the basin to reduce the post-project peak discharge rate back to the prorated pre-project peak discharge rate. Actual storage and rating curves will be provided during final engineering along with detailed outlet-works designs for each BMP. Table 3 below provides a summary of the detention analysis.

Table 3 – Hydrologic Summary Table (Post-project, Detained)

BMP or POI[1] ID/ Drainage Node	Watershed Area (acres)	Runoff Coefficient	Lag Time (min)	Time of Concentration[4] (min)	Detained 100-Year Peak Flow Rate (cfs)	100-Year Peak Flow Velocity[5] (fps)
BMP 1 / 146[2]	3.5	0.89	4.8	10.8	7.3	3.7
BMP 2 / 106[2]	2.4	0.83	4.8	10.5	4.7	3.2
BMP 3 / 126[2]	1.3	0.68	4.8	10.7	2.4	3.2
POI 1 / 150[2]	8.7	0.74	N/A	12.9	15.1	5.9
POI 2 / 160[3]	1.2	0.30	N/A	4.6	3.1	N/A
POI 3 (Total Site)	9.9	.69	N/A	12.9	16.7	N/A

([1]): POI is the Point of Interest for the project
([2]): Flow Rate calculated using the Modified Rational Method
([3]): Refers to fill slope (landscaped) acreage on west perimeter of project that does not convey drainage into the proposed storm drain system tributary to POI 1.
([4]): Time of Concentration includes lag time for detained conditions
([5]): Velocities determined using normal depth calculations, see Appendix B

Based on the HEC-1 hydraulic model, the required detention volume for BMP-1, 2, & 3 is approximately 0.30, 0.18 & 0.07 acre-feet, respectively for the 100-year storm event. Refer to Appendix C for a schematic of the proposed basins, calculation back-up and results from the HEC-1 detention analyses. It should be noted that the peak discharge rate from the entire site at POI 3with detention (16.7 cfs from Table 3) is less than the pre-project peak discharge rate (19.4 cfs from Table 1).

4.0 HYDRAULICS

4.1 Hydraulic Methodology and Criteria

The 100-year post-project peak flow rates determined using the Modified Rational Method were used to preliminarily size the on-site storm drain system. Additional hydraulic analyses such as open channel sizing for brow ditches, proposed inlet sizing, dry lane calculations, and energy dissipaters will be prepared during final engineering pursuant to the San Diego County Hydrology Manual (June 2003).

4.2 Storm Drain Sizing

Proposed storm drain pipes were designed using normal depth calculations (storm drain sizing spreadsheet or Federal Highway Administration's Hydraulic Toolbox (v.4.2)). The anticipated 100-year flow rate to each storm drain pipe was estimated with AES Modified Rational Method. The anticipated 100-year flow rate with a 30% bump-up factor was used in calculations to provide recommended storm drain sizes. The 30% bump-up helps account for hydraulic losses within the system. A preliminary (general) storm drain sizing table was created to size proposed storm drain pipes.

The preliminary storm drain sizing table and the estimate velocities at each pipe outlet are provided in Appendix B of this report.

5.0 SUMMARY/CONCLUSION

This Drainage Study presents the hydrologic and hydraulic analyses for the Jamul Retail Center. The pre-project and post-project condition peak discharge rates were determined using the Modified Rational Method based on the hydrologic methodology and criteria described in the *San Diego County Hydrology Manual 2003.*

Preliminary storm drain sizes have been determined based on the 100-year peak flow rates. Preliminary detention sizing is provided for the 100-year, 6-hour storm event so that post-project peak discharge rates are routed back to pre-project conditions using the HEC-1 hydrologic model.

Post-project flows will be treated per the County of San Diego's BMP Design Manual, dated February 2016. For more information on water quality and HMP sizing, please refer to the a separate report titled, "Priority Development Project Storm Water Quality Management Plan (PDP SWQMP) for Jamul Retail Center," dated October 10, 2018 and prepared by Rick Engineering Company (Job No. 18145).

The proposed project will safely direct drainage away from the mobile home community and to the natural, unnamed channel located north of the project site (POI 1), and ultimately confluence with Steele Canyon Creek (POI 3). As a result, the amount of drainage that sheet flows directly to the mobile home community is significantly reduced (at POI 2). Therefore, it is not anticipated that there will be adverse impacts on existing or planned storm water drainage systems as a result of the project. The proposed project is not expected to alter the existing drainage pattern in a manner which would result in flooding on- or off-site.

The proposed outfall to the north will be protected with rip rap, and concentrated flows from the storm drain will be dissipated such that velocities leaving the rip rap pad will be non-erosive to the natural channel. The proposed project is not anticipated to alter the existing drainage pattern in a manner which would result in substantial erosion or siltation on- or off-site. Additionally, the proposed project is not anticipated to place housing or structures within a 100-year flood hazard area. The FEMA FIRM provided in Appendix D shows that the project is located in a Zone X, which is an area of minimal flooding.

No levees or dams are located within the vicinity of the project site. Therefore, the proposed project is not anticipated to expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam.

APPENDIX A

Hydrology

APPENDIX A1

Existing Condition AES Output

[100-Year]

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0 Release Date: 06/01/2014  License ID 1261

                              Analysis prepared by:

                             Rick Engineering Company
                             1160 Marsh St. Suite 150
                            San Luis Obispo, CA 93401


 ************************** DESCRIPTION OF STUDY **************************
* JAMUL RETAIL CENTER, J-18145                                            *
* 100-YR, 6-HR EXISTING CONDITION FOR BASIN 100                           *
* J:\18145\WATERRESOURCES\HYDROLOGY\RATIONALMETHOD\..                     *
 **************************************************************************

  FILE NAME: JR100E1H.RAT
  TIME/DATE OF STUDY: 10:37 07/06/2018
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4100
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    997.00
  DOWNSTREAM ELEVATION(FEET) =    989.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.210
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.560
```

```
  SUBAREA RUNOFF(CFS) =      0.93
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.93

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    160.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  CHANNEL LENGTH THRU SUBAREA(FEET) =   650.00
  REPRESENTATIVE CHANNEL SLOPE =  0.1000
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.070
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3200
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.43
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.30
  AVERAGE FLOW DEPTH(FEET) =   0.30   TRAVEL TIME(MIN.) =   2.52
  Tc(MIN.) =    8.73
  SUBAREA AREA(ACRES) =     9.60       SUBAREA RUNOFF(CFS) =   18.65
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.323
  TOTAL AREA(ACRES) =        9.9         PEAK FLOW RATE(CFS) =      19.39

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.42   FLOW VELOCITY(FEET/SEC.) =   5.08
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    160.00 =     750.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        9.9  TC(MIN.) =      8.73
  PEAK FLOW RATE(CFS)   =      19.39
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

APPENDIX A2

Proposed Condition AES Output

[100-Year, Undetained]

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0 Release Date: 06/01/2014  License ID 1261

                              Analysis prepared by:

                             Rick Engineering Company
                             1160 Marsh St. Suite 150
                            San Luis Obispo, CA 93401


 ************************** DESCRIPTION OF STUDY **************************
* JAMUL RETAIL CENTER, J-18145                                            *
* 100-YR, 6-HR POST-PROJECT CONDITION FOR BASIN 100, UNDETAINED           *
* J:\18145\WATERRESOURCES\HYDROLOGY\RATIONALMETHOD\..                     *
 **************************************************************************

  FILE NAME: JR100P.RAT
  TIME/DATE OF STUDY: 09:10 07/06/2018
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   30.0     25.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0180

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    998.00
  DOWNSTREAM ELEVATION(FEET) =    997.20
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.889
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.72
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0200
 STREET LENGTH(FEET) =   100.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 30.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.018
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.08
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.25
   HALFSTREET FLOOD WIDTH(FEET) =    5.03
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.58
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
 STREET FLOW TRAVEL TIME(MIN.) =   0.65   Tc(MIN.) =    4.54
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.830
 SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.72
 TOTAL AREA(ACRES) =        0.2        PEAK FLOW RATE(CFS) =       1.44

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   6.28
 FLOW VELOCITY(FEET/SEC.) =  2.64   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     170.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0050
 FLOW LENGTH(FEET) =   225.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.20
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.44
 PIPE TRAVEL TIME(MIN.) =   1.17    Tc(MIN.) =    5.71
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =     395.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.982
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8300
  SUBAREA AREA(ACRES) =    2.20   SUBAREA RUNOFF(CFS) =   14.57
  TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =      15.90
  TC(MIN.) =    5.71

**************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    108.00 IS CODE =  41
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==========================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.00
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.90
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    6.01
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =     555.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.01
  RAINFALL INTENSITY(INCH/HR) =   7.73
  TOTAL STREAM AREA(ACRES) =     2.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.90

**************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    984.00
  DOWNSTREAM ELEVATION(FEET) =    983.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.182
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.496
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.16

**************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00
```

```
  REPRESENTATIVE CHANNEL SLOPE =  0.0050
  CHANNEL BASE(FEET) =    0.50   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.791
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.38
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.86
  AVERAGE FLOW DEPTH(FEET) =   0.22   TRAVEL TIME(MIN.) =   2.42
  Tc(MIN.) =   12.60
  SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.43
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       0.57

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.26   FLOW VELOCITY(FEET/SEC.) =   2.12
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =     320.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    108.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.46
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.57
  PIPE TRAVEL TIME(MIN.) =   2.85    Tc(MIN.) =   15.45
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    108.00 =     740.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.45
  RAINFALL INTENSITY(INCH/HR) =   4.20
  TOTAL STREAM AREA(ACRES) =     0.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.57

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    998.00
  DOWNSTREAM ELEVATION(FEET) =    997.20
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.889
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.72
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.72
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0100
  STREET LENGTH(FEET) =   130.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.08
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    6.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.91
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
  STREET FLOW TRAVEL TIME(MIN.) =   1.14   Tc(MIN.) =    5.03
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.665
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.830
  SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.72
  TOTAL AREA(ACRES) =        0.2        PEAK FLOW RATE(CFS) =       1.44

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   7.72
  FLOW VELOCITY(FEET/SEC.) =  1.98   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     200.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   170.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.20
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.44
  PIPE TRAVEL TIME(MIN.) =   0.89    Tc(MIN.) =    5.91
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    126.00 =     370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.804
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6777
  SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    5.58
  TOTAL AREA(ACRES) =        1.3   TOTAL RUNOFF(CFS) =       6.88
  TC(MIN.) =    5.91

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    108.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   520.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.66
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.88
  PIPE TRAVEL TIME(MIN.) =   1.86    Tc(MIN.) =    7.77
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    108.00 =     890.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.77
  RAINFALL INTENSITY(INCH/HR) =   6.54
  TOTAL STREAM AREA(ACRES) =     1.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       15.90     6.01        7.726          2.40
      2        0.57    15.45        4.201          0.40
      3        6.88     7.77        6.542          1.30

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       21.44     6.01       7.726
      2       20.63     7.77       6.542
      3       13.63    15.45       4.201

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      21.44   Tc(MIN.) =    6.01
  TOTAL AREA(ACRES) =        4.1
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    108.00 =     890.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    134.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
```

```
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.82
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.44
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    6.13
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    134.00 =     940.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    134.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.626
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6918
  SUBAREA AREA(ACRES) =    0.40   SUBAREA RUNOFF(CFS) =    0.92
  TOTAL AREA(ACRES) =        4.5   TOTAL RUNOFF(CFS) =      23.74
  TC(MIN.) =    6.13

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    135.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0200
  FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.92
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.74
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =    6.40
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    135.00 =    1120.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    135.00 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.) =    6.40
  RAINFALL INTENSITY(INCH/HR) =   7.41
  TOTAL STREAM AREA(ACRES) =     4.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.74

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    992.00
  DOWNSTREAM ELEVATION(FEET) =    985.00
  ELEVATION DIFFERENCE(FEET) =      7.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.541
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.72
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
 FLOW PROCESS FROM NODE    142.00 TO NODE    144.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0500
 STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 30.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.018
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.44
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.24
   HALFSTREET FLOOD WIDTH(FEET) =    4.28
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.04
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
 STREET FLOW TRAVEL TIME(MIN.) =   1.24   Tc(MIN.) =    3.78
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.830
 SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    1.44
 TOTAL AREA(ACRES) =        0.3        PEAK FLOW RATE(CFS) =       2.16

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   6.03
 FLOW VELOCITY(FEET/SEC.) =  4.17   DEPTH*VELOCITY(FT*FT/SEC.) =   1.13
 LONGEST FLOWPATH FROM NODE    140.00 TO NODE    144.00 =     400.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    144.00 TO NODE    146.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0050
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.58
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.16
 PIPE TRAVEL TIME(MIN.) =   2.24    Tc(MIN.) =    6.02
 LONGEST FLOWPATH FROM NODE    140.00 TO NODE    146.00 =     880.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.718
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8940
  SUBAREA AREA(ACRES) =    3.20   SUBAREA RUNOFF(CFS) =   22.23
  TOTAL AREA(ACRES) =        3.5   TOTAL RUNOFF(CFS) =      24.15
  TC(MIN.) =    6.02

********************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    135.00 IS CODE =  41
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.69
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.15
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    6.15
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    135.00 =     940.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    135.00 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.) =    6.15
  RAINFALL INTENSITY(INCH/HR) =   7.61
  TOTAL STREAM AREA(ACRES) =     3.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     24.15

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       23.74     6.40        7.413          4.50
      2       24.15     6.15        7.612          3.50

  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       47.27     6.15       7.612
      2       47.26     6.40       7.413

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      47.27   Tc(MIN.) =    6.15
  TOTAL AREA(ACRES) =        8.0
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    135.00 =    1120.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    150.00 IS CODE =  41
--------------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.63
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      47.27
  PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =    6.87
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    150.00 =    1540.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.082
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7416
  SUBAREA AREA(ACRES) =    0.70   SUBAREA RUNOFF(CFS) =    1.49
  TOTAL AREA(ACRES) =       8.7   TOTAL RUNOFF(CFS) =     47.27
  TC(MIN.) =    6.87
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    160.10 TO NODE    160.20 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    45.00
  UPSTREAM ELEVATION(FEET) =    969.67
  DOWNSTREAM ELEVATION(FEET) =    950.00
  ELEVATION DIFFERENCE(FEET) =     19.67
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.484
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    106.20 TO NODE    160.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  CHANNEL LENGTH THRU SUBAREA(FEET) =    45.00
  REPRESENTATIVE CHANNEL SLOPE =  0.5000
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.70
```

```
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.73
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   0.16
  Tc(MIN.) =    4.64
  SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    2.87
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       3.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   5.83
  LONGEST FLOWPATH FROM NODE    160.10 TO NODE    160.00 =      90.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.2  TC(MIN.) =      4.64
  PEAK FLOW RATE(CFS)   =       3.13
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

Jamul Retail Center
J-18145
10/9/2018

Confluence Analysis - Post-Project Un-detained Condition

The purpose of this sheet is to provide the confluenced Q for 2 streams, based on the 2003 County of San Diego hydrology criteria.

	P_6 (in)	3.3	(100-Yr, 6-Hr)

At Node: Total Site

Let:

Q_1 (cfs)	3.13	
T_1 (min)	4.64	(Sheet flow to POI 2)
I_1 (in/hr)	9.1239	
Q_2 (cfs)	47.27	(Flow to POI 1 - Outfall)
T_2 (min)	6.87	
I_2 (in/hr)	7.0835	

Then:

Q_{T1} (cfs)	35.06	
Q_{T2} (cfs)	49.70	

Final Results: (Choosing the largest Q and the associated T_c)

Q_T (cfs)	49.70	Total Site Peak Discharge Rate
T_c (min)	6.87	

APPENDIX A3

Proposed Condition AES Output

[100-Year, Detained]

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0 Release Date: 06/01/2014  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 **************************
* JAMUL RETAIL CENTER, J-18145                                            *
* 100-YR, 6-HR POST-PROJECT CONDITION FOR BASIN 100, DETAINED             *
* J:\18145\WATERRESOURCES\HYDROLOGY\RATIONALMETHOD\..                     *
 **************************************************************************

  FILE NAME: JR100P1H.RAT
  TIME/DATE OF STUDY: 13:53 07/09/2018
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   30.0     25.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0180

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    998.00
  DOWNSTREAM ELEVATION(FEET) =    997.20
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.889
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.72
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0200
 STREET LENGTH(FEET) =   100.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 30.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.018
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.08
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.25
   HALFSTREET FLOOD WIDTH(FEET) =    5.03
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.58
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
 STREET FLOW TRAVEL TIME(MIN.) =   0.65   Tc(MIN.) =    4.54
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.830
 SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.72
 TOTAL AREA(ACRES) =        0.2        PEAK FLOW RATE(CFS) =       1.44

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   6.28
 FLOW VELOCITY(FEET/SEC.) =  2.64   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     170.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0050
 FLOW LENGTH(FEET) =   225.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.20
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.44
 PIPE TRAVEL TIME(MIN.) =   1.17    Tc(MIN.) =    5.71
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =     395.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.982
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8300
  SUBAREA AREA(ACRES) =    2.20   SUBAREA RUNOFF(CFS) =   14.57
  TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =      15.90
  TC(MIN.) =    5.71

+------------------------------------------------------------------------------+
| THE CODE 7 BELOW IS THE DETAINED 100-YEAR PEAK FLOW AND Tc FROM BMP-2        |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+

********************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   7
--------------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
================================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.51   RAIN INTENSITY(INCH/HOUR) =  5.38
  TOTAL AREA(ACRES) =     2.40   TOTAL RUNOFF(CFS) =      4.70

********************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    108.00 IS CODE =  41
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.36
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.70
  PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =   11.12
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =     555.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.12
  RAINFALL INTENSITY(INCH/HR) =   5.19
  TOTAL STREAM AREA(ACRES) =     2.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.70

********************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  21
--------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    984.00
```

```
 DOWNSTREAM ELEVATION(FEET) =    983.50
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.182
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.496
 SUBAREA RUNOFF(CFS) =      0.16
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00
 REPRESENTATIVE CHANNEL SLOPE =  0.0050
 CHANNEL BASE(FEET) =    0.50   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.791
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.38
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.86
 AVERAGE FLOW DEPTH(FEET) =   0.22   TRAVEL TIME(MIN.) =   2.42
 Tc(MIN.) =   12.60
 SUBAREA AREA(ACRES) =     0.30       SUBAREA RUNOFF(CFS) =    0.43
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
 TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       0.57

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.26   FLOW VELOCITY(FEET/SEC.) =   2.12
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =     320.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    114.00 TO NODE    108.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0050
 FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   2.46
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       0.57
 PIPE TRAVEL TIME(MIN.) =   2.85    Tc(MIN.) =   15.45
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    108.00 =     740.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   15.45
 RAINFALL INTENSITY(INCH/HR) =   4.20
 TOTAL STREAM AREA(ACRES) =     0.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.57

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    998.00
  DOWNSTREAM ELEVATION(FEET) =    997.20
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.889
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.72
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.72

********************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  62
--------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
================================================================================
  REPRESENTATIVE SLOPE =  0.0100
  STREET LENGTH(FEET) =   130.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.08
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    6.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.91
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
  STREET FLOW TRAVEL TIME(MIN.) =   1.14   Tc(MIN.) =    5.03
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.665
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.830
  SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.72
  TOTAL AREA(ACRES) =        0.2        PEAK FLOW RATE(CFS) =       1.44

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   7.72
  FLOW VELOCITY(FEET/SEC.) =  1.98   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     200.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  41
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   170.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.4 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.20
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.44
  PIPE TRAVEL TIME(MIN.) =   0.89    Tc(MIN.) =    5.91
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    126.00 =     370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.804
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6777
  SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    5.58
  TOTAL AREA(ACRES) =        1.3   TOTAL RUNOFF(CFS) =       6.88
  TC(MIN.) =    5.91

+--------------------------------------------------------------------------+
| THE CODE 7 BELOW IS THE DETAINED 100-YR PEAK FLOW AND Tc FROM BMP-3      |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.71   RAIN INTENSITY(INCH/HOUR) =  5.32
  TOTAL AREA(ACRES) =     1.30   TOTAL RUNOFF(CFS) =      2.40

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    108.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   520.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.68
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.40
  PIPE TRAVEL TIME(MIN.) =   2.36    Tc(MIN.) =   13.07
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    108.00 =     890.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.07
  RAINFALL INTENSITY(INCH/HR) =   4.68
  TOTAL STREAM AREA(ACRES) =     1.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.40
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        4.70    11.12        5.192          2.40
      2        0.57    15.45        4.201          0.40
      3        2.40    13.07        4.679          1.30

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        7.16    11.12       5.192
      2        7.12    13.07       4.679
      3        6.53    15.45       4.201

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.16   Tc(MIN.) =   11.12
  TOTAL AREA(ACRES) =        4.1
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    108.00 =     890.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    134.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.85
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.16
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   11.29
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    134.00 =     940.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    134.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.141
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3476
  SUBAREA AREA(ACRES) =    0.40   SUBAREA RUNOFF(CFS) =    0.62
  TOTAL AREA(ACRES) =        4.5   TOTAL RUNOFF(CFS) =       8.04
  TC(MIN.) =   11.29

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    135.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0200
  FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   8.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.32
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.04
```

```
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   11.65
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    135.00 =    1120.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    135.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.65
  RAINFALL INTENSITY(INCH/HR) =   5.04
  TOTAL STREAM AREA(ACRES) =     4.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.04

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    992.00
  DOWNSTREAM ELEVATION(FEET) =    985.00
  ELEVATION DIFFERENCE(FEET) =      7.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.541
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.72
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    144.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0500
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.44
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    4.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.04
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
  STREET FLOW TRAVEL TIME(MIN.) =   1.24   Tc(MIN.) =    3.78
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.830
  SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    1.44
  TOTAL AREA(ACRES) =        0.3        PEAK FLOW RATE(CFS) =       2.16

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   6.03
  FLOW VELOCITY(FEET/SEC.) =  4.17   DEPTH*VELOCITY(FT*FT/SEC.) =   1.13
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    144.00 =     400.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    144.00 TO NODE    146.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.58
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.16
  PIPE TRAVEL TIME(MIN.) =   2.24    Tc(MIN.) =    6.02
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    146.00 =     880.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.718
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8940
  SUBAREA AREA(ACRES) =    3.20   SUBAREA RUNOFF(CFS) =   22.23
  TOTAL AREA(ACRES) =        3.5   TOTAL RUNOFF(CFS) =      24.15
  TC(MIN.) =    6.02

+--------------------------------------------------------------------------+
| THE CODE 7 BELOW IS THE DETAINED 100-YR PEAK FLOW AND Tc FROM BMP-1      |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.80   RAIN INTENSITY(INCH/HOUR) =  5.29
  TOTAL AREA(ACRES) =     3.50   TOTAL RUNOFF(CFS) =      7.30

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    135.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  11.5 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.88
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.30
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   11.00
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    135.00 =     940.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    135.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.00
  RAINFALL INTENSITY(INCH/HR) =   5.23
  TOTAL STREAM AREA(ACRES) =     3.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        8.04    11.65        5.038          4.50
      2        7.30    11.00        5.227          3.50

  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       15.05    11.00       5.227
      2       15.08    11.65       5.038

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      15.08   Tc(MIN.) =   11.65
  TOTAL AREA(ACRES) =        8.0
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    135.00 =    1120.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    150.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0050
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  15.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.85
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.08
  PIPE TRAVEL TIME(MIN.) =   1.20    Tc(MIN.) =   12.85
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    150.00 =    1540.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.730
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
```

AREA-AVERAGE RUNOFF COEFFICIENT = 0.3625
SUBAREA AREA(ACRES) = 0.70 SUBAREA RUNOFF(CFS) = 0.99
TOTAL AREA(ACRES) = 8.7 TOTAL RUNOFF(CFS) = 15.08
TC(MIN.) = 12.85
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

+--+
| NODE 150 REPRESENTS THE SINGLE PROPOSED OUTFALL FOR THE PROJECT SITE |
| NODE 160 REPRESENTS THE FILL SLOPE ALONG THE WESTERN PERIMETER OF THE |
| PROJECT SITE |
+--+

****
FLOW PROCESS FROM NODE 160.10 TO NODE 160.20 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3000
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 45.00
UPSTREAM ELEVATION(FEET) = 969.67
DOWNSTREAM ELEVATION(FEET) = 950.00
ELEVATION DIFFERENCE(FEET) = 19.67
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.484
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) = 0.26
TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.26

****
FLOW PROCESS FROM NODE 106.20 TO NODE 160.00 IS CODE = 51

>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========
CHANNEL LENGTH THRU SUBAREA(FEET) = 45.00
REPRESENTATIVE CHANNEL SLOPE = 0.5000
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 20.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 0.50
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3000
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.70
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.73
AVERAGE FLOW DEPTH(FEET) = 0.06 TRAVEL TIME(MIN.) = 0.16
Tc(MIN.) = 4.64
SUBAREA AREA(ACRES) = 1.10 SUBAREA RUNOFF(CFS) = 2.87
AREA-AVERAGE RUNOFF COEFFICIENT = 0.300
TOTAL AREA(ACRES) = 1.2 PEAK FLOW RATE(CFS) = 3.13

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.08 FLOW VELOCITY(FEET/SEC.) = 5.83
LONGEST FLOWPATH FROM NODE 160.10 TO NODE 160.00 = 90.00 FEET.
==========
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 1.2 TC(MIN.) = 4.64
PEAK FLOW RATE(CFS) = 3.13
==========
==========

END OF RATIONAL METHOD ANALYSIS

♀

Jamul Retail Center
J-18145
10/9/2018

Confluence Analysis - Post-Project Detained Condition

The purpose of this sheet is to provide the confluenced Q for 2 streams, based on the 2003 County of San Diego hydrology criteria.

	P_6 (in)	3.3	(100-Yr, 6-Hr)

At Node: Total Site

Let:	Q_1 (cfs)	3.13	
	T_1 (min)	4.64	(Sheet flow to POI 2)
	I_1 (in/hr)	9.1239	
	Q_2 (cfs)	15.10	(Flow to POI 1 - Outfall)
	T_2 (min)	12.85	
	I_2 (in/hr)	4.7298	
Then:	Q_{T1} (cfs)	8.58	
	Q_{T2} (cfs)	16.72	

Final Results: (Choosing the largest Q and the associated T_c)

	Q_T (cfs)	16.72	Total Site Peak Discharge Rate
	T_c (min)	12.85	

APPENDIX A4

AES Analysis Back-Up

Hydrologic Soil Group—San Diego County Area, California
(Jamul Retail Center)

Map Scale: 1:2,450 if printed on A portrait (8.5" x 11") sheet.

N

0 35 70 140 210 Meters

0 100 200 400 600 Feet

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 12, Sep 13, 2017

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

Date(s) aerial images were photographed: Dec 31, 2009—Mar 11, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes	D	4.4	16.8%
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded	C	3.4	13.1%
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded	C	0.3	1.0%
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded	D	0.9	3.3%
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	D	0.0	0.1%
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded	C	12.2	46.9%
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded	C	4.9	18.7%
Totals for Area of Interest			**26.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

RICK ENGINEERING COMPANY™
1160 Marsh Street, Suite 150
San Luis Obispo, CA 93401
Tel: (805) 544-0707

Date 7/6/18
Job No. 18145
Page
Done By TWK
Checked By

JAMUL RETAIL CENTER

- DETAINED AES RATIONAL METHOD BACKUP (CODE 7's)

BMP-1

TOTAL TRIBUTARY AREA = 3.5 AC

T_C = 6.0 MIN (FROM AES) + 0.08 (60 MIN) (LAG PER HEC-1) = 10.80 MIN

$Q_{P\,DETAINED}$ = 7.3 CFS

BMP-2

TOTAL TRIBUTARY AREA = 2.4 AC

T_C = 5.71 MIN (FROM AES) + 0.08 (60 MIN) (LAG PER HEC-1) = 10.51 MIN

$Q_{P\,DETAINED}$ = 4.7 CFS

BMP-3

TOTAL TRIBUTARY AREA = 1.3 AC

T_C = 5.91 MIN (FROM AES) + 0.08 (60 MIN) (LAG PER HEC-1) = 10.71 MIN

$Q_{P\,DETAINED}$ = 2.4 CFS

APPENDIX B

Preliminary Storm Drain Sizing Calculations

Jamul Retail Center
18145
7-10-2018

Preliminary Storm Drain Size

The purpose of this table is to provide an estimated pipe size to convey the 100-year flow rates with a sizing factor.

Manning's n: 0.013

Sizing Factor (%): 30

			Slope at:	0.5%		1.0%		2.0%		3.0%	
Q_{100} (cfs[1])	**Pipe Segment (Node to Node)**	**Q_{100} with Sizing Factor (cfs[1])**		**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size [2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**
1.4	104 to 106	1.9		0.89	12"	0.78	10"	0.69	10"	0.64	8"
4.7	106 to 108	6.1		1.39	18"	1.22	18"	1.07	18"	1.00	12"
0.6	114 to 108	0.8		0.64	8"	0.57	8"	0.50	6"	0.46	6"
1.4	124 to 126	1.8		0.88	12"	0.78	10"	0.68	10"	0.63	8"
2.4	126 to 108	3.1		1.08	18"	0.95	12"	0.83	10"	0.77	10"
7.2	108 to 134	9.4		1.63	24"	1.44	18"	1.26	18"	1.17	18"
8.0	134 to 135	10.4		1.70	24"	1.49	18"	1.31	18"	1.21	18"
2.2	144 to 146	2.9		1.05	18"	0.92	12"	0.81	10"	0.75	10"
7.3	146 to 135	9.5		1.64	24"	1.44	18"	1.27	18"	1.17	18"
14.9	135 to 150	19.4		2.15	30"	1.89	24"	1.66	24"	1.53	24"

Note:

1. "cfs" = cubic feet per second.

2. Minimum pipe sizes are calculated using the Manning's equation and are based on the flow rates with 30% factor.

Hydraulic Analysis Report

Project Data

Project Title: 18145 Jamul

Designer: BWC

Project Date: Friday, July 06, 2018

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Pipe 104 to 106

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 (ft)

Longitudinal Slope: 0.0050 (ft/ft)

Manning's n: 0.0130

Flow: 1.4000 (cfs)

Result Parameters

Depth: 0.4412 (ft)

Area of Flow: 0.4338 (ft^2)

Wetted Perimeter: 1.7197 (ft)

Hydraulic Radius: 0.2523 (ft)

Average Velocity: 3.2272 (ft/s)

Top Width: 1.3670 (ft)

Froude Number: 1.0095

Critical Depth: 0.4435 (ft)

Critical Velocity: 3.2041 (ft/s)

Critical Slope: 0.0049 (ft/ft)

Critical Top Width: 1.3690 (ft)

Calculated Max Shear Stress: 0.1377 (lb/ft^2)

Calculated Avg Shear Stress: 0.0787 (lb/ft^2)

Channel Analysis: Pipe 124 to 126

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 (ft)

Longitudinal Slope: 0.0050 (ft/ft)

Manning's n: 0.0130

Flow: 1.4000 (cfs)

Result Parameters

Depth: 0.4412 (ft)

Area of Flow: 0.4338 (ft^2)

Wetted Perimeter: 1.7197 (ft)

Hydraulic Radius: 0.2523 (ft)

Average Velocity: 3.2272 (ft/s)

Top Width: 1.3670 (ft)

Froude Number: 1.0095

Critical Depth: 0.4435 (ft)

Critical Velocity: 3.2041 (ft/s)

Critical Slope: 0.0049 (ft/ft)

Critical Top Width: 1.3690 (ft)

Calculated Max Shear Stress: 0.1377 (lb/ft^2)

Calculated Avg Shear Stress: 0.0787 (lb/ft^2)

Channel Analysis: Pipe 144 to 146

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 (ft)

Longitudinal Slope: 0.0050 (ft/ft)

Manning's n: 0.0130

Flow: 2.2000 (cfs)

Result Parameters

Depth: 0.5595 (ft)

Area of Flow: 0.6009 (ft^2)

Wetted Perimeter: 1.9710 (ft)

Hydraulic Radius: 0.3049 (ft)

Average Velocity: 3.6611 (ft/s)

Top Width: 1.4508 (ft)

Froude Number: 1.0025

Critical Depth: 0.5603 (ft)

Critical Velocity: 3.6539 (ft/s)

Critical Slope: 0.0050 (ft/ft)

Critical Top Width: 1.4512 (ft)

Calculated Max Shear Stress: 0.1746 (lb/ft^2)

Calculated Avg Shear Stress: 0.0951 (lb/ft^2)

Channel Analysis: Pipe 135 to 150

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 (ft)

Longitudinal Slope: 0.0050 (ft/ft)

Manning's n: 0.0130

Flow: 14.9000 (cfs)

Result Parameters

Depth: 1.2702 (ft)

Area of Flow: 2.5049 (ft^2)

Wetted Perimeter: 3.9674 (ft)

Hydraulic Radius: 0.6314 (ft)

Average Velocity: 5.9484 (ft/s)

Top Width: 2.4997 (ft)

Froude Number: 1.0472

Critical Depth: 1.3013 (ft)

Critical Velocity: 5.7696 (ft/s)

Critical Slope: 0.0046 (ft/ft)

Critical Top Width: 2.4979 (ft)

Calculated Max Shear Stress: 0.3963 (lb/ft^2)

Calculated Avg Shear Stress: 0.1970 (lb/ft^2)

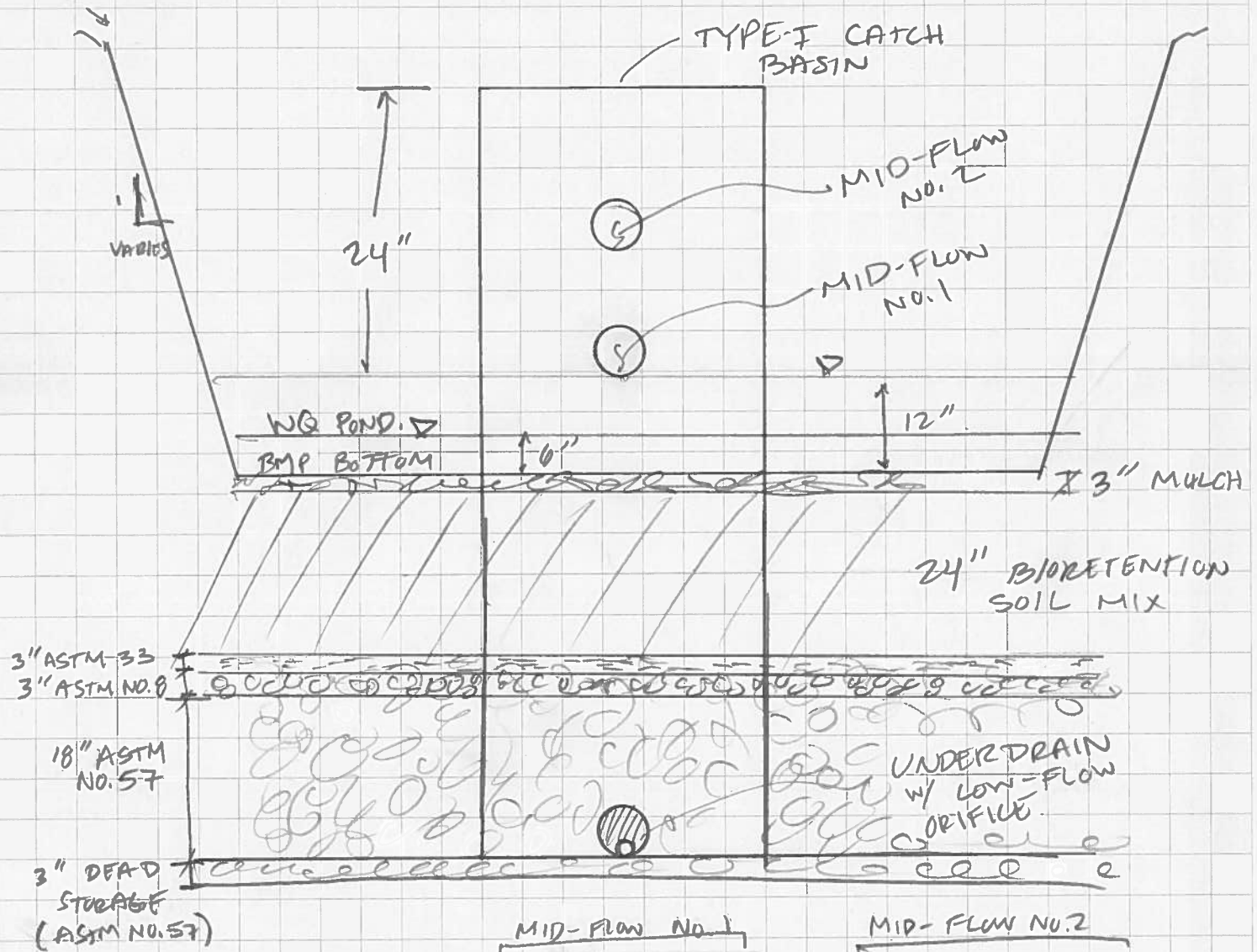
APPENDIX C

Preliminary Detention Analysis

RICK ENGINEERING COMPANY™
5620 Friars Road
San Diego, CA 92110-2596
Tel: (619) 291-0707
Fax: (619) 291-4165

Date 3/26/18
Job No. 18145
Page
Done By HC
Checked By

JAMUL RETAIL CENTER - BMP x-SECT.



BMP I.D	LOW FLOW DIAM (in)	MID-FLOW NO. 1 ELEV (ft)	MID-FLOW NO. 1 DIAM (in)	MID-FLOW NO. 2 ELEV (ft)	MID-FLOW NO. 2 DIAM (in)
BMP 1	0.6875	1.0'	0.6875_{x1}	2.5'	0.75_{x4}
BMP 2	0.6875	1.0'	1.0_{x1}	N/A	N/A
BMP 3	0.5	1.0'	0.5625_{x1}	2.0'	0.5_{x1}

NOTE: ELEVATIONS ARE RELATIVE TO BMP BOTTOM.

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   06JUL18  TIME  09:18:35   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 *** FREE ***
                       *DIAGRAM
              1        ID   JAMUL RETAIL CENTER, J-18145 BIOFILTRATION BASIN, BMP-1
              2        ID   100-YEAR DETENTION ANALYSES - PRELIMINARY ENGINEERING
              3        ID   FEBRUARY 14, 2018 - FILE NAME: JR_B1P1H.HC1
              4        IT       1 01JAN90    1200    1000
              5        IO       5       0

              6        KKBMP1_RatHydro_rev.hc1
              7        KM   RUN DATE   7/5/2018
              8        KM   RATIONAL METHOD HYDROGRAPH PROGRAM
              9        KM   COPYRIGHT 1992, 2014, RICK ENGINEERING COMPANY
             10        KM   6HR RAINFALL IS 3.3 INCHES
             11        KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.89
             12        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 6 MIN.
             13        KM   FOR THIS DATA TO RUN PROPERLY THIS IT CARD MUST BE ADDED TO YOUR HEC-1
             14        KM   IT 2 01JAN90 1200 200
             15        BA  0.0055
             16        IN       6 01JAN90    1157
             17        QI       0     0.6     0.6     0.6     0.6     0.7     0.7     0.7     0.7     0.7
             18        QI     0.7     0.7     0.7     0.8     0.8     0.8     0.8     0.9     0.9     0.9
             19        QI     0.9       1       1       1     1.1     1.1     1.1     1.2     1.3     1.3
             20        QI     1.4     1.5     1.6     1.8     1.9     2.2     2.3     2.9     3.2     4.8
             21        QI     6.7    24.1     3.8     2.6       2     1.7     1.5     1.3     1.2     1.1
             22        QI       1     0.9     0.9     0.8     0.8     0.8     0.7     0.7     0.7     0.6
             23        QI     0.6       0       0       0       0       0       0       0       0       0
             24        QI       0       0

             25        KK  DETAIN
             26        KO       0       0       0       0      21
             27        RS       1    STOR      -1
             28        SV       0     0.3
             29        SQ       0     7.3
             30        SE     100     101
             31        ZZ
```

Detention Volume (ac-ft)

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

    NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

      6    BMP1_Rat
                V
                V
     25      DETAIN

  (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```


```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   06JUL18  TIME  09:18:35   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

JAMUL RETAIL CENTER, J-18145 BIOFILTRATION BASIN, BMP-1
100-YEAR DETENTION ANALYSES - PRELIMINARY ENGINEERING
FEBRUARY 14, 2018 - FILE NAME: JR_B1P1H.HC1

```
    5 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          1  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1JAN90  STARTING DATE
                        ITIME        1200  STARTING TIME
                           NQ        1000  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      2JAN90  ENDING DATE
                       NDTIME        0439  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   16.65 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


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


              **************
              *            *
   25 KK      *    DETAIN  *
              *            *
              **************

   26 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
                        IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                         IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                        ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                        ISAV2       1000  LAST ORDINATE PUNCHED OR SAVED
                       TIMINT       .017  TIME INTERVAL IN HOURS

1
                                                RUNOFF SUMMARY
                                           FLOW IN CUBIC FEET PER SECOND
                                          TIME IN HOURS,  AREA IN SQUARE MILES

                                      PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN      MAXIMUM      TIME OF
          OPERATION       STATION     FLOW     PEAK                                            AREA       STAGE      MAX STAGE
+                                                                  6-HOUR     24-HOUR     72-HOUR
          HYDROGRAPH AT
+                        BMP1_Rat       24.     4.05          2.          1.          1.        .01
          ROUTED TO
+                          DETAIN        7.     4.13          2.          1.          1.        .01
+                                                                                                      100.94        4.13


 *** NORMAL END OF HEC-1 ***
```

Lag time = 4.13 - 4.05 hrs
= 0.08 hrs

Peak Discharge Rate (from BMP 1)

DETAIN 11200 1JAN90 0 1 11000 .005

.300	.302	.307	.315	.324	.333	.342	.350	.359	.367
.374	.382	.389	.396	.403	.409	.415	.421	.427	.433
.439	.444	.449	.455	.461	.468	.475	.482	.489	.496
.503	.509	.515	.521	.527	.533	.539	.544	.549	.554
.559	.563	.568	.572	.577	.581	.585	.588	.592	.596
.599	.602	.606	.609	.612	.615	.617	.620	.623	.625
.628	.630	.632	.635	.637	.639	.641	.643	.645	.647
.649	.651	.654	.658	.661	.666	.670	.674	.679	.683
.686	.690	.694	.697	.701	.704	.707	.710	.713	.716
.719	.721	.724	.727	.729	.732	.736	.740	.744	.749
.754	.759	.764	.768	.773	.777	.781	.785	.789	.792
.796	.799	.803	.806	.809	.812	.815	.818	.821	.824
.828	.832	.837	.842	.847	.852	.857	.862	.866	.871
.875	.879	.883	.887	.891	.894	.898	.902	.907	.912
.917	.923	.929	.934	.940	.945	.950	.955	.960	.965
.969	.973	.978	.982	.986	.990	.995	1.001	1.006	1.013
1.019	1.026	1.033	1.040	1.048	1.056	1.064	1.072	1.079	1.087
1.094	1.101	1.107	1.115	1.122	1.130	1.138	1.146	1.155	1.164
1.173	1.182	1.192	1.202	1.212	1.222	1.233	1.244	1.255	1.266
1.277	1.290	1.302	1.316	1.330	1.345	1.361	1.376	1.391	1.407
1.422	1.438	1.454	1.471	1.489	1.508	1.529	1.550	1.572	1.593
1.615	1.636	1.657	1.678	1.700	1.725	1.752	1.782	1.813	1.848
1.883	1.919	1.956	1.993	2.030	2.068	2.109	2.158	2.215	2.278
2.348	2.424	2.508	2.599	2.698	2.804	2.916	3.036	3.204	3.463
3.809	4.239	4.750	5.340	5.903	6.335	6.642	6.827	6.895	6.848
6.745	6.638	6.528	6.415	6.299	6.180	6.061	5.942	5.823	5.705
5.588	5.472	5.356	5.243	5.132	5.023	4.916	4.811	4.708	4.607
4.508	4.412	4.318	4.225	4.135	4.046	3.960	3.875	3.792	3.710
3.630	3.553	3.477	3.403	3.331	3.261	3.193	3.127	3.062	2.999
2.937	2.877	2.818	2.760	2.704	2.649	2.596	2.543	2.492	2.442
2.393	2.346	2.299	2.253	2.208	2.165	2.123	2.083	2.044	2.006
1.970	1.934	1.898	1.863	1.829	1.795	1.763	1.731	1.700	1.670
1.642	1.614	1.587	1.561	1.536	1.512	1.488	1.466	1.444	1.421
1.400	1.378	1.356	1.335	1.314	1.294	1.274	1.255	1.237	1.219
1.202	1.186	1.170	1.154	1.139	1.125	1.110	1.096	1.082	1.067
1.053	1.038	1.024	1.010	.996	.983	.970	.958	.945	.928
.909	.888	.863	.836	.809	.782	.756	.732	.707	.684
.662	.640	.619	.598	.579	.559	.541	.523	.506	.489
.473	.458	.442	.428	.414	.400	.387	.374	.362	.350
.338	.327	.316	.306	.296	.286	.277	.268	.259	.250
.242	.234	.226	.219	.212	.205	.198	.191	.185	.179
.173	.167	.162	.157	.151	.146	.142	.137	.132	.128
.124	.120	.116	.112	.108	.105	.101	.098	.095	.092
.089	.086	.083	.080	.077	.075	.072	.070	.068	.065
.063	.061	.059	.057	.055	.054	.052	.050	.048	.047
.045	.044	.042	.041	.040	.038	.037	.036	.035	.033
.032	.031	.030	.029	.028	.027	.026	.026	.025	.024
.023	.022	.022	.021	.020	.020	.019	.018	.018	.017
.017	.016	.015	.015	.014	.014	.014	.013	.013	.012
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 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   06JUL18  TIME  09:20:21   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************

                                                    X     X  XXXXXXX   XXXXX          X
                                                    X     X  X        X     X        XX
                                                    X     X  X        X              X
                                                    XXXXXXX  XXXX     X        XXXXX  X
                                                    X     X  X        X              X
                                                    X     X  X        X     X        X
                                                    X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                  HEC-1 INPUT                                                 PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 *** FREE ***
                       *DIAGRAM
              1        ID   JAMUL RETAIL CENTER, J-18145 BIOFILTRATION BASIN, BMP-2
              2        ID   100-YEAR DETENTION ANALYSES - PRELIMINARY ENGINEERING
              3        ID   FEBRUARY 14, 2018 - FILE NAME: JR_B2P1H.HC1
              4        IT       1 01JAN90    1200    1000
              5        IO       5       0

              6        KKBMP2_RatHydro.hc1
              7        KM   RUN DATE   7/3/2018
              8        KM   RATIONAL METHOD HYDROGRAPH PROGRAM
              9        KM   COPYRIGHT 1992, 2014, RICK ENGINEERING COMPANY
             10        KM   6HR RAINFALL IS 3.3 INCHES
             11        KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.83
             12        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 6 MIN.
             13        KM   FOR THIS DATA TO RUN PROPERLY THIS IT CARD MUST BE ADDED TO YOUR HEC-1
             14        KM   IT 2 01JAN90 1200 200
             15        BA  0.0038
             16        IN       6 01JAN90    1157
             17        QI       0     0.4     0.4     0.4     0.4     0.4     0.4     0.4     0.5
             18        QI     0.5     0.5     0.5     0.5     0.5     0.5     0.5     0.6     0.6
             19        QI     0.6     0.6     0.6     0.7     0.7     0.7     0.7     0.8     0.8     0.9
             20        QI     0.9       1       1     1.1     1.2     1.4     1.5     1.8     2.1       3
             21        QI     3.8    15.9     2.4     1.6     1.3     1.1     0.9     0.8     0.8     0.7
             22        QI     0.6     0.6     0.6     0.5     0.5     0.5     0.5     0.4     0.4     0.4
             23        QI     0.4       0       0       0       0       0       0       0       0       0
             24        QI       0       0

             25        KK  DETAIN
             26        KO       0       0       0       0      21
             27        RS       1    STOR      -1
             28        SV       0    0.18
             29        SQ       0     4.7
             30        SE     100     101
             31        ZZ
```

Detention Volume (ac-ft)

```
1                  SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

    NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

      6    BMP2_Rat
                V
                V
     25      DETAIN

  (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   06JUL18  TIME  09:20:21   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
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JAMUL RETAIL CENTER, J-18145 BIOFILTRATION BASIN, BMP-2
100-YEAR DETENTION ANALYSES - PRELIMINARY ENGINEERING
FEBRUARY 14, 2018 - FILE NAME: JR_B2P1H.HC1

```
  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          1  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN90  STARTING DATE
                      ITIME        1200  STARTING TIME
                         NQ        1000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2JAN90  ENDING DATE
                     NDTIME        0439  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   16.65 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT


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


            **************
            *            *
  25 KK     *    DETAIN  *
            *            *
            **************

  26 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2       1000  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .017  TIME INTERVAL IN HOURS

1
                                        RUNOFF SUMMARY
                                    FLOW IN CUBIC FEET PER SECOND
                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                    PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN     MAXIMUM     TIME OF
         OPERATION       STATION    FLOW     PEAK                                           AREA      STAGE     MAX STAGE
+                                                      6-HOUR     24-HOUR     72-HOUR
         HYDROGRAPH AT
+                      BMP2_Rat      16.     4.05         1.          0.          0.        .00
         ROUTED TO
+                        DETAIN       5.     4.13         1.          0.          0.        .00
+                                                                                          100.98        4.13


*** NORMAL END OF HEC-1 ***
```

Lag time = 4.13 - 4.05 hrs
= 0.08 hrs

Peak Discharge Rate (from BMP 2)

DETAIN 11200 1JAN90 0 1 11000 .004

.200	.201	.205	.210	.217	.224	.230	.236	.242	.247
.253	.258	.263	.268	.272	.277	.281	.285	.289	.293
.297	.301	.304	.308	.311	.314	.317	.320	.323	.326
.328	.331	.333	.336	.338	.340	.342	.344	.346	.348
.350	.352	.353	.355	.357	.358	.360	.362	.365	.368
.372	.376	.381	.385	.389	.393	.397	.400	.404	.407
.411	.414	.417	.420	.423	.425	.428	.430	.433	.435
.438	.440	.442	.444	.446	.448	.450	.451	.453	.455
.456	.458	.459	.461	.462	.464	.465	.466	.467	.468
.470	.471	.472	.473	.474	.475	.475	.476	.477	.478
.479	.481	.483	.486	.489	.492	.496	.500	.503	.507
.510	.513	.516	.519	.522	.525	.528	.530	.533	.535
.537	.539	.542	.544	.546	.548	.549	.551	.553	.555
.556	.559	.562	.565	.569	.573	.578	.582	.586	.590
.594	.598	.602	.605	.608	.612	.615	.618	.621	.624
.626	.629	.631	.634	.636	.640	.643	.647	.652	.657
.662	.667	.671	.676	.680	.684	.689	.694	.699	.705
.711	.717	.723	.730	.736	.741	.747	.752	.758	.764
.770	.777	.784	.791	.799	.806	.813	.819	.826	.832
.838	.845	.852	.859	.866	.874	.883	.891	.900	.909
.919	.928	.938	.949	.961	.974	.987	1.001	1.015	1.030
1.044	1.059	1.074	1.089	1.104	1.121	1.138	1.157	1.177	1.199
1.221	1.244	1.268	1.293	1.319	1.345	1.375	1.408	1.446	1.488
1.533	1.582	1.635	1.690	1.748	1.809	1.872	1.938	2.039	2.208
2.443	2.740	3.098	3.515	3.913	4.217	4.431	4.558	4.601	4.563
4.484	4.403	4.321	4.237	4.150	4.063	3.975	3.888	3.803	3.719
3.636	3.555	3.474	3.396	3.319	3.243	3.169	3.097	3.026	2.956
2.887	2.820	2.754	2.689	2.626	2.564	2.503	2.445	2.388	2.332
2.278	2.225	2.175	2.126	2.080	2.034	1.990	1.948	1.906	1.864
1.824	1.785	1.746	1.708	1.671	1.635	1.599	1.564	1.530	1.497
1.466	1.435	1.405	1.377	1.350	1.323	1.297	1.273	1.249	1.226
1.204	1.182	1.160	1.138	1.116	1.095	1.074	1.053	1.034	1.015
.997	.979	.962	.946	.930	.915	.900	.886	.872	.859
.847	.834	.823	.811	.800	.788	.777	.765	.753	.741
.729	.717	.706	.695	.685	.675	.665	.656	.646	.638
.629	.621	.613	.606	.599	.592	.585	.578	.571	.561
.550	.536	.521	.504	.486	.469	.452	.436	.421	.406
.391	.378	.364	.351	.339	.327	.315	.304	.294	.283
.273	.264	.254	.245	.237	.228	.220	.212	.205	.198
.191	.184	.177	.171	.165	.159	.154	.148	.143	.138
.133	.128	.124	.119	.115	.111	.107	.103	.100	.096
.093	.090	.086	.083	.080	.078	.075	.072	.070	.067
.065	.063	.060	.058	.056	.054	.052	.050	.049	.047
.045	.044	.042	.041	.039	.038	.036	.035	.034	.033
.032	.030	.029	.028	.027	.026	.025	.025	.024	.023
.022	.021	.020	.020	.019	.018	.018	.017	.017	.016
.015	.015	.014	.014	.013	.013	.012	.012	.012	.011
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 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   06JUL18  TIME  09:57:21   *
 *                                       *
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
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X     X  XXXXXXX   XXXXX          X
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X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 *** FREE ***
                       *DIAGRAM
              1        ID   JAMUL RETAIL CENTER, J-18145 BIOFILTRATION BASIN, BMP-3
              2        ID   100-YEAR DETENTION ANALYSES - PRELIMINARY ENGINEERING
              3        ID   FEBRUARY 14, 2018 - FILE NAME: JR_B3P1H.HC1
              4        IT       1 01JAN90    1200    1000
              5        IO       5       0

              6        KKBMP3_RatHydro.hc1
              7        KM   RUN DATE   7/3/2018
              8        KM   RATIONAL METHOD HYDROGRAPH PROGRAM
              9        KM   COPYRIGHT 1992, 2014, RICK ENGINEERING COMPANY
             10        KM   6HR RAINFALL IS 3.3 INCHES
             11        KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.68
             12        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 6 MIN.
             13        KM   FOR THIS DATA TO RUN PROPERLY THIS IT CARD MUST BE ADDED TO YOUR HEC-1
             14        KM   IT 2 01JAN90 1200 200
             15        BA   0.002
             16        IN       6 01JAN90    1157
             17        QI       0     0.2     0.2     0.2     0.2     0.2     0.2     0.2     0.2     0.2
             18        QI     0.2     0.2     0.2     0.2     0.2     0.2     0.2     0.2     0.2     0.3
             19        QI     0.3     0.3     0.3     0.3     0.3     0.3     0.3     0.3     0.4     0.4
             20        QI     0.4     0.4     0.5     0.5     0.5     0.6     0.7     0.8     0.9     1.4
             21        QI     1.8     6.9     1.1     0.7     0.6     0.5     0.4     0.4     0.3     0.3
             22        QI     0.3     0.3     0.3     0.2     0.2     0.2     0.2     0.2     0.2     0.2
             23        QI     0.2       0       0       0       0       0       0       0       0       0
             24        QI       0       0

             25        KK  DETAIN
             26        KO       0       0       0       0      21
             27        RS       1    STOR      -1
             28        SV       0    0.07
             29        SQ       0     2.4
             30        SE     100     101
             31        ZZ
```

Detention Volume (ac-ft)

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

    NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

      6    BMP3_Rat
                V
                V
     25      DETAIN

  (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```


```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   06JUL18  TIME  09:57:21   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
*****************************************
```

JAMUL RETAIL CENTER, J-18145 BIOFILTRATION BASIN, BMP-3
100-YEAR DETENTION ANALYSES - PRELIMINARY ENGINEERING
FEBRUARY 14, 2018 - FILE NAME: JR_B3P1H.HC1

```
    5 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          1  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1JAN90  STARTING DATE
                        ITIME        1200  STARTING TIME
                           NQ        1000  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      2JAN90  ENDING DATE
                       NDTIME        0439  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE   16.65 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


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


           **************
           *            *
   25 KK   *    DETAIN  *
           *            *
           **************

   26 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
                        IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                         IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                        ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                        ISAV2       1000  LAST ORDINATE PUNCHED OR SAVED
                       TIMINT       .017  TIME INTERVAL IN HOURS

1
                                          RUNOFF SUMMARY
                                      FLOW IN CUBIC FEET PER SECOND
                                    TIME IN HOURS,  AREA IN SQUARE MILES

                                    PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN     MAXIMUM     TIME OF
          OPERATION       STATION   FLOW     PEAK       6-HOUR     24-HOUR     72-HOUR       AREA      STAGE     MAX STAGE
+
          HYDROGRAPH AT
+                        BMP3_Rat      7.     4.05          0.          0.          0.        .00
          ROUTED TO
+                          DETAIN      2.     4.13          0.          0.          0.        .00
+                                                                                                     100.99        4.13


*** NORMAL END OF HEC-1 ***
```

Lag time = 4.13 - 4.05 hrs
= 0.08 hrs

Peak Discharge Rate
(from BMP 3)

DETAIN 11200 1JAN90 0 1 11000 .002

.100	.101	.103	.107	.111	.115	.119	.123	.126	.130
.133	.136	.139	.142	.145	.147	.150	.152	.154	.156
.158	.160	.162	.164	.165	.167	.169	.170	.171	.173
.174	.175	.176	.177	.178	.179	.180	.181	.182	.183
.184	.185	.185	.186	.187	.187	.188	.188	.189	.189
.190	.190	.191	.191	.192	.192	.192	.193	.193	.193
.194	.194	.194	.195	.195	.195	.195	.195	.196	.196
.196	.196	.196	.197	.197	.197	.197	.197	.197	.197
.198	.198	.198	.198	.198	.198	.198	.198	.198	.198
.198	.199	.199	.199	.199	.199	.199	.199	.199	.199
.199	.199	.199	.199	.199	.199	.200	.201	.203	.205
.209	.212	.216	.220	.224	.227	.231	.234	.237	.240
.243	.245	.248	.250	.253	.255	.257	.259	.261	.263
.264	.266	.267	.269	.270	.272	.273	.274	.276	.277
.278	.279	.280	.281	.282	.282	.283	.284	.285	.285
.286	.287	.287	.288	.288	.289	.290	.290	.290	.291
.292	.293	.295	.298	.302	.306	.310	.315	.318	.322
.326	.329	.333	.336	.339	.341	.344	.347	.349	.352
.354	.356	.358	.360	.362	.365	.369	.373	.377	.383
.388	.393	.398	.403	.407	.412	.416	.420	.423	.427
.430	.433	.437	.441	.446	.451	.457	.463	.469	.477
.484	.492	.501	.510	.519	.528	.538	.548	.559	.569
.580	.592	.603	.615	.627	.639	.653	.670	.691	.714
.740	.768	.799	.831	.865	.901	.937	.976	1.033	1.128
1.257	1.419	1.613	1.837	2.049	2.205	2.311	2.366	2.375	2.338
2.280	2.220	2.161	2.101	2.041	1.981	1.922	1.864	1.808	1.755
1.702	1.652	1.603	1.556	1.510	1.465	1.422	1.379	1.338	1.299
1.260	1.222	1.185	1.150	1.115	1.082	1.050	1.020	.992	.965
.938	.912	.887	.861	.837	.812	.789	.766	.745	.724
.705	.686	.668	.651	.635	.619	.605	.591	.577	.564
.552	.541	.530	.519	.509	.499	.490	.481	.473	.465
.457	.449	.440	.431	.421	.411	.402	.392	.383	.375
.367	.359	.352	.345	.338	.332	.326	.320	.314	.309
.304	.299	.295	.290	.286	.282	.278	.275	.271	.268
.265	.262	.259	.256	.254	.251	.249	.247	.244	.242
.240	.239	.237	.235	.233	.232	.230	.229	.227	.223
.218	.212	.205	.196	.187	.178	.170	.162	.155	.148
.141	.134	.128	.122	.117	.111	.106	.101	.097	.092
.088	.084	.080	.076	.073	.069	.066	.063	.060	.057
.055	.052	.050	.048	.045	.043	.041	.039	.038	.036
.034	.033	.031	.030	.028	.027	.026	.025	.023	.022
.021	.020	.019	.018	.018	.017	.016	.015	.015	.014
.013	.013	.012	.012	.011	.010	.010	.010	.009	.009
.008	.008	.008	.007	.007	.007	.006	.006	.006	.005
.005	.005	.005	.004	.004	.004	.004	.004	.004	.003
.003	.003	.003	.003	.003	.003	.002	.002	.002	.002
.002	.002	.002	.002	.002	.002	.002	.001	.001	.001
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.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

APPENDIX D

FEMA - FIRM

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). this information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

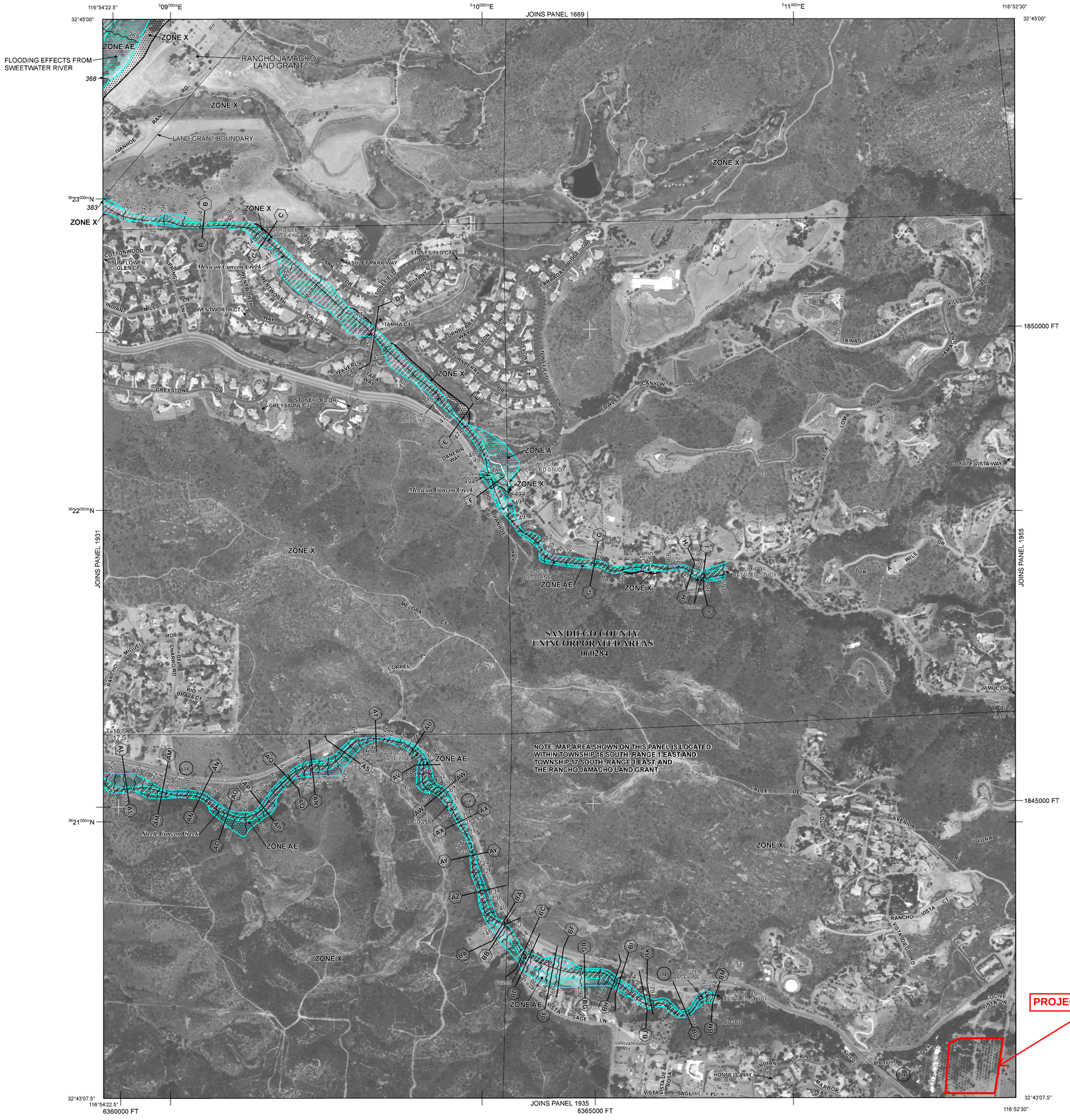
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-877-FEMA MAP (1-877-336-2627) for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4275 000m E — 1000-meter Universal Transverse Mercator grid ticks, zone 11
- 6000000 FT — 5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
June 19, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
May 16, 2012 – to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to update map elevations to North American Vertical Datum of 1988.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1932G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1932 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO COUNTY	060284	1932	G

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

MAP NUMBER
06073C1932G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

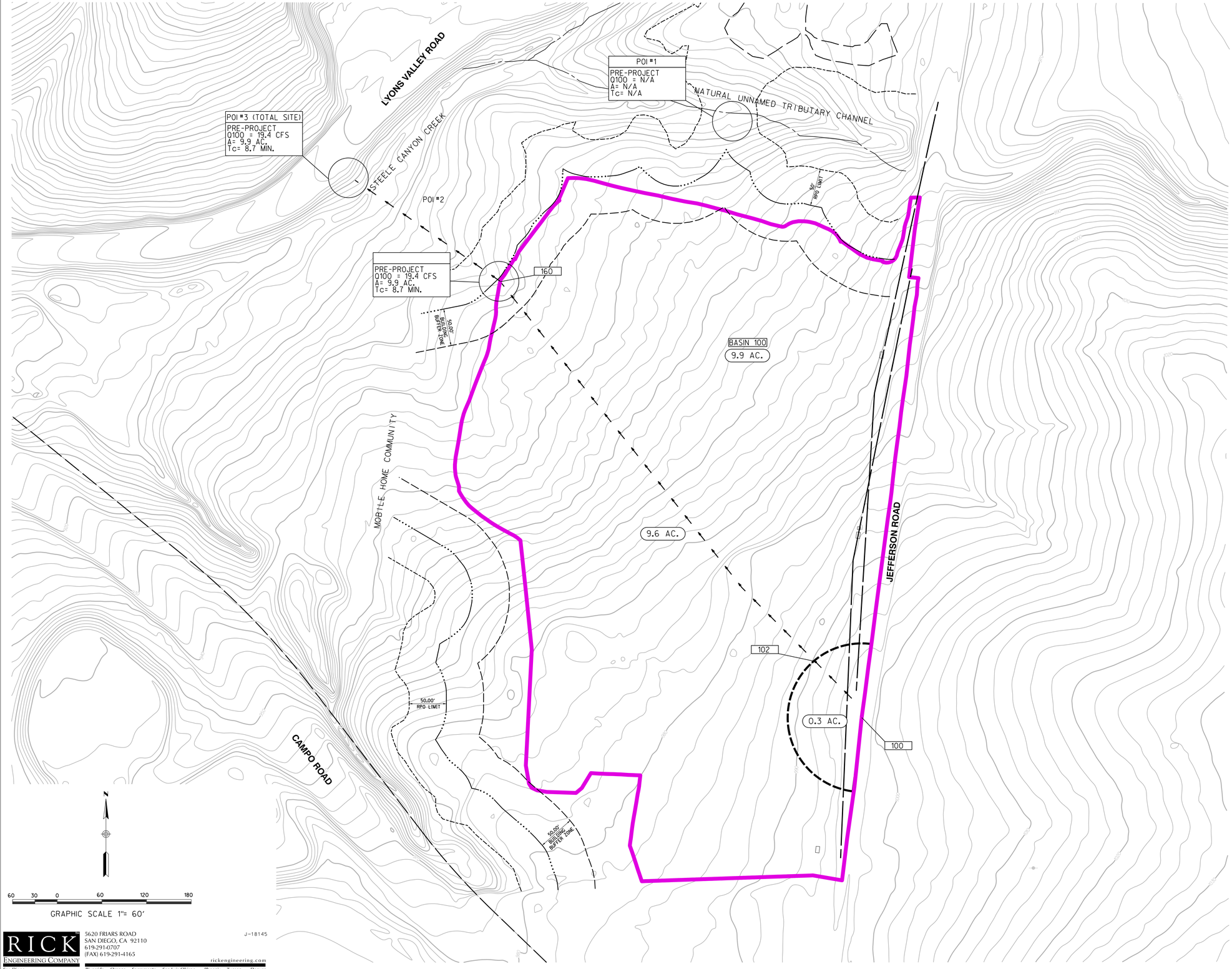
MAP POCKET 1

Drainage Study Map

for

Jamul Retail Center

[Pre-project]



NOTES

1. UNDERLYING HYDROLOGIC SOIL GROUP: TYPE "C"
2. PURSUANT TO THE PROJECT'S GEOTECHNICAL REPORT, GROUNDWATER IS EXPECTED TO BE DEEPER THAN 50 FEET BELOW EXISTING GROUND. GROUNDWATER WAS NOT ENCOUNTERED DURING THE SOILS INVESTIGATION.
3. OFF-SITE AREA DRAINING WESTERLY ONTO JEFFERSON ROAD IS CONVEYED NORTHERLY INTO A NATURAL UNNAMED CHANNEL OR SOUTHWESTERLY TOWARD CAMPO ROAD, BYPASSING THE PROJECT SITE
4. POI 1 IS PROVIDED FOR REFERENCE PUSPOSES ONLY. STORMWATER GENERATED FROM THE SITE IS NOT TRIBUTARY TO POI 1 IN THE PRE-PROJECT CONDITION; HOWEVER, IT IS IN THE POST-PROJECT CONDITION. POI 1 WAS SELECTED AS THE PROJECT'S OUTFALL TO MINIMIZE IMPACTS TO RIPERIAN AND BILOGOCIAL OPEN SPACE THROUGH COORDINATION WITH THE PROJECT BIOLOGIST. ADDITIONALLY, POI 1 WAS SELECTED IN ORDER TO MITIGATE EXISTING ADVERSE DRAIANGE CONDITIONS AT THE DOWNSTREAM MOBILE HOME PARK DUE TO THE PROJECT SITE.
5. POI 3 IS PROVIDED FOR REFERENCE PURPOSES ONLY. POI 3 IS THE CONFLUENCE OF THE ENTIRE SITE AT STEELE CANYON CREEK AND DOES NOT INCLUDE OFF-SITE AREAS.

LEGEND

- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN SUBAREA BOUNDARY
- XX.X AC. — TRIBUTARY AREA TO DRAINAGE BASIN
- BASIN X — DRAINAGE BASIN ID
- XXX — DRAINAGE NODE NUMBER
- FLOW PATH
- (POI) POINT OF INTEREST

DRAINAGE STUDY MAP FOR JAMUL RETAIL CENTER (PRE-PROJECT)

J-18145

Date: March 26, 2018
Revised: July 10, 2018
Revised: October 10, 2018

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NOT FOR CONSTRUCTION - EXHIBIT FOR PRELIMINARY DRAINAGE STUDY

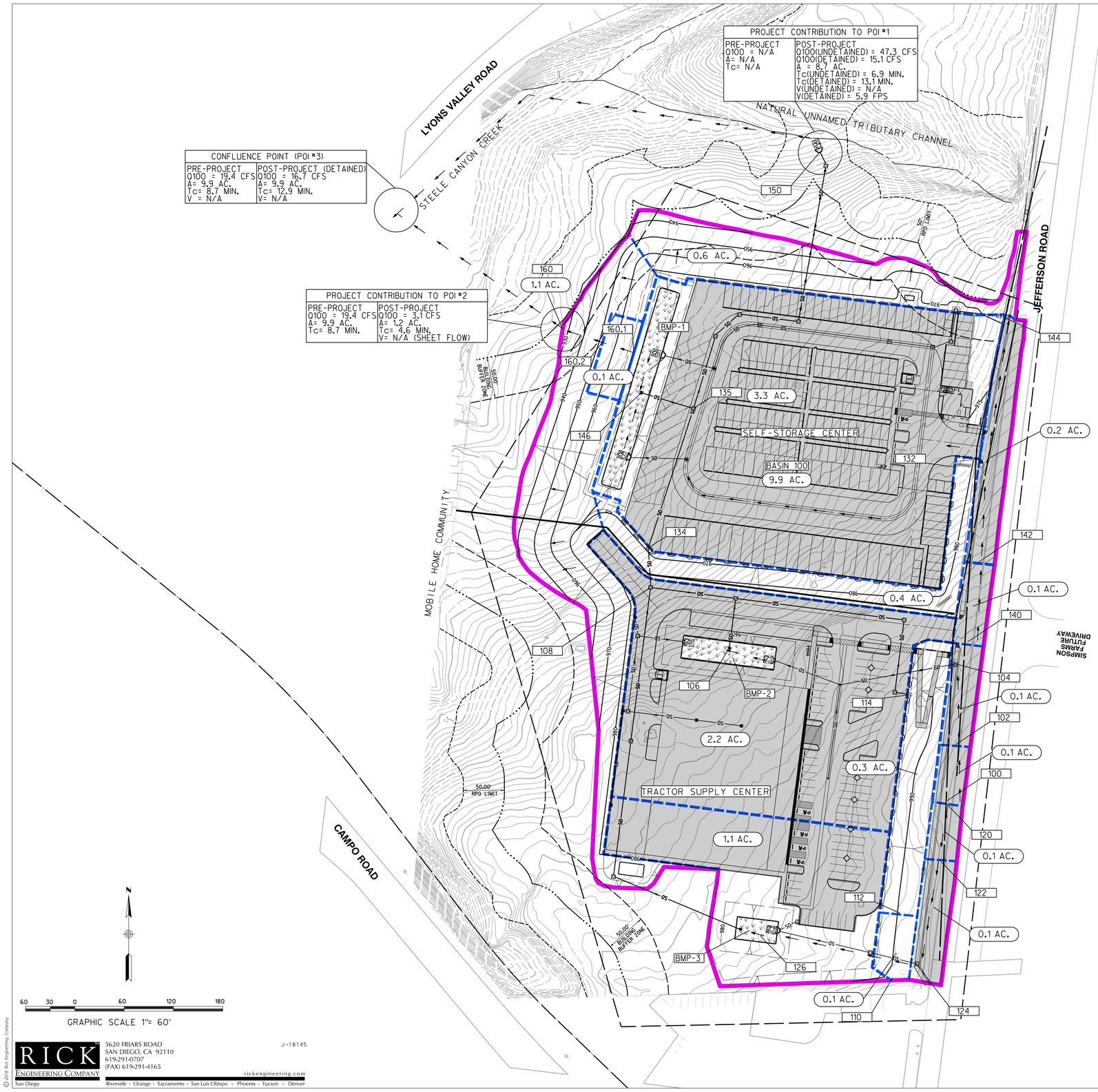
MAP POCKET 2

Drainage Study Map

for

Jamul Retail Center

[Post-project]



NOTES

1. UNDERLYING HYDROLOGIC SOIL GROUP: TYPE "C"

2. PURSUANT TO THE PROJECT'S GEOTECHNICAL REPORT, GROUNDWATER IS EXPECTED TO BE DEEPER THAN 50 FEET BELOW EXISTING GROUND. GROUNDWATER WAS NOT ENCOUNTERED DURING THE SOILS INVESTIGATION.

3. OFF-SITE AREA DRAINING WESTERLY ONTO JEFFERSON ROAD IS CONVEYED NORTHERLY INTO A NATURAL UNNAMED CHANNEL OR SOUTHWESTERLY TOWARD CAMPO ROAD, BYPASSING THE PROJECT SITE

4. IT SHOULD BE NOTED THAT POI 3 IS THE CONFLUENCE OF THE SITE AS A WHOLE (FLOWS FROM POI 1 AND 2) AT STEELE CREEK. THE ANALYSIS DOES NOT INLCUDE FLOWS FROM OFF-SITE CONTRIBUTING AREAS. THE TOTAL PEAK FLOW FOR THE ENTIRE SITE DURING THE POST-PROJECT CONDITION IS LESS THAN THE EXISTING CONDITION (AT POI 3); THEREFORE, IT IS ANTICIPATED THAT THERE WILL BE NO ADVERSE IMPACTS TO THE EXISTING MOBILE HOME COMMUNITY OR DOWNSTREAM DRAINAGE FACILITIES AS A RESULT OF THE PROJECT.

5. THROUGH COORDINATION WITH THE PROJECT'S BIOLOGIST, POI 1 WAS SELECTED AS THE DISCHARGE POINT FOR A MAJORITY OF THE PROJECT AREA IN ORDER TO MINIMIZE IMPACTS TO RIPERIAN AREAS AND BIOOLIGICAL OPEN SPACE AND ALSO TO MITIGATE EXISTING ADVERSE DRAIANGE CONDITIONS ON THE DOWNSTREAM MOBILE HOME PARK. POI 1 IS LOCATED APPROXIMATELY 550 FEET UPSTREAM OF THE EXISTING CONFLUENCE WITH STEELE CANYON CREEK (POI 3).

LEGEND

- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN SUBAREA BOUNDARY
- XX.X AC. — TRIBUTARY AREA TO DRAINAGE BASIN
- BASIN X — DRAINAGE BASIN ID
- XXX — DRAINAGE NODE NUMBER
- LOCATION OF BIOFILTRATION BASIN
- BMP-X — STRUCTURAL BMP
- FLOW PATH
- (POI) POINT OF INTEREST

DRAINAGE STUDY MAP FOR JAMUL RETAIL CENTER (POST-PROJECT)

J-18145

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