# Preliminary Drainage Analysis

Western Alton Parcel

Northern Parcel

Irvine Boulevard

## Irvine, CA.

April 15, 2015

This Preliminary Drainage Analysis has been prepared by, and under the direction of, the undersigned, a duly Registered Civil Engineer in the State of California. Except as noted, the undersigned attests to the technical information contained herein, and has judged to be acceptable the qualifications of any technical specialists providing engineering data for this report, upon which findings, conclusions, and recommendations are based.


**D. Todd Schmieder, P.E.**
Registered Civil Engineer No. C37167
Exp.: 06/30/16


REGISTERED PROFESSIONAL ENGINEER
D. TODD SCHMIEDER
No. C37167
EXP. 6-30-16
CIVIL
STATE OF CALIFORNIA

*Prepared for:*

**Orange County Public Works**
County Executive Office – Land Development
445 Civic Center Drive West, 2nd Floor
Santa Ana, CA

Attn: Mr. James Campbell, Project Manager
714-667-9673

*Prepared by:*

TAIT
RISING TO THE CHALLENGE


**Tait & Associates, Inc.**
701 N. Parkcenter Drive
Santa Ana, CA 92705
(714) 560-8200


TAIT JOB # SP7531

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# Section 1 Purpose and Scope

This study presents an analysis of the hydrologic effects associated with the development of a 21.98 acre parcel for multi-family residential housing, in the City of Irvine, California, known as the North West Alton Parcel.

This study addresses runoff from the project site and its impact to the existing downstream storm drainage system. The study includes 25-year and 100-year storm calculations for both the existing and proposed condition. The study also details the general project characteristics, the design, criteria and methodology applied to the analysis of the project. The report provides a design analysis for the drainage facilities proposed as part of the project, with the drainage improvements being designed to mitigate all rainfall event frequencies up to a 24-hour, 25-year storm event. 24-hr, 100-year storm analysis is also included in this report to demonstrate the project will provide 100-year flood protection for all habitable structures.

This Hydrology Study fulfills the requirements of the Orange County Drainage Area Management Plan (DAMP 2011) and the Orange County Hydrology Manual (October 1986 and 1996 Addendum).

The plans and specifications in the Hydrology Study are not for construction purposes; the contractor shall refer to final approved construction documents for plans and specifications.

# Section 2 Project Information

## 2.1 Project Description

The proposed project involves the development of approximately 21.98 acres of multifamily residential dwelling units on a relatively linear shaped property located within the City of Irvine.

### 2.1.1 Project Location

The project is located in the northeasterly quadrant of the former El Toro Marine Corps Air Station, northerly of the intersection of Alton Parkway and Irvine Boulevard, within the City of Irvine, California, as graphically shown in Figure 1, below. The site is separated from the South West Alton Parcel by an existing wildlife corridor.

**Figure 1 – Vicinity Map (Not To Scale)**

## 2.2 Hydrologic Setting

This section summarizes the project's size and location in the context of the larger watershed perspective, topography, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and other relevant hydrologic and environmental factors to be protected specific to the project area's watershed.

### 2.2.1 Watershed

The project site is located within the Santa Ana Region Hydrologic Unit as defined by the California Regional Water Quality Control Board, Region 8, and is tributary to the Newport Bay. Stormwater runoff from the site will maintain existing drainage patterns. The majority of site's stormwater runoff will be conveyed north along the west side of Irvine Boulevard and will eventually discharge into the Agua Chinon Channel. The a smaller portion of the project's stormwater runoff will enter the wildlife corridor to the south of the development and then be conveyed in an existing storm drain system to an existing public storm drain line located within Irvine Boulevard that connects to Borrego Canyon Wash at the intersection of Irvine Boulevard and Alton Parkway.

The historical watershed drainage boundary for this area has been modified with the County's grading for the wildlife corridor that was completed in 2014 as part of the Alton Parkway roadway extension project. The ownership of the wildlife corridor property is eventually slated to be transferred to the City of Irvine.

The excavation for the wildlife corridor has resulted in a redirection of a portion of the offsite stormwater runoff northwest of the West Alton Parcel boundary into the wildlife corridor's drainage system and the remaining off-site runoff into the Agua Chinon Channel drainage system. In addition a small portion of the North West Alton Parcel will also drain into the wildlife corridor via two existing 18-inch storm drain lines constructed by the County. The contributing area of stormwater runoff to the wildlife corridor will remain approximately the same in the pre- and post-development conditions (in order to maintain the existing source of water to the wildlife corridor)

The wildlife corridor drainage has an interim storm drain connection to existing City storm drain line in Irvine Boulevard that the South West Alton Parcel will be draining into. However, the ultimate plan for the Wildlife corridor is to extend under Irvine Boulevard and continue

southwest in the City of Irvine Great Park. Storm water runoff collected within the wildlife corridor would ultimately cross under Irvine Boulevard via the existing roadway bridge structure and continue southwest in a future drainage system through the Great Park where it will eventually recollect to Borrego Canyon Wash near the southern boundary of the Great Park.

The rest of offsite upstream drainage area that has been redirected to the Agua Chinon Channel drainage system (due to the wildlife corridor grading) flows off-site along the northwest boundary of the West Alton Parcel (and the North West Alton Parcel). The remaining portion of the on-site stormwater runoff flows north and eventually connects with the off-site runoff and is eventually collected in an existing unlined drainage swale that runs along the west side of Irvine Boulevard flowing northerly where it eventually discharges into an underground storm drain that crosses Irvine Boulevard and extends into the Great Park Neighborhoods east of Irvine Boulevard.

### 2.2.2 Existing Topography and Facilities

Although the topography of the project site is relatively flat, there is a consistent 2% to 3% slope downward to the north and west. On-site ground surface elevations range from +497 to +423 feet above mean sea level. The reconstructed Magazine Road runs along the southern perimeter of the site adjacent to the wildlife corridor and extends off-site to provide access to the existing FBI training facility west of the county property. Magazine Road is paved with asphalt and has a concrete v-ditch along the north side of the roadway which intercept runoff from both the roadway and the existing area north of magazine road. Two existing 18-inch storm drain lines collect runoff in the concrete v-ditch and discharge stormwater into the existing wildlife corridor. These existing storm drain lines are designated as WCL-1 and WCL-3 in the Alton Parkway Improvement Plans.

### 2.2.3 Adjacent Land Use

The project is bounded by Irvine Boulevard to the west, a portion of the Irvine Wildlife Corridor to the south and open space property owned by the FBI to the east. The small north tip of the property abuts ta future Great Park Neighborhood housing development.

### 2.2.4 Soil Conditions

The project site location resides within the hydrology soil group of B. The site location has been graphically shown on a Hydrologic Soil Group Map provided by Orange County Public Works, which has been included in *Appendix D* of this report.

### 2.2.5 Downstream Conditions

Storm water runoff discharges from the site in two separate directions. The majority of site runoff is conveyed off-site north along Irvine Boulevard in an existing open drainage channel. This channel connects to an underground storm drain line that crosses under Irvine Boulevard and will connect via an underground storm drain line to the Agua Chinon Channel.

The remaining site runoff will enter the wildlife corridor to the south via the two existing 18-inch storm drains. The improvement plans for the wildlife corridor's storm drain system have been included as a supporting exhibit in *Appendix E* of this report. Within the wildlife corridor, a the runoff is collected by an existing 30-inch RCP storm drain (designated as WCL-2) that extends south through the South Western Alton Parcel where it connects to a 30-inch RCP within Irvine Boulevard that discharges the storm water flow to the Borrego Canyon Wash at the intersection of Irvine Boulevard and Alton Parkway.

### 2.2.6 Existing Drainage Patterns

The existing on-site drainage pattern predominately consists of sheet flow across the site in an east to west and south to north direction and includes a shallow concentrated flow westward across the entirety of the barren site, as graphically shown as Subarea A on the Existing Hydrology Map in *Appendix A* of this report. Runoff from Subarea A discharges offsite at the western property line into an open channel trench adjacent to Irvine Boulevard. Subarea B represents a portion of Irvine Boulevard that also discharges to the open channel trench and has been included in this report for total trench flow analysis downstream of the project site.

Runoff entering the Wildlife Corridor is represented with Subarea C on the Existing Hydrology Map. Subarea C includes an off-site portion of brush-covered hillside and the existing Magazine Road. Stormwater runoff generated within Subarea C is collected in an open channel trench adjacent to Magazine Road and is conveyed to the flow-by riser inlet of WCL-3. The remaining runoff not entering WCL-3 continues west along Magazine Road in open channel trench flow to

the riser inlet of WCL-1. Of the total 7.97 acres contributing runoff within Subarea C, 4.71 acres account for off-site run-on.

### 2.2.7 Proposed Drainage Patterns

The proposed drainage pattern will follow the existing drainage pattern as shown on the Conceptual Hydrology Map included in *Appendix A*. The majority of proposed development, Subarea A, will direct runoff westward through a storm drain system to an on-site detention basin. The detention basin will discharge site runoff to the existing open channel trench adjacent to Irvine Boulevard that is currently serving the site.

Based on limited infiltration percolation test results it is anticipated that the proposed on-site detention basins may also provide an area for stormwater infiltration. Additional testing will be conducted in the final design to further investigate the site to determine the potential level of infiltration that would exist for stormwater treatment and retention.

The portion of Irvine Boulevard adjacent to the project site will be improved and widened to include a parkway, curb and gutter, and a lane expansion. Subarea B represents runoff from the proposed portion of Irvine Boulevard that flows west to the existing open channel trench downstream of the project site.

The proposed development will maintain on-site and off-site storm water runoff contributions to the wildlife corridor similar to the existing condition, represented by Subareas C and D. Stormwater runoff in both Subareas will sheet flow to graded inlets and enter a stormdrain system. Subarea C will discharge to the existing WLC-3 storm drain and Subarea D will discharge to the existing WLC-1 storm drain.

### 2.2.8 Impervious Cover

The existing on-site area is approximately 10% impervious. Total existing cover consists of on-site barren dirt, portions of asphalt paved Magazine road, and portions of asphalt paved Irvine Boulevard. The proposed site will include multifamily residential dwelling units, parking lots, sidewalks, asphalt roads, landscape features, and a detention basin. The proposed on-site improvements will be approximately 65% impervious. Impervious cover percentages of existing and proposed Subareas A, B, C, and D were calculated on an individual basis and can be found in AES Rational Method Calculations in *Appendix B.*

# Section 3 Design Criteria and Methodology

This section summarizes the design criteria and methodology applied during the drainage analysis of the project site. The design criteria and methodology follow the Orange County Hydrology Manual dated October 1986.

## 3.1 Design Criteria

### 3.1.1 Drainage Design Criteria

The project storm drain facilities (inlets, culverts, detention, etc.) have been designed to conform to Orange County standards.

### 3.1.2 Flow-Based Numeric Sizing

A Detention basin will be included in the design to ensure the post-development peak flow of the 25-year storm event remains below the existing 25-year storm event peak flow. The Detention basin has also been designed to fully contain the 100-year storm without overflowing and confirmed with the 100-year Detention basin analysis provided in *Appendix C.*

### 3.1.3 Runoff Calculation Method

Runoff calculations for this study were accomplished using the rational method in accordance with the recommendations of the Orange County Hydrology Manual.

A computer model was made using AES RATSCX and CH1 software with built-in methodology following the 1986 Orange County Hydrology Criterion. The RATSCX module was used to analyze and route runoff through each subarea using elevations, flow lengths, soil types, and area inputs to calculate peak flows developed during a 25-and 100-year storm. The CH1 module was then used to produce hydrographs for each stream using the Orange County Small Area Unit Hydrograph Method and then route the hydrograph produced flows within a flow-through basin model to produce a delayed flow-thru basin hydrograph with a user defined elevation-area-discharge relationship of the proposed basin.

Design input criteria for the model were as follows:

| | |
|---|---|
| Design Storm: | 25-year, [100-year] |
| Antecedent Moisture Condition (AMC): | II, [III] |
| SCS Soil Group: | B |
| Existing Land Use: | Barren – Natural poor cover plus paved access roadway, (10% impervious) |
| Proposed Land Use: | Multifamily, (65% impervious) |

Full AES RATSCX hydrologic calculations and values are included *Appendix B*. Proposed condition hydrographs and flow-through basin routing hydrographs are included in *Appendix C*.

### 3.1.4 Runoff and Detention

The proposed runoff for this project is limited to the existing 25-year storm peak runoff rate. Using AES RATSCX software, the existing and proposed peak flow rates were calculated to be 57.38 cfs and 82.33 cfs. To ensure post-development peak flow rates are not higher than the existing peak flows, a detention basin will be incorporated into the site's design which will reduce on-site peak runoff to 57.38 cfs or less.

The detention basin will allow ponding to reach a depth of roughly 4 feet and has a dual purpose of detention and infiltration for LID requirements. The basin is purposely oversized in the current design to allow for possible future changes to basin functionality concerning possible LID treatment and aesthetic options. Outflow from the detention basin will include a flow limiting riser pipe as to limit discharge to the allowable peak rate. Detention basin analysis was performed using runoff hydrographs produced in the AES CH1 program with the Orange County Hydrology Manual's modified Pul's method for flow-through basins. Runoff hydrographs and detention basin calculations are included in *Appendix C*. The detention basin and overall site drainage were also analyzed for the 100-year storm event as an additional measure of safety and to assess the size and performance of the basin under severe conditions. The 100-year storm runoff hydrograph and detention basin calculation are also included in *Appendix C*.

Final detention system designs will be determined during the design and preparation of final construction documents. For the purpose of this preliminary study, a total of 34,000 cubic feet of detention is provided.

### 3.1.5 LID and Treatment Control

Within the Santa Ana Regional Water Quality Control Board jurisdiction, the Fourth Term MS4 Permit has been adopted with specific requirements for new development and significant redevelopment stormwater control. Low impact development (LID) is a stormwater management strategy that emphasizes conservation and use of existing site features integrated with distributed stormwater controls that are designed to more closely mimic natural hydrologic patterns of undeveloped sites than traditional stormwater management controls. LID best management practices (BMPs) must me selected based on a hierarchy of controls and sized to capture the maximum feasible portion of the Design Capture Volume (DCV) (e.g. retention), before attempting to address the remaining volume with the next lower priority control (biotreatment).

Available options for on-site stormwater retention include the use of infiltration BMPs, harvest and use BMPs, and Evapotranspiration BMPs, in order of selection priority. These stormwater retention options are occasionally deemed infeasible on a project specific basis for a number of reasons including the location of groundwater, risk of groundwater pollution, geotechnical hazards, adjacent land uses, and site soil conditions among others.

Biotreatment BMPs provide a variety of treatment mechanisms to remove both suspended and dissolved pollutants in urban stormwater runoff. All biotreatment BMPs may be volume-based (storage a key design component) and are designed to treat and discharge urban stormwater runoff to a downstream conveyance system. Biotreatment BMPs can be designed to promote infiltration and evapotranspiration even though they are treat-and-release BMPs. If necessary to mitigate risks to structures, human health, or other concerns, a biotreatment BMP may also be lined to prevent infiltration of urban stormwater runoff into underlying soils. Examples of biotreatment BMPs include rain gardens, vegetated swales, retention ponds, constructed wetlands, detention basin, and proprietary biotreatment devices such as the Filterra and/or Modular Wetland systems.

Initial review of the Western Alton Parcel suggests retention is not be feasible for the entire site therefore, for the purpose of this Preliminary Drainage Analysis, a combination of infiltration and biotreatment BMPs will be used in the conceptual design of this project. Refer to the project WQMP for further details regarding LID and BMP use and selection.

# Section 4 Hydrology and Drainage Analysis

This section summarizes the quantitative hydrologic analysis of the existing and proposed conditions of the site.

## 4.1 Drainage Delineation

*Appendix A* of this report contains the existing condition hydrology map and a conceptual hydrology map for the proposed condition. Both the existing and proposed hydrology maps show the drainage subareas and flow paths correlating to AES runoff calculations.

## 4.2 Summary of Results*

Based on the results of this study, the project mitigation measures proposed will prevent an increase in runoff. Therefore, the proposed project improvements will not have an adverse effect on the downstream storm drain system. A summary of results has been included in Table 1 below.

**Table 1 - Summary of Existing Runoff Results**

| | Area (ac) | | Impervious % | | Peak 25 yr Flow Q25 (cfs) | | Peak 100 yr Flow Q100 (cfs) | | Detention Storage* (cf) |
|---|---|---|---|---|---|---|---|---|---|
| | Existing | Prop. | Existing | Prop. | Existing | Proposed (w/ detention) | Existing | Proposed (w/ detention) | |
| A | 17.91 | 17.45 | 0 | 65 | 30.08 | 22.02 | 40.39 | 22.66 | 34,000 |
| B | 2.92 | 3.17 | 75 | 90 | 6.67 | 7.88 | 8.84 | 10.25 | - |
| C | 7.97 | 6.66 | 17 | 22 | 20.63 | 21.88 | 27.46 | 28.78 | - |
| D | - | 1.54 | - | 79 | - | 4.97 | - | 6.45 | - |
| Total | 28.81 | 28.81 | 12 | 55 | 57.38 | 56.75 | 76.69 | 68.14 | |

* This analysis for the Post-Development Condition shall be considered to be a planning tool only to help guide the developer and the architect in creating a land use plan. Additional design analysis is required to determine the Post Development Condition requirements for stormwater detention and treatment.

Runoff from the project discharges to 2 separate receiving waters. Table 2 below summarizes the project's runoff to each water body.

**Table 2 - Summary of downstream Receiving Waters.**

| Downstream Receiving Water | Receiving Runoff Sources | | Peak Runoff **Q25 (cfs)** | | Peak Runoff **Q100 (cfs)** | |
|---|---|---|---|---|---|---|
| | Existing (ac) | Proposed (ac) | Existing | Proposed | Existing | Proposed |
| Agua Chinon Channel | Subareas A, B 20.83 | Subareas A, B 20.61 | 36.75 | 29.90 | 49.23 | 32.91 |
| Wildlife Corridor (WLC-1 + WCL-3) | Subarea C 7.98 | Subareas C, D 8.20 | 20.63 | 26.85 | 27.46 | 35.23 |
| **TOTAL** | **28.81** | **28.81** | **57.38** | **56.75** | **76.69** | **68.14** |

## THIS STUDY SHALL NOT BE USED FOR FINAL DESIGN.

# APPENDIX

# Appendix A – Hydrology Maps

See Attached Exhibits.

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| NO. | DESCRIPTION | BY | DATE | CHK |
|---|---|---|---|---|
| | REVISIONS | | | |

# EXISTING CONCEPTUAL HYDROLOGY MAP

NORTH WESTERN ALTON PARCEL - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.11.24
CHECKED: DTS
DATE: 2015.11.24
REVISION # –
DATE:
JOB NO: SP7531

Mar 14, 2016 – 4:40pm by cgoldstein K:\Drawings\SP\SP7531 Lowe El Toro\Eng\Alton Parcels\Hydrology\SP7531-NWAP-HYD-PRE.dwg

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REAL ESTATE GROUP

COUNTY OF ORANGE CALIFORNIA

DRAWN: RH
DATE: 2015.08.10
CHECKED: DTS
DATE:
REVISION #: --
DATE:
JOB NO: SP7531

# PROPOSED CONCEPTUAL HYDROLOGY MAP

NORTH WESTERN ALTON PARCEL - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

| NO. | DESCRIPTION | BY | DATE | CHK |
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# Appendix B – AES Rational Method Calculations

See Attached Exhibit

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****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
EXISTING CONDITION - STREAM A
25 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAPX25A.DAT
   TIME/DATE OF STUDY: 15:32 11/18/2015
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

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

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

```
       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   285.00
  ELEVATION DATA: UPSTREAM(FEET) =    497.00  DOWNSTREAM(FEET) =    476.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.484
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.576
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        0.38      0.30     1.000    86    8.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      1.12
  TOTAL AREA(ACRES) =      0.38   PEAK FLOW RATE(CFS) =      1.12

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    476.00  DOWNSTREAM(FEET) =    469.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   169.00   CHANNEL SLOPE =  0.0379
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.385
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        1.02      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.54
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.25
  AVERAGE FLOW DEPTH(FEET) =   0.23   TRAVEL TIME(MIN.) =   0.87
  Tc(MIN.) =    9.35
```

```
  SUBAREA AREA(ACRES) =     1.02       SUBAREA RUNOFF(CFS) =    2.83
  EFFECTIVE AREA(ACRES) =      1.40     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       3.89

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   3.70
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     454.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    469.60  DOWNSTREAM(FEET) =    449.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   992.00   CHANNEL SLOPE =  0.0208
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.719
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        3.26      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.46
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.74
  AVERAGE FLOW DEPTH(FEET) =   0.50   TRAVEL TIME(MIN.) =   4.42
  Tc(MIN.) =   13.77
  SUBAREA AREA(ACRES) =     3.26       SUBAREA RUNOFF(CFS) =    7.10
  EFFECTIVE AREA(ACRES) =      4.66     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        4.7         PEAK FLOW RATE(CFS) =      10.15

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.59   FLOW VELOCITY(FEET/SEC.) =   4.11
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1446.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    107.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    449.00  DOWNSTREAM(FEET) =    423.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1169.00   CHANNEL SLOPE =  0.0218
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.232
  SUBAREA LOSS RATE DATA(AMC  II):
```

```
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
NATURAL POOR COVER
"BARREN"                   B        4.74      0.30     1.000    86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.28
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.39
AVERAGE FLOW DEPTH(FEET) =   0.52   TRAVEL TIME(MIN.) =   5.74
Tc(MIN.) =   19.51
SUBAREA AREA(ACRES) =     4.74       SUBAREA RUNOFF(CFS) =    8.24
EFFECTIVE AREA(ACRES) =      9.40     AREA-AVERAGED Fm(INCH/HR) =   0.30
AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
TOTAL AREA(ACRES) =        9.4         PEAK FLOW RATE(CFS) =      16.35

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.55   FLOW VELOCITY(FEET/SEC.) =   3.53
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    2615.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 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.) =   19.51
RAINFALL INTENSITY(INCH/HR) =   2.23
AREA-AVERAGED Fm(INCH/HR) =  0.30
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  1.00
EFFECTIVE STREAM AREA(ACRES) =       9.40
TOTAL STREAM AREA(ACRES) =       9.40
PEAK FLOW RATE(CFS) AT CONFLUENCE =      16.35

****************************************************************************
FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
ELEVATION DATA: UPSTREAM(FEET) =    485.00  DOWNSTREAM(FEET) =    468.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.127
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.431
SUBAREA Tc AND LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
NATURAL POOR COVER
"BARREN"                   B        0.71      0.30     1.000    86    9.13
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.00
  TOTAL AREA(ACRES) =      0.71   PEAK FLOW RATE(CFS) =      2.00

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    468.00  DOWNSTREAM(FEET) =    450.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   641.00   CHANNEL SLOPE =  0.0281
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.743
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        4.11      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.56
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.41
  AVERAGE FLOW DEPTH(FEET) =   0.20   TRAVEL TIME(MIN.) =   4.43
  Tc(MIN.) =   13.56
  SUBAREA AREA(ACRES) =     4.11       SUBAREA RUNOFF(CFS) =    9.04
  EFFECTIVE AREA(ACRES) =      4.82     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        4.8         PEAK FLOW RATE(CFS) =      10.60

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   2.76
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    106.00 =     941.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    450.00  DOWNSTREAM(FEET) =    423.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1184.00   CHANNEL SLOPE =  0.0224
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =  15.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.204
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        3.26      0.30     1.000    86
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.39
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.08
  AVERAGE FLOW DEPTH(FEET) =   0.45   TRAVEL TIME(MIN.) =   6.40
  Tc(MIN.) =   19.96
  SUBAREA AREA(ACRES) =     3.26       SUBAREA RUNOFF(CFS) =    5.59
  EFFECTIVE AREA(ACRES) =      8.08     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        8.1         PEAK FLOW RATE(CFS) =      13.84

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   3.10
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    107.00 =    2125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   19.96
  RAINFALL INTENSITY(INCH/HR) =   2.20
  AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       8.08
  TOTAL STREAM AREA(ACRES) =       8.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      13.84

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       16.35   19.51    2.232  0.30( 0.30) 1.00       9.4     100.00
      2       13.84   19.96    2.204  0.30( 0.30) 1.00       8.1     104.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       30.08   19.51    2.232  0.30( 0.30) 1.00      17.3     100.00
      2       29.95   19.96    2.204  0.30( 0.30) 1.00      17.5     104.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      30.08    Tc(MIN.) =    19.51
  EFFECTIVE AREA(ACRES) =      17.30   AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =       17.5
```

```
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    2615.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    423.50  DOWNSTREAM(FEET) =    422.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   143.00   CHANNEL SLOPE =  0.0070
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  15.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.169
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        0.43      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      30.44
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.36
  AVERAGE FLOW DEPTH(FEET) =   0.65   TRAVEL TIME(MIN.) =   1.01
  Tc(MIN.) =   20.52
  SUBAREA AREA(ACRES) =     0.43       SUBAREA RUNOFF(CFS) =    0.72
  EFFECTIVE AREA(ACRES) =     17.73     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =       17.9         PEAK FLOW RATE(CFS) =      30.08
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.65   FLOW VELOCITY(FEET/SEC.) =   2.37
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    203.00 =    2758.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       17.9  TC(MIN.) =     20.52
  EFFECTIVE AREA(ACRES) =     17.73  AREA-AVERAGED Fm(INCH/HR)=  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      30.08

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       30.08   20.52    2.169  0.30( 0.30) 1.00      17.7     100.00
      2       29.95   20.96    2.144  0.30( 0.30) 1.00      17.9     104.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
EXISTING CONDITION - STREAM B
25 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAPX25B.DAT
   TIME/DATE OF STUDY: 15:56 11/18/2015
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

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       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    456.50  DOWNSTREAM(FEET) =    448.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.071
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.322
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.36      0.30     0.100    56    6.07
  NATURAL POOR COVER
  "BARREN"                   B        0.12      0.30     1.000    86   10.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.325
  SUBAREA RUNOFF(CFS) =      1.82
  TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      1.82

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    448.00  DOWNSTREAM(FEET) =    439.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   535.00   CHANNEL SLOPE =  0.0168
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.259
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.73      0.30     0.100    56
  NATURAL POOR COVER
  "BARREN"                   B        0.24      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.323
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.22
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.27
```

```
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   3.92
  Tc(MIN.) =   10.00
  SUBAREA AREA(ACRES) =     0.97       SUBAREA RUNOFF(CFS) =    2.76
  EFFECTIVE AREA(ACRES) =      1.45     AREA-AVERAGED Fm(INCH/HR) =   0.10
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.32
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       4.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.28   FLOW VELOCITY(FEET/SEC.) =   2.53
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     835.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    439.00  DOWNSTREAM(FEET) =    422.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   818.00   CHANNEL SLOPE =  0.0202
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.635
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.10      0.30     0.100    56
  NATURAL POOR COVER
  "BARREN"                   B        0.37      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.327
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.81
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.99
  AVERAGE FLOW DEPTH(FEET) =   0.33   TRAVEL TIME(MIN.) =   4.56
  Tc(MIN.) =   14.55
  SUBAREA AREA(ACRES) =     1.47       SUBAREA RUNOFF(CFS) =    3.36
  EFFECTIVE AREA(ACRES) =      2.92     AREA-AVERAGED Fm(INCH/HR) =   0.10
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.32
  TOTAL AREA(ACRES) =        2.9         PEAK FLOW RATE(CFS) =       6.67

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.35   FLOW VELOCITY(FEET/SEC.) =   3.11
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1653.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.9  TC(MIN.) =     14.55
  EFFECTIVE AREA(ACRES) =      2.92  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.325
  PEAK FLOW RATE(CFS)   =       6.67
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
EXISTING CONDITION - STREAM C
25 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAPX25C.DAT
   TIME/DATE OF STUDY: 16:34 11/18/2015
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

```
       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    535.00  DOWNSTREAM(FEET) =    489.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.824
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        0.77      0.30     1.000    86    7.49
  COMMERCIAL                 B        0.14      0.30     0.100    56    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.862
  SUBAREA RUNOFF(CFS) =      3.74
  TOTAL AREA(ACRES) =      0.91   PEAK FLOW RATE(CFS) =      3.74

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    489.40  DOWNSTREAM(FEET) =    478.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   544.00   CHANNEL SLOPE =  0.0195
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.891
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        4.46      0.30     1.000    86
  COMMERCIAL                 B        0.36      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.933
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.65
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.93
```

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  AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   2.31
  Tc(MIN.) =    7.31
  SUBAREA AREA(ACRES) =     4.82       SUBAREA RUNOFF(CFS) =   15.66
  EFFECTIVE AREA(ACRES) =      5.73     AREA-AVERAGED Fm(INCH/HR) =   0.28
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.92
  TOTAL AREA(ACRES) =        5.7         PEAK FLOW RATE(CFS) =      18.64

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.78   FLOW VELOCITY(FEET/SEC.) =   4.51
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     844.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    478.80  DOWNSTREAM(FEET) =    466.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   421.00   CHANNEL SLOPE =  0.0297
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.541
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.28      0.30     0.100    56
  NATURAL POOR COVER
  "BARREN"                   B        0.43      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.645
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      19.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.30
  AVERAGE FLOW DEPTH(FEET) =   0.72   TRAVEL TIME(MIN.) =   1.32
  Tc(MIN.) =    8.63
  SUBAREA AREA(ACRES) =     0.71       SUBAREA RUNOFF(CFS) =    2.14
  EFFECTIVE AREA(ACRES) =      6.44     AREA-AVERAGED Fm(INCH/HR) =   0.27
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.89
  TOTAL AREA(ACRES) =        6.4         PEAK FLOW RATE(CFS) =      18.98

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.70   FLOW VELOCITY(FEET/SEC.) =   5.26
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1265.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    466.30  DOWNSTREAM(FEET) =    454.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   601.00   CHANNEL SLOPE =  0.0205
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
```

```
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.129
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.61      0.30     0.100    56
  NATURAL POOR COVER
  "BARREN"                   B        0.92      0.30     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.641
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      21.00
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.74
  AVERAGE FLOW DEPTH(FEET) =   0.81   TRAVEL TIME(MIN.) =   2.11
  Tc(MIN.) =   10.74
  SUBAREA AREA(ACRES) =     1.53       SUBAREA RUNOFF(CFS) =    4.04
  EFFECTIVE AREA(ACRES) =      7.97     AREA-AVERAGED Fm(INCH/HR) =   0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.84
  TOTAL AREA(ACRES) =        8.0         PEAK FLOW RATE(CFS) =      20.63

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.81   FLOW VELOCITY(FEET/SEC.) =   4.73
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =    1866.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.0  TC(MIN.) =     10.74
  EFFECTIVE AREA(ACRES) =      7.97  AREA-AVERAGED Fm(INCH/HR)=  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.843
  PEAK FLOW RATE(CFS)   =      20.63
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM A
25 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAPQ25A.DAT
   TIME/DATE OF STUDY: 10:03 11/23/2015
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   30.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0313 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

```
       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   312.00
  ELEVATION DATA: UPSTREAM(FEET) =    482.80  DOWNSTREAM(FEET) =    472.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.097
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.956
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        0.77      0.30     0.350    56    7.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      2.67
  TOTAL AREA(ACRES) =      0.77   PEAK FLOW RATE(CFS) =      2.67

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   469.10  DOWNSTREAM(FEET) =   459.80
  FLOW LENGTH(FEET) =   244.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.71
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.67
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =    7.62
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =     556.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.62
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.799
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.52      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    1.73
  EFFECTIVE AREA(ACRES) =      1.29   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.3       PEAK FLOW RATE(CFS) =       4.29

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.62
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.799
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.38      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.38      SUBAREA RUNOFF(CFS) =    1.26
  EFFECTIVE AREA(ACRES) =      1.67   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.7       PEAK FLOW RATE(CFS) =       5.55

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   459.80  DOWNSTREAM(FEET) =   453.20
  FLOW LENGTH(FEET) =   207.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.55
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    8.01
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =     763.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.01
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.694
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.11      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.11      SUBAREA RUNOFF(CFS) =    3.59
  EFFECTIVE AREA(ACRES) =      2.78   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.8       PEAK FLOW RATE(CFS) =       8.98

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   453.20  DOWNSTREAM(FEET) =   450.10
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.98
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    8.21
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =     875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    140.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.21
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.644
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.73      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.73      SUBAREA RUNOFF(CFS) =    2.33
  EFFECTIVE AREA(ACRES) =      3.51   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.5       PEAK FLOW RATE(CFS) =      11.18

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    140.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.21
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.644
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.80      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.80      SUBAREA RUNOFF(CFS) =    5.73
  EFFECTIVE AREA(ACRES) =      5.31   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        5.3       PEAK FLOW RATE(CFS) =      16.91

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    150.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   450.10  DOWNSTREAM(FEET) =   447.20
  FLOW LENGTH(FEET) =   377.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.78
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.91
  PIPE TRAVEL TIME(MIN.) =   0.93    Tc(MIN.) =    9.13
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    1252.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.13
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.430
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.89      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.89      SUBAREA RUNOFF(CFS) =    5.66
  EFFECTIVE AREA(ACRES) =      7.20   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        7.2       PEAK FLOW RATE(CFS) =      21.54

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   447.20  DOWNSTREAM(FEET) =   431.70
  FLOW LENGTH(FEET) =   934.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.73
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.54
  PIPE TRAVEL TIME(MIN.) =   1.60    Tc(MIN.) =   10.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    160.00 =    2186.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.73
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.130
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.61      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    4.38
  EFFECTIVE AREA(ACRES) =      8.81   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        8.8       PEAK FLOW RATE(CFS) =      23.99

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   431.70  DOWNSTREAM(FEET) =   426.50
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.46
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.99
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =   10.96
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    170.00 =    2354.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.96
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.094
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.89      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.89      SUBAREA RUNOFF(CFS) =    2.39
  EFFECTIVE AREA(ACRES) =      9.70   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      26.09

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    290.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   426.50  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   124.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.05
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.09
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   11.19
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    290.00 =    2478.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    290.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   11.19
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.058
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.68      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.68      SUBAREA RUNOFF(CFS) =    1.81
  EFFECTIVE AREA(ACRES) =     10.38   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =       10.4       PEAK FLOW RATE(CFS) =      27.59

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    290.00 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.) =   11.19
  RAINFALL INTENSITY(INCH/HR) =   3.06
  AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =      10.38
```

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  TOTAL STREAM AREA(ACRES) =      10.38
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      27.59

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   214.00
  ELEVATION DATA: UPSTREAM(FEET) =    456.00  DOWNSTREAM(FEET) =    451.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.528
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.148
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        1.47      0.30     0.350    56    6.53
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      5.35
  TOTAL AREA(ACRES) =      1.47   PEAK FLOW RATE(CFS) =      5.35

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.00  DOWNSTREAM(FEET) =   446.00
  FLOW LENGTH(FEET) =   201.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.05
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.35
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =    6.94
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    220.00 =     415.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.94
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.005
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.82      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    2.88
  EFFECTIVE AREA(ACRES) =      2.29   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.3       PEAK FLOW RATE(CFS) =       8.04

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   446.00  DOWNSTREAM(FEET) =   443.50
  FLOW LENGTH(FEET) =    23.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.36
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.04
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    6.97
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     438.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.97
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.997
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.57      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.57      SUBAREA RUNOFF(CFS) =    2.00
  EFFECTIVE AREA(ACRES) =      2.86   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.9       PEAK FLOW RATE(CFS) =      10.02

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.97
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.997
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.62      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.62      SUBAREA RUNOFF(CFS) =    2.17
  EFFECTIVE AREA(ACRES) =      3.48   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.5       PEAK FLOW RATE(CFS) =      12.19

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.50  DOWNSTREAM(FEET) =   442.50
  FLOW LENGTH(FEET) =    84.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.47
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.19
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =    7.16
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    240.00 =     522.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    240.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.16
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.938
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.23      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.23      SUBAREA RUNOFF(CFS) =    0.79
  EFFECTIVE AREA(ACRES) =      3.71   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.7       PEAK FLOW RATE(CFS) =      12.80

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   442.50  DOWNSTREAM(FEET) =   438.80
  FLOW LENGTH(FEET) =   212.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.49
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.80
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =    7.57
```

```
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    250.00 =     734.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.57
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.814
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.26      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.26      SUBAREA RUNOFF(CFS) =    4.21
  EFFECTIVE AREA(ACRES) =      4.97   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        5.0       PEAK FLOW RATE(CFS) =      16.59

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.80  DOWNSTREAM(FEET) =   435.40
  FLOW LENGTH(FEET) =   197.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.20
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.59
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =    7.93
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    260.00 =     931.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    260.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.93
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.716
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.10      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.10      SUBAREA RUNOFF(CFS) =    3.57
  EFFECTIVE AREA(ACRES) =      6.07   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        6.1       PEAK FLOW RATE(CFS) =      19.72
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   435.40  DOWNSTREAM(FEET) =   432.80
  FLOW LENGTH(FEET) =   152.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.67
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.72
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    8.19
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    270.00 =    1083.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.19
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.648
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.69      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    2.20
  EFFECTIVE AREA(ACRES) =      6.76   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        6.8       PEAK FLOW RATE(CFS) =      21.55

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.19
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.648
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.19      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.61
  EFFECTIVE AREA(ACRES) =      6.95   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        7.0       PEAK FLOW RATE(CFS) =      22.16
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    280.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   432.80  DOWNSTREAM(FEET) =   431.70
  FLOW LENGTH(FEET) =    62.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.05
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.16
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    8.29
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    280.00 =    1145.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    280.00 TO NODE    280.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.29
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.622
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.12      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.12      SUBAREA RUNOFF(CFS) =    0.38
  EFFECTIVE AREA(ACRES) =      7.07   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        7.1       PEAK FLOW RATE(CFS) =      22.38

****************************************************************************
  FLOW PROCESS FROM NODE    280.00 TO NODE    290.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   431.70  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   419.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.65
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.38
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    9.02
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    290.00 =    1564.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    290.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.02
  RAINFALL INTENSITY(INCH/HR) =   3.45
  AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       7.07
  TOTAL STREAM AREA(ACRES) =       7.07
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      22.38

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       27.59   11.19    3.058  0.30( 0.11) 0.35      10.4     100.00
      2       22.38    9.02    3.455  0.30( 0.11) 0.35       7.1     200.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       47.60    9.02    3.455  0.30( 0.11) 0.35      15.4     200.00
      2       47.31   11.19    3.058  0.30( 0.10) 0.35      17.5     100.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      47.60    Tc(MIN.) =     9.02
  EFFECTIVE AREA(ACRES) =      15.44   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    290.00 =    2478.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    550.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   422.50
  FLOW LENGTH(FEET) =   163.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  24.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.19
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      47.60
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =    9.26
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    550.00 =    2641.00 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       17.5  TC(MIN.) =      9.26
```

```
  EFFECTIVE AREA(ACRES) =     15.44  AREA-AVERAGED Fm(INCH/HR)=  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =      47.60

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       47.60    9.26    3.403  0.30( 0.11) 0.35      15.4     200.00
      2       47.31   11.43    3.021  0.30( 0.10) 0.35      17.5     100.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM B
25 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAPQ25B.DAT
   TIME/DATE OF STUDY: 10:08 11/23/2015
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   52.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

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       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    510.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   213.00
  ELEVATION DATA: UPSTREAM(FEET) =    456.60  DOWNSTREAM(FEET) =    453.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.938
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.377
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.36      0.30     0.100    56    5.94
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.41
  TOTAL AREA(ACRES) =      0.36   PEAK FLOW RATE(CFS) =      1.41

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    520.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  453.20  DOWNSTREAM ELEVATION(FEET) =  449.00
  STREET LENGTH(FEET) =   233.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  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 =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.67

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.19
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
```

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    HALFSTREET FLOOD WIDTH(FEET) =    7.24
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.87
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
  STREET FLOW TRAVEL TIME(MIN.) =   1.35   Tc(MIN.) =    7.29
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.897
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.45      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.45      SUBAREA RUNOFF(CFS) =    1.57
  EFFECTIVE AREA(ACRES) =      0.81    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.82

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =   8.24
  FLOW VELOCITY(FEET/SEC.) =  3.02   DEPTH*VELOCITY(FT*FT/SEC.) =   1.01
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    520.00 =     446.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    520.00 TO NODE    530.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  449.00  DOWNSTREAM ELEVATION(FEET) =  438.30
  STREET LENGTH(FEET) =   611.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  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 =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.67

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.50
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   10.35
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.30
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.26
  STREET FLOW TRAVEL TIME(MIN.) =   3.08   Tc(MIN.) =   10.37
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.192
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  COMMERCIAL                  B        1.18      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.18      SUBAREA RUNOFF(CFS) =    3.36
  EFFECTIVE AREA(ACRES) =      1.99    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =       5.66

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  11.46
  FLOW VELOCITY(FEET/SEC.) =  3.47   DEPTH*VELOCITY(FT*FT/SEC.) =   1.41
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    530.00 =    1057.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    530.00 TO NODE    540.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  438.30  DOWNSTREAM ELEVATION(FEET) =  427.50
  STREET LENGTH(FEET) =   600.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  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 =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.67

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.12
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.43
    HALFSTREET FLOOD WIDTH(FEET) =   12.58
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.70
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.59
  STREET FLOW TRAVEL TIME(MIN.) =   2.70   Tc(MIN.) =   13.08
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.800
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.17      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.17      SUBAREA RUNOFF(CFS) =    2.92
  EFFECTIVE AREA(ACRES) =      3.16    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =       7.88
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  13.10
  FLOW VELOCITY(FEET/SEC.) =  3.80   DEPTH*VELOCITY(FT*FT/SEC.) =   1.68
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    540.00 =    1657.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.2  TC(MIN.) =     13.08
  EFFECTIVE AREA(ACRES) =      3.16  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       7.88
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM C
25 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAPQ25C.DAT
   TIME/DATE OF STUDY: 11:07 11/23/2015
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   46.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

```
       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    535.00  DOWNSTREAM(FEET) =    489.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.824
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        0.77      0.30     1.000    86    7.49
  COMMERCIAL                 B        0.14      0.30     0.100    56    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.862
  SUBAREA RUNOFF(CFS) =      3.74
  TOTAL AREA(ACRES) =      0.91   PEAK FLOW RATE(CFS) =      3.74

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    489.40  DOWNSTREAM(FEET) =    484.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   282.00   CHANNEL SLOPE =  0.0191
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.251
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        3.25      0.30     1.000    86
  COMMERCIAL                 B        0.28      0.30     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.929
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.06
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.75
```

```
  AVERAGE FLOW DEPTH(FEET) =   0.57   TRAVEL TIME(MIN.) =   1.25
  Tc(MIN.) =    6.25
  SUBAREA AREA(ACRES) =     3.53       SUBAREA RUNOFF(CFS) =   12.62
  EFFECTIVE AREA(ACRES) =      4.44     AREA-AVERAGED Fm(INCH/HR) =   0.27
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.91
  TOTAL AREA(ACRES) =        4.4         PEAK FLOW RATE(CFS) =      15.89

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.72   FLOW VELOCITY(FEET/SEC.) =   4.28
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =     582.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   480.00  DOWNSTREAM(FEET) =   475.00
  FLOW LENGTH(FEET) =   199.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.61
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.89
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    6.56
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =     781.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.56
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.135
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                B        0.97      0.30     0.850    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.97      SUBAREA RUNOFF(CFS) =    3.39
  EFFECTIVE AREA(ACRES) =      5.41   AREA-AVERAGED Fm(INCH/HR) =  0.27
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =        5.4       PEAK FLOW RATE(CFS) =      18.81

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    340.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   475.00  DOWNSTREAM(FEET) =   471.00
  FLOW LENGTH(FEET) =   163.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.87
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.81
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    6.81
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    340.00 =     944.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.81
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.048
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.29      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.29      SUBAREA RUNOFF(CFS) =    1.03
  EFFECTIVE AREA(ACRES) =      5.70   AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.88
  TOTAL AREA(ACRES) =        5.7       PEAK FLOW RATE(CFS) =      19.42

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    350.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   471.00  DOWNSTREAM(FEET) =   466.00
  FLOW LENGTH(FEET) =   204.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.93
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.42
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    7.13
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    350.00 =    1148.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    350.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.13
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.947
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.67      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.67      SUBAREA RUNOFF(CFS) =    2.32
  EFFECTIVE AREA(ACRES) =      6.37   AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.82
  TOTAL AREA(ACRES) =        6.4       PEAK FLOW RATE(CFS) =      21.22

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   466.00  DOWNSTREAM(FEET) =   463.30
  FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.66
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.22
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =    7.31
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    360.00 =    1268.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    360.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.31
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.890
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.29      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.29      SUBAREA RUNOFF(CFS) =    0.99
  EFFECTIVE AREA(ACRES) =      6.66   AREA-AVERAGED Fm(INCH/HR) =  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.80
  TOTAL AREA(ACRES) =        6.7       PEAK FLOW RATE(CFS) =      21.88
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.7  TC(MIN.) =      7.31
  EFFECTIVE AREA(ACRES) =      6.66  AREA-AVERAGED Fm(INCH/HR)=  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.799
  PEAK FLOW RATE(CFS)   =      21.88
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM D
25 YEAR STORM

 ----------------------------------------------------------------------------
   FILE NAME: NWAPQ25D.DAT
   TIME/DATE OF STUDY: 11:23 11/23/2015
 ============================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   46.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

```
       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   212.00
  ELEVATION DATA: UPSTREAM(FEET) =    467.00  DOWNSTREAM(FEET) =    461.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.259
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.248
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        0.17      0.30     0.350    56    6.26
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      0.63
  TOTAL AREA(ACRES) =      0.17   PEAK FLOW RATE(CFS) =      0.63

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   458.00  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =   391.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.66
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.63
  PIPE TRAVEL TIME(MIN.) =   1.78    Tc(MIN.) =    8.04
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =     603.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    420.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.04
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.687
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.37      0.30     0.350    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.37      SUBAREA RUNOFF(CFS) =    4.42
  EFFECTIVE AREA(ACRES) =      1.54   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.5       PEAK FLOW RATE(CFS) =       4.97
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      8.04
  EFFECTIVE AREA(ACRES) =      1.54  AREA-AVERAGED Fm(INCH/HR)=  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =       4.97
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
EXISTING CONDITION - STREAM A
100 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAX100A.DAT
   TIME/DATE OF STUDY: 18:04 03/15/2016
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

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

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

```
        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   285.00
  ELEVATION DATA: UPSTREAM(FEET) =    497.00  DOWNSTREAM(FEET) =    476.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.484
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.570
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        0.38      0.30     1.000    97    8.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      1.46
  TOTAL AREA(ACRES) =      0.38   PEAK FLOW RATE(CFS) =      1.46

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    476.00  DOWNSTREAM(FEET) =    469.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   169.00   CHANNEL SLOPE =  0.0379
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.342
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        1.02      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.32
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.56
  AVERAGE FLOW DEPTH(FEET) =   0.26   TRAVEL TIME(MIN.) =   0.79
  Tc(MIN.) =    9.28
```

```
  SUBAREA AREA(ACRES) =     1.02       SUBAREA RUNOFF(CFS) =    3.71
  EFFECTIVE AREA(ACRES) =      1.40     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       5.09

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.34   FLOW VELOCITY(FEET/SEC.) =   4.09
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     454.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    469.60  DOWNSTREAM(FEET) =    449.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   992.00   CHANNEL SLOPE =  0.0208
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.525
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        3.26      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.86
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.06
  AVERAGE FLOW DEPTH(FEET) =   0.58   TRAVEL TIME(MIN.) =   4.07
  Tc(MIN.) =   13.35
  SUBAREA AREA(ACRES) =     3.26       SUBAREA RUNOFF(CFS) =    9.46
  EFFECTIVE AREA(ACRES) =      4.66     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        4.7         PEAK FLOW RATE(CFS) =      13.53

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.69   FLOW VELOCITY(FEET/SEC.) =   4.48
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1446.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    107.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    449.00  DOWNSTREAM(FEET) =    423.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1169.00   CHANNEL SLOPE =  0.0218
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.905
  SUBAREA LOSS RATE DATA(AMC III):
```

```
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
NATURAL POOR COVER
"BARREN"                   B        4.74      0.30     1.000    97
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      19.11
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.64
AVERAGE FLOW DEPTH(FEET) =   0.59   TRAVEL TIME(MIN.) =   5.36
Tc(MIN.) =   18.70
SUBAREA AREA(ACRES) =     4.74       SUBAREA RUNOFF(CFS) =   11.11
EFFECTIVE AREA(ACRES) =      9.40     AREA-AVERAGED Fm(INCH/HR) =   0.30
AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
TOTAL AREA(ACRES) =        9.4         PEAK FLOW RATE(CFS) =      22.04

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.63   FLOW VELOCITY(FEET/SEC.) =   3.78
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    2615.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 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.) =   18.70
RAINFALL INTENSITY(INCH/HR) =   2.91
AREA-AVERAGED Fm(INCH/HR) =  0.30
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  1.00
EFFECTIVE STREAM AREA(ACRES) =       9.40
TOTAL STREAM AREA(ACRES) =       9.40
PEAK FLOW RATE(CFS) AT CONFLUENCE =      22.04

****************************************************************************
FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
ELEVATION DATA: UPSTREAM(FEET) =    485.00  DOWNSTREAM(FEET) =    468.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.127
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.383
SUBAREA Tc AND LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
NATURAL POOR COVER
"BARREN"                   B        0.71      0.30     1.000    97    9.13
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.61
  TOTAL AREA(ACRES) =      0.71   PEAK FLOW RATE(CFS) =      2.61

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    468.00  DOWNSTREAM(FEET) =    450.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   641.00   CHANNEL SLOPE =  0.0281
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.530
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        4.11      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.66
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.55
  AVERAGE FLOW DEPTH(FEET) =   0.23   TRAVEL TIME(MIN.) =   4.18
  Tc(MIN.) =   13.31
  SUBAREA AREA(ACRES) =     4.11       SUBAREA RUNOFF(CFS) =   11.95
  EFFECTIVE AREA(ACRES) =      4.82     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        4.8         PEAK FLOW RATE(CFS) =      14.01

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   2.99
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    106.00 =     941.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    450.00  DOWNSTREAM(FEET) =    423.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1184.00   CHANNEL SLOPE =  0.0224
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =  15.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.853
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        3.26      0.30     1.000    97
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      17.77
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.29
  AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   6.00
  Tc(MIN.) =   19.31
  SUBAREA AREA(ACRES) =     3.26       SUBAREA RUNOFF(CFS) =    7.49
  EFFECTIVE AREA(ACRES) =      8.08     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        8.1         PEAK FLOW RATE(CFS) =      18.56

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.52   FLOW VELOCITY(FEET/SEC.) =   3.35
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    107.00 =    2125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   19.31
  RAINFALL INTENSITY(INCH/HR) =   2.85
  AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       8.08
  TOTAL STREAM AREA(ACRES) =       8.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      18.56

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       22.04   18.70    2.905  0.30( 0.30) 1.00       9.4     100.00
      2       18.56   19.31    2.853  0.30( 0.30) 1.00       8.1     104.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       40.39   18.70    2.905  0.30( 0.30) 1.00      17.2     100.00
      2       40.16   19.31    2.853  0.30( 0.30) 1.00      17.5     104.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      40.39    Tc(MIN.) =    18.70
  EFFECTIVE AREA(ACRES) =      17.23   AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =       17.5
```

```
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    2615.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    423.50  DOWNSTREAM(FEET) =    422.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   143.00   CHANNEL SLOPE =  0.0070
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  15.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.826
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        0.43      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      40.88
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.56
  AVERAGE FLOW DEPTH(FEET) =   0.75   TRAVEL TIME(MIN.) =   0.93
  Tc(MIN.) =   19.63
  SUBAREA AREA(ACRES) =     0.43       SUBAREA RUNOFF(CFS) =    0.98
  EFFECTIVE AREA(ACRES) =     17.66     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =       17.9         PEAK FLOW RATE(CFS) =      40.39
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.74   FLOW VELOCITY(FEET/SEC.) =   2.56
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    203.00 =    2758.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       17.9  TC(MIN.) =     19.63
  EFFECTIVE AREA(ACRES) =     17.66  AREA-AVERAGED Fm(INCH/HR)=  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      40.39

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       40.39   19.63    2.826  0.30( 0.30) 1.00      17.7     100.00
      2       40.16   20.24    2.777  0.30( 0.30) 1.00      17.9     104.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
EXISTING CONDITION - STREAM B
100 YEAR STORM

 ----------------------------------------------------------------------------
   FILE NAME: NWAX100B.DAT
   TIME/DATE OF STUDY: 18:05 03/15/2016
 ============================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

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        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    456.50  DOWNSTREAM(FEET) =    448.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.071
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.536
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.36      0.30     0.100    76    6.07
  NATURAL POOR COVER
  "BARREN"                   B        0.12      0.30     1.000    97   10.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.325
  SUBAREA RUNOFF(CFS) =      2.35
  TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      2.35

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    448.00  DOWNSTREAM(FEET) =    439.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   535.00   CHANNEL SLOPE =  0.0168
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.250
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.73      0.30     0.100    76
  NATURAL POOR COVER
  "BARREN"                   B        0.24      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.323
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.18
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.51
```

```
  AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   3.56
  Tc(MIN.) =    9.63
  SUBAREA AREA(ACRES) =     0.97       SUBAREA RUNOFF(CFS) =    3.63
  EFFECTIVE AREA(ACRES) =      1.45     AREA-AVERAGED Fm(INCH/HR) =   0.10
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.32
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       5.42

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.33   FLOW VELOCITY(FEET/SEC.) =   2.73
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     835.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    439.00  DOWNSTREAM(FEET) =    422.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   818.00   CHANNEL SLOPE =  0.0202
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.463
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.10      0.30     0.100    76
  NATURAL POOR COVER
  "BARREN"                   B        0.37      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.327
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.65
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.29
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   4.14
  Tc(MIN.) =   13.77
  SUBAREA AREA(ACRES) =     1.47       SUBAREA RUNOFF(CFS) =    4.45
  EFFECTIVE AREA(ACRES) =      2.92     AREA-AVERAGED Fm(INCH/HR) =   0.10
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.32
  TOTAL AREA(ACRES) =        2.9         PEAK FLOW RATE(CFS) =       8.84

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.41   FLOW VELOCITY(FEET/SEC.) =   3.41
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1653.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.9  TC(MIN.) =     13.77
  EFFECTIVE AREA(ACRES) =      2.92  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.325
  PEAK FLOW RATE(CFS)   =       8.84
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
EXISTING CONDITION - STREAM C
100 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAX100C.DAT
   TIME/DATE OF STUDY: 18:39 03/15/2016
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

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

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

```
        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    535.00  DOWNSTREAM(FEET) =    489.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.187
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        0.77      0.30     1.000    97    7.49
  COMMERCIAL                 B        0.14      0.30     0.100    76    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.862
  SUBAREA RUNOFF(CFS) =      4.86
  TOTAL AREA(ACRES) =      0.91   PEAK FLOW RATE(CFS) =      4.86

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    489.40  DOWNSTREAM(FEET) =    478.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   544.00   CHANNEL SLOPE =  0.0195
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.045
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        4.46      0.30     1.000    97
  COMMERCIAL                 B        0.36      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.933
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.27
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.24
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```
  AVERAGE FLOW DEPTH(FEET) =   0.70   TRAVEL TIME(MIN.) =   2.14
  Tc(MIN.) =    7.14
  SUBAREA AREA(ACRES) =     4.82       SUBAREA RUNOFF(CFS) =   20.67
  EFFECTIVE AREA(ACRES) =      5.73     AREA-AVERAGED Fm(INCH/HR) =   0.28
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.92
  TOTAL AREA(ACRES) =        5.7         PEAK FLOW RATE(CFS) =      24.59

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.90   FLOW VELOCITY(FEET/SEC.) =   4.83
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     844.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    478.80  DOWNSTREAM(FEET) =    466.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   421.00   CHANNEL SLOPE =  0.0297
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.608
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.28      0.30     0.100    76
  NATURAL POOR COVER
  "BARREN"                   B        0.43      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.645
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      26.00
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.74
  AVERAGE FLOW DEPTH(FEET) =   0.83   TRAVEL TIME(MIN.) =   1.22
  Tc(MIN.) =    8.36
  SUBAREA AREA(ACRES) =     0.71       SUBAREA RUNOFF(CFS) =    2.82
  EFFECTIVE AREA(ACRES) =      6.44     AREA-AVERAGED Fm(INCH/HR) =   0.27
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.89
  TOTAL AREA(ACRES) =        6.4         PEAK FLOW RATE(CFS) =      25.16

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.81   FLOW VELOCITY(FEET/SEC.) =   5.68
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1265.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    466.30  DOWNSTREAM(FEET) =    454.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   601.00   CHANNEL SLOPE =  0.0205
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
```

```
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.081
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.61      0.30     0.100    76
  NATURAL POOR COVER
  "BARREN"                   B        0.92      0.30     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.641
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      27.84
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.08
  AVERAGE FLOW DEPTH(FEET) =   0.94   TRAVEL TIME(MIN.) =   1.97
  Tc(MIN.) =   10.33
  SUBAREA AREA(ACRES) =     1.53       SUBAREA RUNOFF(CFS) =    5.36
  EFFECTIVE AREA(ACRES) =      7.97     AREA-AVERAGED Fm(INCH/HR) =   0.25
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.84
  TOTAL AREA(ACRES) =        8.0         PEAK FLOW RATE(CFS) =      27.46

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.93   FLOW VELOCITY(FEET/SEC.) =   5.07
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =    1866.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.0  TC(MIN.) =     10.33
  EFFECTIVE AREA(ACRES) =      7.97  AREA-AVERAGED Fm(INCH/HR)=  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.843
  PEAK FLOW RATE(CFS)   =      27.46
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM A
100 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAQ100A.DAT
   TIME/DATE OF STUDY: 18:08 03/15/2016
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   30.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

```
        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   312.00
  ELEVATION DATA: UPSTREAM(FEET) =    482.80  DOWNSTREAM(FEET) =    472.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.097
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.062
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        0.77      0.30     0.350    76    7.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      3.44
  TOTAL AREA(ACRES) =      0.77   PEAK FLOW RATE(CFS) =      3.44

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   469.10  DOWNSTREAM(FEET) =   459.80
  FLOW LENGTH(FEET) =   244.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.29
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.44
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =    7.59
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =     556.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.59
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.872
```

```
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.52      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    2.23
  EFFECTIVE AREA(ACRES) =      1.29   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.3       PEAK FLOW RATE(CFS) =       5.53

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.59
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.872
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.38      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.38      SUBAREA RUNOFF(CFS) =    1.63
  EFFECTIVE AREA(ACRES) =      1.67   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.7       PEAK FLOW RATE(CFS) =       7.16

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   459.80  DOWNSTREAM(FEET) =   453.20
  FLOW LENGTH(FEET) =   207.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.53
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.16
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =    7.95
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =     763.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.95
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.744
```

```
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.11      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.11      SUBAREA RUNOFF(CFS) =    4.63
  EFFECTIVE AREA(ACRES) =      2.78   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.8       PEAK FLOW RATE(CFS) =      11.61

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   453.20  DOWNSTREAM(FEET) =   450.10
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.15
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.61
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    8.13
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =     875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    140.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.13
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.682
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.73      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.73      SUBAREA RUNOFF(CFS) =    3.01
  EFFECTIVE AREA(ACRES) =      3.51   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.5       PEAK FLOW RATE(CFS) =      14.46

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    140.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.13
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.682
  SUBAREA LOSS RATE DATA(AMC III):
```

```
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.80      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.80      SUBAREA RUNOFF(CFS) =    7.41
  EFFECTIVE AREA(ACRES) =      5.31   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        5.3       PEAK FLOW RATE(CFS) =      21.87

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    150.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   450.10  DOWNSTREAM(FEET) =   447.20
  FLOW LENGTH(FEET) =   377.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.27
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.87
  PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =    9.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    1252.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.419
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.89      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.89      SUBAREA RUNOFF(CFS) =    7.34
  EFFECTIVE AREA(ACRES) =      7.20   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        7.2       PEAK FLOW RATE(CFS) =      27.95

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   447.20  DOWNSTREAM(FEET) =   431.70
  FLOW LENGTH(FEET) =   934.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.3 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.42
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.95
  PIPE TRAVEL TIME(MIN.) =   1.49    Tc(MIN.) =   10.49
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    160.00 =    2186.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    160.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.49
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.046
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.61      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    5.71
  EFFECTIVE AREA(ACRES) =      8.81   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        8.8       PEAK FLOW RATE(CFS) =      31.25

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   431.70  DOWNSTREAM(FEET) =   426.50
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.43
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      31.25
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   10.70
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    170.00 =    2354.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.70
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.001
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.89      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
```

```
  SUBAREA AREA(ACRES) =    0.89      SUBAREA RUNOFF(CFS) =    3.12
  EFFECTIVE AREA(ACRES) =      9.70   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      34.01

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    290.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   426.50  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   124.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.67
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      34.01
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   10.91
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    290.00 =    2478.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    290.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.91
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.956
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.68      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.68      SUBAREA RUNOFF(CFS) =    2.36
  EFFECTIVE AREA(ACRES) =     10.38   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =       10.4       PEAK FLOW RATE(CFS) =      35.97

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    290.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.91
  RAINFALL INTENSITY(INCH/HR) =   3.96
  AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =      10.38
  TOTAL STREAM AREA(ACRES) =      10.38
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      35.97

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   214.00
  ELEVATION DATA: UPSTREAM(FEET) =    456.00  DOWNSTREAM(FEET) =    451.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.528
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.311
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        1.47      0.30     0.350    76    6.53
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      6.89
  TOTAL AREA(ACRES) =      1.47   PEAK FLOW RATE(CFS) =      6.89

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.00  DOWNSTREAM(FEET) =   446.00
  FLOW LENGTH(FEET) =   201.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.60
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.89
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    6.92
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    220.00 =     415.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.92
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.137
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.82      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
```

```
  SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    3.71
  EFFECTIVE AREA(ACRES) =      2.29   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.3       PEAK FLOW RATE(CFS) =      10.37

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   446.00  DOWNSTREAM(FEET) =   443.50
  FLOW LENGTH(FEET) =    23.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.48
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.37
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    6.94
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     438.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.94
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.127
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.57      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.57      SUBAREA RUNOFF(CFS) =    2.58
  EFFECTIVE AREA(ACRES) =      2.86   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.9       PEAK FLOW RATE(CFS) =      12.93

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.94
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.127
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.62      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
```

```
  SUBAREA AREA(ACRES) =    0.62      SUBAREA RUNOFF(CFS) =    2.80
  EFFECTIVE AREA(ACRES) =      3.48   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.5       PEAK FLOW RATE(CFS) =      15.73

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.50  DOWNSTREAM(FEET) =   442.50
  FLOW LENGTH(FEET) =    84.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.76
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.73
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    7.12
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    240.00 =     522.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    240.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.12
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.053
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.23      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.23      SUBAREA RUNOFF(CFS) =    1.02
  EFFECTIVE AREA(ACRES) =      3.71   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.7       PEAK FLOW RATE(CFS) =      16.52

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   442.50  DOWNSTREAM(FEET) =   438.80
  FLOW LENGTH(FEET) =   212.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.24
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.52
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    7.50
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    250.00 =     734.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.903
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.26      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.26      SUBAREA RUNOFF(CFS) =    5.44
  EFFECTIVE AREA(ACRES) =      4.97   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        5.0       PEAK FLOW RATE(CFS) =      21.46

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.80  DOWNSTREAM(FEET) =   435.40
  FLOW LENGTH(FEET) =   197.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.88
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.46
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =    7.84
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    260.00 =     931.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    260.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.84
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.783
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.10      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.10      SUBAREA RUNOFF(CFS) =    4.63
  EFFECTIVE AREA(ACRES) =      6.07   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        6.1       PEAK FLOW RATE(CFS) =      25.56
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   435.40  DOWNSTREAM(FEET) =   432.80
  FLOW LENGTH(FEET) =   152.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.13
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.56
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    8.09
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    270.00 =    1083.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.09
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.698
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.69      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    2.85
  EFFECTIVE AREA(ACRES) =      6.76   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        6.8       PEAK FLOW RATE(CFS) =      27.94

****************************************************************************
  FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.09
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.698
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.19      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.79
  EFFECTIVE AREA(ACRES) =      6.95   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        7.0       PEAK FLOW RATE(CFS) =      28.73

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

```
  FLOW PROCESS FROM NODE    270.00 TO NODE    280.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   432.80  DOWNSTREAM(FEET) =   431.70
  FLOW LENGTH(FEET) =    62.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.76
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      28.73
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    8.18
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    280.00 =    1145.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    280.00 TO NODE    280.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.18
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.666
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.12      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.12      SUBAREA RUNOFF(CFS) =    0.49
  EFFECTIVE AREA(ACRES) =      7.07   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        7.1       PEAK FLOW RATE(CFS) =      29.02

****************************************************************************
  FLOW PROCESS FROM NODE    280.00 TO NODE    290.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   431.70  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   419.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.33
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      29.02
  PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =    8.86
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    290.00 =    1564.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    290.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.86
  RAINFALL INTENSITY(INCH/HR) =   4.46
  AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       7.07
  TOTAL STREAM AREA(ACRES) =       7.07
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      29.02

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       35.97   10.91    3.956  0.30( 0.11) 0.35      10.4     100.00
      2       29.02    8.86    4.459  0.30( 0.11) 0.35       7.1     200.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       62.03    8.86    4.459  0.30( 0.11) 0.35      15.5     200.00
      2       61.64   10.91    3.956  0.30( 0.10) 0.35      17.5     100.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      62.03    Tc(MIN.) =     8.86
  EFFECTIVE AREA(ACRES) =      15.49   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    290.00 =    2478.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    290.00 TO NODE    550.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   422.50
  FLOW LENGTH(FEET) =   163.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  27.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.92
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      62.03
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =    9.09
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    550.00 =    2641.00 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       17.5  TC(MIN.) =      9.09
  EFFECTIVE AREA(ACRES) =     15.49  AREA-AVERAGED Fm(INCH/HR)=  0.10
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =      62.03

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       62.03    9.09    4.394  0.30( 0.11) 0.35      15.5     200.00
      2       61.64   11.14    3.909  0.30( 0.10) 0.35      17.5     100.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM B
100 YEAR STORM

 ----------------------------------------------------------------------------
   FILE NAME: NWAQ100B.DAT
   TIME/DATE OF STUDY: 18:10 03/15/2016
 ============================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   52.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0313 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

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        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    510.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   213.00
  ELEVATION DATA: UPSTREAM(FEET) =    456.60  DOWNSTREAM(FEET) =    453.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.938
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.607
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.36      0.30     0.100    76    5.94
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.81
  TOTAL AREA(ACRES) =      0.36   PEAK FLOW RATE(CFS) =      1.81

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    520.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  453.20  DOWNSTREAM ELEVATION(FEET) =  449.00
  STREET LENGTH(FEET) =   233.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  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 =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.67

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.82
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
```

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    HALFSTREET FLOOD WIDTH(FEET) =    8.24
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
  STREET FLOW TRAVEL TIME(MIN.) =   1.29   Tc(MIN.) =    7.22
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.011
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.45      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.45      SUBAREA RUNOFF(CFS) =    2.02
  EFFECTIVE AREA(ACRES) =      0.81    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       3.63

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =   9.29
  FLOW VELOCITY(FEET/SEC.) =  3.20   DEPTH*VELOCITY(FT*FT/SEC.) =   1.15
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    520.00 =     446.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    520.00 TO NODE    530.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  449.00  DOWNSTREAM ELEVATION(FEET) =  438.30
  STREET LENGTH(FEET) =   611.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  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 =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.67

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.81
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.41
    HALFSTREET FLOOD WIDTH(FEET) =   11.58
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.50
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.43
  STREET FLOW TRAVEL TIME(MIN.) =   2.91   Tc(MIN.) =   10.13
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.128
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  COMMERCIAL                  B        1.18      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.18      SUBAREA RUNOFF(CFS) =    4.35
  EFFECTIVE AREA(ACRES) =      1.99    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =       7.34

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  12.81
  FLOW VELOCITY(FEET/SEC.) =  3.69   DEPTH*VELOCITY(FT*FT/SEC.) =   1.61
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    530.00 =    1057.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    530.00 TO NODE    540.00 IS CODE =  63
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  438.30  DOWNSTREAM ELEVATION(FEET) =  427.50
  STREET LENGTH(FEET) =   600.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.022
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.022

  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 =   0.0170
  MAXIMUM ALLOWABLE STREET FLOW DEPTH(FEET) =   0.67

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.24
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   13.98
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.95
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.83
  STREET FLOW TRAVEL TIME(MIN.) =   2.53   Tc(MIN.) =   12.66
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.633
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.17      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.17      SUBAREA RUNOFF(CFS) =    3.79
  EFFECTIVE AREA(ACRES) =      3.16    AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.2        PEAK FLOW RATE(CFS) =      10.25
```

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  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.48   HALFSTREET FLOOD WIDTH(FEET) =  14.63
  FLOW VELOCITY(FEET/SEC.) =  4.04   DEPTH*VELOCITY(FT*FT/SEC.) =   1.92
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    540.00 =    1657.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.2  TC(MIN.) =     12.66
  EFFECTIVE AREA(ACRES) =      3.16  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      10.25
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
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****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM C
100 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAQ100C.DAT
   TIME/DATE OF STUDY: 18:26 03/15/2016
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   46.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0313 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

```
        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    535.00  DOWNSTREAM(FEET) =    489.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.187
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        0.77      0.30     1.000    97    7.49
  COMMERCIAL                 B        0.14      0.30     0.100    76    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.862
  SUBAREA RUNOFF(CFS) =      4.86
  TOTAL AREA(ACRES) =      0.91   PEAK FLOW RATE(CFS) =      4.86

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    489.40  DOWNSTREAM(FEET) =    484.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   282.00   CHANNEL SLOPE =  0.0191
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.491
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        3.25      0.30     1.000    97
  COMMERCIAL                 B        0.28      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.929
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.16
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.06
```

```
  AVERAGE FLOW DEPTH(FEET) =   0.65   TRAVEL TIME(MIN.) =   1.16
  Tc(MIN.) =    6.16
  SUBAREA AREA(ACRES) =     3.53       SUBAREA RUNOFF(CFS) =   16.56
  EFFECTIVE AREA(ACRES) =      4.44     AREA-AVERAGED Fm(INCH/HR) =   0.27
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.91
  TOTAL AREA(ACRES) =        4.4         PEAK FLOW RATE(CFS) =      20.85

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.83   FLOW VELOCITY(FEET/SEC.) =   4.60
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =     582.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   480.00  DOWNSTREAM(FEET) =   475.00
  FLOW LENGTH(FEET) =   199.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.17
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.85
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    6.45
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =     781.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.45
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.345
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                B        0.97      0.30     0.850    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.97      SUBAREA RUNOFF(CFS) =    4.44
  EFFECTIVE AREA(ACRES) =      5.41   AREA-AVERAGED Fm(INCH/HR) =  0.27
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =        5.4       PEAK FLOW RATE(CFS) =      24.71

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    340.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   475.00  DOWNSTREAM(FEET) =   471.00
  FLOW LENGTH(FEET) =   163.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.70
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.71
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =    6.69
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    340.00 =     944.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.69
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.238
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.29      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.29      SUBAREA RUNOFF(CFS) =    1.34
  EFFECTIVE AREA(ACRES) =      5.70   AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.88
  TOTAL AREA(ACRES) =        5.7       PEAK FLOW RATE(CFS) =      25.52

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    350.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   471.00  DOWNSTREAM(FEET) =   466.00
  FLOW LENGTH(FEET) =   204.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.77
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.52
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    6.98
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    350.00 =    1148.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    350.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.98
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.113
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.67      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.67      SUBAREA RUNOFF(CFS) =    3.02
  EFFECTIVE AREA(ACRES) =      6.37   AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.82
  TOTAL AREA(ACRES) =        6.4       PEAK FLOW RATE(CFS) =      27.90

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   466.00  DOWNSTREAM(FEET) =   463.30
  FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.54
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.90
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    7.15
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    360.00 =    1268.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    360.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.15
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.041
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        0.29      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.29      SUBAREA RUNOFF(CFS) =    1.29
  EFFECTIVE AREA(ACRES) =      6.66   AREA-AVERAGED Fm(INCH/HR) =  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.80
  TOTAL AREA(ACRES) =        6.7       PEAK FLOW RATE(CFS) =      28.78
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.7  TC(MIN.) =      7.15
  EFFECTIVE AREA(ACRES) =      6.66  AREA-AVERAGED Fm(INCH/HR)=  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.799
  PEAK FLOW RATE(CFS)   =      28.78
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM D
100 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: NWAQ100D.DAT
   TIME/DATE OF STUDY: 18:28 03/15/2016
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   46.0     20.0    0.022/0.022/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

```
        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   212.00
  ELEVATION DATA: UPSTREAM(FEET) =    467.00  DOWNSTREAM(FEET) =    461.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.259
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.440
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        0.17      0.30     0.350    76    6.26
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      0.82
  TOTAL AREA(ACRES) =      0.17   PEAK FLOW RATE(CFS) =      0.82

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   458.00  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =   391.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.94
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.82
  PIPE TRAVEL TIME(MIN.) =   1.65    Tc(MIN.) =    7.91
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =     603.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    420.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.91
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.756
```

```
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               B        1.37      0.30     0.350    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.37      SUBAREA RUNOFF(CFS) =    5.74
  EFFECTIVE AREA(ACRES) =      1.54   AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.5       PEAK FLOW RATE(CFS) =       6.45
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      7.91
  EFFECTIVE AREA(ACRES) =      1.54  AREA-AVERAGED Fm(INCH/HR)=  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =       6.45
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

# Appendix C – Proposed Condition Hydrograph and Detention Basin Calculations

See Attached Exhibit

**SP7531 Western Alton Parcel - North Parcel - HYDROGRAPH PARAMETERS**
**AES CH1 - Small Area Unit Hydrograph/Detention Basin Analysis**

**25 YEAR STORM**

| P 24 (in) | CN | S | Ia | Y | Ybar | Fm | Total A | Ap | Fp | Tc | Calib. Coef. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.49 | 56 | 7.857 | 1.571 | 0.176 | 0.824 | 0.105 | 17.45 | 0.35 | 0.30 | 9.26 | 0.84 |

**100 YEAR STORM**

| P 24 (in) | CN | S | Ia | Y | Ybar | Fm | Total A | Ap | Fp | Tc | Calib. Coef. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.63 | 76 | 3.158 | 0.632 | 0.544 | 0.456 | 0.105 | 17.45 | 0.35 | 0.30 | 9.26 | 0.84 |

**Basin 1**

| | |
|---|---|
| circular orifice diameter (in) = | 18 |
| orifice center elevation = | 416.25 |
| inlet lip elevation = | 421.25 |

| Elevation | Area (sf) | Area (ac) | Inc. Vol (af) | Total. Vol (af) | discharge Q (cfs) | depth |
|---|---|---|---|---|---|---|
| 419 | 18555 | 0.4260 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 420 | 20344 | 0.4670 | 0.4465 | 0.4465 | 0.00 | 1.00 |
| 421 | 22190 | 0.5094 | 0.4882 | 0.9347 | 0.00 | 2.00 |
| 421.25 | 22660 | 0.5202 | 0.1287 | 1.0634 | 0.00 | 2.25 |
| 421.5 | 23134 | 0.5311 | 0.1314 | 1.1948 | 21.12 | 2.50 |
| 422 | 24092 | 0.5531 | 0.2710 | 1.4659 | 22.10 | 3.00 |
| 422.5 | 25065 | 0.5754 | 0.2821 | 1.7480 | 23.04 | 3.50 |
| 423 | 26051 | 0.5980 | 0.2934 | 2.0414 | 23.95 | 4.00 |
| 423.5 | 27052 | 0.6210 | 0.3048 | 2.3461 | 24.82 | 4.50 |
| 424 | 28066 | 0.6443 | 0.3163 | 2.6625 | 25.66 | 5.00 |

$$Qw = CLHw^{1.5}$$

$$Qo = KA\sqrt{2gHo}$$

Qw = Weir Outflow (cfs)
C = Weir Coef., 3.5
L = Weir Width (ft)
Hw = Water height above Weir (ft)

Qo = Orifice Outflow (cfs)
Ho = Water height above orifice center (ft
K = Orifice flow coef., 0.65
A = Cross sectional area of orifice (ft^2)
g = gravitational accel., 32.2 ft/sec^2

```
*****************************************************************************
           NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                     AND LOW LOSS FRACTION ESTIMATIONS
=============================================================================
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                          Analysis prepared by:

                             TAIT & ASSOCIATES


*****************************************************************************
-----------------------------------------------------------------------------

 Problem Descriptions:
  WESTERN ALTON PARCEL - NORTH PARCEL
  PROPOSED CONDITION - STREAM A
  25 YEAR STORM
-----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.84
    TOTAL CATCHMENT AREA(ACRES) =   17.45
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.105
    LOW LOSS FRACTION = 0.824
    TIME OF CONCENTRATION(MIN.) =  9.26
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  25
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.87
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.15
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.94
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.71
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  4.49

-----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.95
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     3.58

*****************************************************************************
  TIME     VOLUME       Q    0.       12.5      25.0      37.5      50.0
 (HOURS)    (AF)      (CFS)
-----------------------------------------------------------------------------
  0.10      0.0008      0.18  Q         .         .         .         .
  0.26      0.0030      0.18  Q         .         .         .         .
  0.41      0.0053      0.18  Q         .         .         .         .
  0.57      0.0075      0.18  Q         .         .         .         .
  0.72      0.0098      0.18  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.88 | 0.0121 | 0.18 | Q | . | . | . | . |
| 1.03 | 0.0144 | 0.18 | Q | . | . | . | . |
| 1.18 | 0.0168 | 0.18 | Q | . | . | . | . |
| 1.34 | 0.0191 | 0.18 | Q | . | . | . | . |
| 1.49 | 0.0215 | 0.19 | Q | . | . | . | . |
| 1.65 | 0.0239 | 0.19 | Q | . | . | . | . |
| 1.80 | 0.0263 | 0.19 | Q | . | . | . | . |
| 1.96 | 0.0287 | 0.19 | Q | . | . | . | . |
| 2.11 | 0.0311 | 0.19 | Q | . | . | . | . |
| 2.26 | 0.0336 | 0.19 | Q | . | . | . | . |
| 2.42 | 0.0360 | 0.19 | Q | . | . | . | . |
| 2.57 | 0.0385 | 0.20 | Q | . | . | . | . |
| 2.73 | 0.0410 | 0.20 | Q | . | . | . | . |
| 2.88 | 0.0435 | 0.20 | Q | . | . | . | . |
| 3.04 | 0.0461 | 0.20 | Q | . | . | . | . |
| 3.19 | 0.0486 | 0.20 | Q | . | . | . | . |
| 3.34 | 0.0512 | 0.20 | Q | . | . | . | . |
| 3.50 | 0.0538 | 0.20 | Q | . | . | . | . |
| 3.65 | 0.0564 | 0.21 | Q | . | . | . | . |
| 3.81 | 0.0591 | 0.21 | Q | . | . | . | . |
| 3.96 | 0.0617 | 0.21 | Q | . | . | . | . |
| 4.12 | 0.0644 | 0.21 | Q | . | . | . | . |
| 4.27 | 0.0671 | 0.21 | Q | . | . | . | . |
| 4.42 | 0.0698 | 0.21 | Q | . | . | . | . |
| 4.58 | 0.0726 | 0.22 | Q | . | . | . | . |
| 4.73 | 0.0753 | 0.22 | Q | . | . | . | . |
| 4.89 | 0.0781 | 0.22 | Q | . | . | . | . |
| 5.04 | 0.0809 | 0.22 | Q | . | . | . | . |
| 5.20 | 0.0838 | 0.22 | Q | . | . | . | . |
| 5.35 | 0.0867 | 0.23 | Q | . | . | . | . |
| 5.51 | 0.0896 | 0.23 | Q | . | . | . | . |
| 5.66 | 0.0925 | 0.23 | Q | . | . | . | . |
| 5.81 | 0.0954 | 0.23 | Q | . | . | . | . |
| 5.97 | 0.0984 | 0.23 | Q | . | . | . | . |
| 6.12 | 0.1014 | 0.24 | Q | . | . | . | . |
| 6.28 | 0.1044 | 0.24 | Q | . | . | . | . |
| 6.43 | 0.1075 | 0.24 | Q | . | . | . | . |
| 6.59 | 0.1106 | 0.24 | Q | . | . | . | . |
| 6.74 | 0.1137 | 0.25 | Q | . | . | . | . |
| 6.89 | 0.1169 | 0.25 | Q | . | . | . | . |
| 7.05 | 0.1201 | 0.25 | Q | . | . | . | . |
| 7.20 | 0.1233 | 0.26 | Q | . | . | . | . |
| 7.36 | 0.1266 | 0.26 | Q | . | . | . | . |
| 7.51 | 0.1299 | 0.26 | Q | . | . | . | . |
| 7.67 | 0.1333 | 0.26 | Q | . | . | . | . |
| 7.82 | 0.1366 | 0.27 | Q | . | . | . | . |
| 7.97 | 0.1401 | 0.27 | Q | . | . | . | . |
| 8.13 | 0.1435 | 0.27 | Q | . | . | . | . |
| 8.28 | 0.1470 | 0.28 | Q | . | . | . | . |
| 8.44 | 0.1506 | 0.28 | Q | . | . | . | . |
| 8.59 | 0.1542 | 0.28 | Q | . | . | . | . |
| 8.75 | 0.1578 | 0.29 | Q | . | . | . | . |

```
 8.90      0.1615      0.29  Q         .         .         .         .
 9.05      0.1652      0.30  Q         .         .         .         .
 9.21      0.1690      0.30  Q         .         .         .         .
 9.36      0.1729      0.30  Q         .         .         .         .
 9.52      0.1768      0.31  Q         .         .         .         .
 9.67      0.1808      0.31  Q         .         .         .         .
 9.83      0.1848      0.32  Q         .         .         .         .
 9.98      0.1889      0.32  Q         .         .         .         .
10.14      0.1930      0.33  Q         .         .         .         .
10.29      0.1974      0.36  Q         .         .         .         .
10.44      0.2022      0.38  Q         .         .         .         .
10.60      0.2074      0.43  Q         .         .         .         .
10.75      0.2130      0.45  Q         .         .         .         .
10.91      0.2191      0.50  Q         .         .         .         .
11.06      0.2257      0.53  Q         .         .         .         .
11.22      0.2327      0.58  Q         .         .         .         .
11.37      0.2404      0.61  Q         .         .         .         .
11.52      0.2486      0.67  Q         .         .         .         .
11.68      0.2574      0.71  Q         .         .         .         .
11.83      0.2668      0.77  Q         .         .         .         .
11.99      0.2769      0.81  Q         .         .         .         .
12.14      0.2921      1.57  .Q        .         .         .         .
12.30      0.3131      1.71  .Q        .         .         .         .
12.45      0.3356      1.81  .Q        .         .         .         .
12.60      0.3589      1.86  .Q        .         .         .         .
12.76      0.3833      1.96  .Q        .         .         .         .
12.91      0.4087      2.02  .Q        .         .         .         .
13.07      0.4353      2.14  .Q        .         .         .         .
13.22      0.4630      2.21  .Q        .         .         .         .
13.38      0.4922      2.35  .Q        .         .         .         .
13.53      0.5227      2.43  .Q        .         .         .         .
13.68      0.5548      2.60  . Q       .         .         .         .
13.84      0.5886      2.70  . Q       .         .         .         .
13.99      0.6244      2.91  . Q       .         .         .         .
14.15      0.6621      3.00  . Q       .         .         .         .
14.30      0.7018      3.23  . Q       .         .         .         .
14.46      0.7439      3.38  . Q       .         .         .         .
14.61      0.7892      3.72  . Q       .         .         .         .
14.77      0.8380      3.92  .  Q      .         .         .         .
14.92      0.8911      4.40  .  Q      .         .         .         .
15.07      0.9491      4.69  .  Q      .         .         .         .
15.23      1.0136      5.42  .   Q     .         .         .         .
15.38      1.0858      5.90  .   Q     .         .         .         .
15.54      1.1614      5.95  .   Q     .         .         .         .
15.69      1.2434      6.91  .    Q    .         .         .         .
15.85      1.3599     11.35  .        Q.         .         .         .
16.00      1.5334     15.86  .         . Q       .         .         .
16.15      1.9413     48.09  .         .         .         .       Q .
16.31      2.3021      8.49  .     Q   .         .         .         .
16.46      2.3938      5.88  .   Q     .         .         .         .
16.62      2.4634      5.03  .   Q     .         .         .         .
16.77      2.5219      4.15  .  Q      .         .         .         .
```

```
 16.93      2.5709      3.54  . Q       .         .         .         .
 17.08      2.6132      3.09  . Q       .         .         .         .
 17.23      2.6508      2.80  . Q       .         .         .         .
 17.39      2.6847      2.52  . Q       .         .         .         .
 17.54      2.7153      2.28  .Q        .         .         .         .
 17.70      2.7431      2.08  .Q        .         .         .         .
 17.85      2.7686      1.91  .Q        .         .         .         .
 18.01      2.7920      1.76  .Q        .         .         .         .
 18.16      2.8086      0.85  Q         .         .         .         .
 18.32      2.8187      0.74  Q         .         .         .         .
 18.47      2.8275      0.64  Q         .         .         .         .
 18.62      2.8352      0.56  Q         .         .         .         .
 18.78      2.8418      0.48  Q         .         .         .         .
 18.93      2.8474      0.41  Q         .         .         .         .
 19.09      2.8522      0.34  Q         .         .         .         .
 19.24      2.8564      0.32  Q         .         .         .         .
 19.40      2.8604      0.31  Q         .         .         .         .
 19.55      2.8643      0.30  Q         .         .         .         .
 19.70      2.8681      0.29  Q         .         .         .         .
 19.86      2.8718      0.29  Q         .         .         .         .
 20.01      2.8754      0.28  Q         .         .         .         .
 20.17      2.8789      0.27  Q         .         .         .         .
 20.32      2.8823      0.27  Q         .         .         .         .
 20.48      2.8857      0.26  Q         .         .         .         .
 20.63      2.8889      0.25  Q         .         .         .         .
 20.78      2.8921      0.25  Q         .         .         .         .
 20.94      2.8953      0.24  Q         .         .         .         .
 21.09      2.8983      0.24  Q         .         .         .         .
 21.25      2.9013      0.23  Q         .         .         .         .
 21.40      2.9043      0.23  Q         .         .         .         .
 21.56      2.9072      0.22  Q         .         .         .         .
 21.71      2.9100      0.22  Q         .         .         .         .
 21.86      2.9128      0.22  Q         .         .         .         .
 22.02      2.9156      0.21  Q         .         .         .         .
 22.17      2.9183      0.21  Q         .         .         .         .
 22.33      2.9209      0.21  Q         .         .         .         .
 22.48      2.9235      0.20  Q         .         .         .         .
 22.64      2.9261      0.20  Q         .         .         .         .
 22.79      2.9287      0.20  Q         .         .         .         .
 22.94      2.9312      0.19  Q         .         .         .         .
 23.10      2.9336      0.19  Q         .         .         .         .
 23.25      2.9361      0.19  Q         .         .         .         .
 23.41      2.9385      0.19  Q         .         .         .         .
 23.56      2.9408      0.18  Q         .         .         .         .
 23.72      2.9432      0.18  Q         .         .         .         .
 23.87      2.9455      0.18  Q         .         .         .         .
 24.03      2.9477      0.18  Q         .         .         .         .
 24.18      2.9489      0.00  Q         .         .         .         .
 ------------------------------------------------------------------------
-----------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
```

(Note: 100% of Peak Flow Rate estimate assumed to have an instantaneous time duration)

| Percentile of Estimated Peak Flow Rate | Duration (minutes) |
|---|---|
| 0% | 1444.6 |
| 10% | 92.6 |
| 20% | 27.8 |
| 30% | 18.5 |
| 40% | 9.3 |
| 50% | 9.3 |
| 60% | 9.3 |
| 70% | 9.3 |
| 80% | 9.3 |
| 90% | 9.3 |

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.260
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                __effective depth
            -------------          |   (and volume)
            |           |    |     |
            | detention |    |....V.............
            |   basin   |<-->|          outflow
            |           |    |.........________
            -------------    |         |   \
                  |          | storage |     basin outlet
                  V          -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 12

| *BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) | **BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) |
|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.000** | 1.000 | 0.447 | 0.000* |
| 2.000 | 0.935 | 0.000** | 2.250 | 1.063 | 0.000* |
| 2.500 | 1.195 | 21.120** | 3.000 | 1.466 | 22.100* |

```
*      3.500      1.748     23.040**      4.000      2.041     23.950*
*      4.500      2.346     24.820**      5.000      2.662     25.660*
*      4.500      0.940     27.160**      5.000      1.101     28.370*
-------------------------------------------------------------------------
     BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
      INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
       NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
           1     0.00       0.00000      0.00000
           2     1.00       0.44650      0.44650
           3     2.00       0.93470      0.93470
           4     2.25       1.06340      1.06340
           5     2.50       1.06011      1.32949
           6     3.00       1.32496      1.60684
           7     3.50       1.60106      1.89494
           8     4.00       1.88866      2.19414
           9     4.50       2.18781      2.50439
          10     5.00       2.49886      2.82614
          11     4.50       0.76679      1.11321
          12     5.00       0.92007      1.28193
     WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)
-------------------------------------------------------------------------
     DETENTION BASIN ROUTING RESULTS:
     NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
           OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
           AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

       TIME  DEAD-STORAGE  INFLOW  EFFECTIVE  OUTFLOW  EFFECTIVE
      (HRS)   FILLED(AF)    (CFS)  DEPTH(FT)   (CFS)   VOLUME(AF)
-------------------------------------------------------------------------
      0.104        0.000     0.18      0.01     0.00      0.002
      0.258        0.000     0.18      0.01     0.00      0.004
      0.412        0.000     0.18      0.02     0.00      0.007
      0.567        0.000     0.18      0.02     0.00      0.009
      0.721        0.000     0.18      0.03     0.00      0.011
      0.875        0.000     0.18      0.03     0.00      0.014
      1.030        0.000     0.18      0.04     0.00      0.016
      1.184        0.000     0.18      0.04     0.00      0.018
      1.338        0.000     0.18      0.05     0.00      0.021
      1.493        0.000     0.19      0.05     0.00      0.023
      1.647        0.000     0.19      0.06     0.00      0.025
      1.801        0.000     0.19      0.06     0.00      0.028
      1.956        0.000     0.19      0.07     0.00      0.030
      2.110        0.000     0.19      0.07     0.00      0.033
      2.264        0.000     0.19      0.08     0.00      0.035
      2.419        0.000     0.19      0.08     0.00      0.038
      2.573        0.000     0.20      0.09     0.00      0.040
      2.727        0.000     0.20      0.10     0.00      0.043
      2.882        0.000     0.20      0.10     0.00      0.045
      3.036        0.000     0.20      0.11     0.00      0.048
      3.190        0.000     0.20      0.11     0.00      0.050
      3.345        0.000     0.20      0.12     0.00      0.053
      3.499        0.000     0.20      0.12     0.00      0.055
```

| | | | | | |
|---|---|---|---|---|---|
| 3.653 | 0.000 | 0.21 | 0.13 | 0.00 | 0.058 |
| 3.808 | 0.000 | 0.21 | 0.14 | 0.00 | 0.061 |
| 3.962 | 0.000 | 0.21 | 0.14 | 0.00 | 0.063 |
| 4.116 | 0.000 | 0.21 | 0.15 | 0.00 | 0.066 |
| 4.271 | 0.000 | 0.21 | 0.15 | 0.00 | 0.069 |
| 4.425 | 0.000 | 0.21 | 0.16 | 0.00 | 0.072 |
| 4.579 | 0.000 | 0.22 | 0.17 | 0.00 | 0.074 |
| 4.734 | 0.000 | 0.22 | 0.17 | 0.00 | 0.077 |
| 4.888 | 0.000 | 0.22 | 0.18 | 0.00 | 0.080 |
| 5.042 | 0.000 | 0.22 | 0.19 | 0.00 | 0.083 |
| 5.197 | 0.000 | 0.22 | 0.19 | 0.00 | 0.086 |
| 5.351 | 0.000 | 0.23 | 0.20 | 0.00 | 0.088 |
| 5.505 | 0.000 | 0.23 | 0.20 | 0.00 | 0.091 |
| 5.660 | 0.000 | 0.23 | 0.21 | 0.00 | 0.094 |
| 5.814 | 0.000 | 0.23 | 0.22 | 0.00 | 0.097 |
| 5.968 | 0.000 | 0.23 | 0.22 | 0.00 | 0.100 |
| 6.123 | 0.000 | 0.24 | 0.23 | 0.00 | 0.103 |
| 6.277 | 0.000 | 0.24 | 0.24 | 0.00 | 0.106 |
| 6.431 | 0.000 | 0.24 | 0.25 | 0.00 | 0.109 |
| 6.586 | 0.000 | 0.24 | 0.25 | 0.00 | 0.113 |
| 6.740 | 0.000 | 0.25 | 0.26 | 0.00 | 0.116 |
| 6.894 | 0.000 | 0.25 | 0.27 | 0.00 | 0.119 |
| 7.049 | 0.000 | 0.25 | 0.27 | 0.00 | 0.122 |
| 7.203 | 0.000 | 0.26 | 0.28 | 0.00 | 0.125 |
| 7.357 | 0.000 | 0.26 | 0.29 | 0.00 | 0.129 |
| 7.512 | 0.000 | 0.26 | 0.30 | 0.00 | 0.132 |
| 7.666 | 0.000 | 0.26 | 0.30 | 0.00 | 0.135 |
| 7.820 | 0.000 | 0.27 | 0.31 | 0.00 | 0.139 |
| 7.975 | 0.000 | 0.27 | 0.32 | 0.00 | 0.142 |
| 8.129 | 0.000 | 0.27 | 0.33 | 0.00 | 0.146 |
| 8.283 | 0.000 | 0.28 | 0.33 | 0.00 | 0.149 |
| 8.438 | 0.000 | 0.28 | 0.34 | 0.00 | 0.153 |
| 8.592 | 0.000 | 0.28 | 0.35 | 0.00 | 0.156 |
| 8.746 | 0.000 | 0.29 | 0.36 | 0.00 | 0.160 |
| 8.901 | 0.000 | 0.29 | 0.37 | 0.00 | 0.164 |
| 9.055 | 0.000 | 0.30 | 0.38 | 0.00 | 0.167 |
| 9.209 | 0.000 | 0.30 | 0.38 | 0.00 | 0.171 |
| 9.364 | 0.000 | 0.30 | 0.39 | 0.00 | 0.175 |
| 9.518 | 0.000 | 0.31 | 0.40 | 0.00 | 0.179 |
| 9.672 | 0.000 | 0.31 | 0.41 | 0.00 | 0.183 |
| 9.827 | 0.000 | 0.32 | 0.42 | 0.00 | 0.187 |
| 9.981 | 0.000 | 0.32 | 0.43 | 0.00 | 0.191 |
| 10.135 | 0.000 | 0.33 | 0.44 | 0.00 | 0.195 |
| 10.290 | 0.000 | 0.36 | 0.45 | 0.00 | 0.200 |
| 10.444 | 0.000 | 0.38 | 0.46 | 0.00 | 0.205 |
| 10.598 | 0.000 | 0.43 | 0.47 | 0.00 | 0.210 |
| 10.753 | 0.000 | 0.45 | 0.48 | 0.00 | 0.216 |
| 10.907 | 0.000 | 0.50 | 0.50 | 0.00 | 0.223 |
| 11.061 | 0.000 | 0.53 | 0.51 | 0.00 | 0.229 |
| 11.216 | 0.000 | 0.58 | 0.53 | 0.00 | 0.237 |
| 11.370 | 0.000 | 0.61 | 0.55 | 0.00 | 0.245 |
| 11.524 | 0.000 | 0.67 | 0.57 | 0.00 | 0.253 |

| | | | | | |
|---|---|---|---|---|---|
| 11.679 | 0.000 | 0.71 | 0.59 | 0.00 | 0.262 |
| 11.833 | 0.000 | 0.77 | 0.61 | 0.00 | 0.272 |
| 11.987 | 0.000 | 0.81 | 0.63 | 0.00 | 0.282 |
| 12.142 | 0.000 | 1.57 | 0.68 | 0.00 | 0.303 |
| 12.296 | 0.000 | 1.71 | 0.73 | 0.00 | 0.324 |
| 12.450 | 0.000 | 1.81 | 0.78 | 0.00 | 0.347 |
| 12.605 | 0.000 | 1.86 | 0.83 | 0.00 | 0.371 |
| 12.759 | 0.000 | 1.96 | 0.89 | 0.00 | 0.396 |
| 12.913 | 0.000 | 2.02 | 0.95 | 0.00 | 0.422 |
| 13.068 | 0.000 | 2.14 | 1.01 | 0.00 | 0.449 |
| 13.222 | 0.000 | 2.21 | 1.06 | 0.00 | 0.478 |
| 13.376 | 0.000 | 2.35 | 1.13 | 0.00 | 0.508 |
| 13.531 | 0.000 | 2.43 | 1.19 | 0.00 | 0.539 |
| 13.685 | 0.000 | 2.60 | 1.26 | 0.00 | 0.572 |
| 13.839 | 0.000 | 2.70 | 1.33 | 0.00 | 0.606 |
| 13.994 | 0.000 | 2.91 | 1.40 | 0.00 | 0.643 |
| 14.148 | 0.000 | 3.00 | 1.48 | 0.00 | 0.682 |
| 14.302 | 0.000 | 3.23 | 1.57 | 0.00 | 0.723 |
| 14.457 | 0.000 | 3.38 | 1.65 | 0.00 | 0.766 |
| 14.611 | 0.000 | 3.72 | 1.75 | 0.00 | 0.813 |
| 14.765 | 0.000 | 3.92 | 1.85 | 0.00 | 0.863 |
| 14.920 | 0.000 | 4.40 | 1.97 | 0.00 | 0.920 |
| 15.074 | 0.000 | 4.69 | 2.09 | 0.00 | 0.979 |
| 15.228 | 0.000 | 5.42 | 2.22 | 0.00 | 1.049 |
| 15.383 | 0.000 | 5.90 | 2.31 | 2.40 | 1.093 |
| 15.537 | 0.000 | 5.95 | 2.32 | 5.38 | 1.101 |
| 15.691 | 0.000 | 6.91 | 2.33 | 6.45 | 1.106 |
| 15.846 | 0.000 | 11.35 | 2.38 | 9.16 | 1.134 |
| 16.000 | 0.000 | 15.86 | 2.44 | 13.66 | 1.162 |
| 16.154 | 0.000 | 48.09 | 3.12 | 19.12 | 1.532 |
| 16.309 | 0.000 | 8.49 | 2.80 | 22.02 | 1.359 |
| 16.463 | 0.000 | 5.88 | 2.47 | 20.09 | 1.178 |
| 16.617 | 0.000 | 5.03 | 2.31 | 11.66 | 1.094 |
| 16.772 | 0.000 | 4.15 | 2.30 | 4.50 | 1.089 |
| 16.926 | 0.000 | 3.54 | 2.29 | 3.84 | 1.085 |
| 17.080 | 0.000 | 3.09 | 2.29 | 3.31 | 1.083 |
| 17.235 | 0.000 | 2.80 | 2.28 | 2.94 | 1.081 |
| 17.389 | 0.000 | 2.52 | 2.28 | 2.65 | 1.079 |
| 17.543 | 0.000 | 2.28 | 2.28 | 2.40 | 1.078 |
| 17.698 | 0.000 | 2.08 | 2.27 | 2.18 | 1.076 |
| 17.852 | 0.000 | 1.91 | 2.27 | 1.99 | 1.075 |
| 18.006 | 0.000 | 1.76 | 2.27 | 1.83 | 1.074 |
| 18.161 | 0.000 | 0.85 | 2.26 | 1.30 | 1.069 |
| 18.315 | 0.000 | 0.74 | 2.26 | 0.79 | 1.068 |
| 18.469 | 0.000 | 0.64 | 2.26 | 0.69 | 1.067 |
| 18.624 | 0.000 | 0.56 | 2.26 | 0.60 | 1.067 |
| 18.778 | 0.000 | 0.48 | 2.26 | 0.52 | 1.066 |
| 18.932 | 0.000 | 0.41 | 2.25 | 0.44 | 1.066 |
| 19.087 | 0.000 | 0.34 | 2.25 | 0.37 | 1.066 |
| 19.241 | 0.000 | 0.32 | 2.25 | 0.33 | 1.065 |
| 19.395 | 0.000 | 0.31 | 2.25 | 0.32 | 1.065 |
| 19.550 | 0.000 | 0.30 | 2.25 | 0.31 | 1.065 |

| | | | | | |
|---|---|---|---|---|---|
| 19.704 | 0.000 | 0.29 | 2.25 | 0.30 | 1.065 |
| 19.858 | 0.000 | 0.29 | 2.25 | 0.29 | 1.065 |
| 20.013 | 0.000 | 0.28 | 2.25 | 0.28 | 1.065 |
| 20.167 | 0.000 | 0.27 | 2.25 | 0.27 | 1.065 |
| 20.321 | 0.000 | 0.27 | 2.25 | 0.27 | 1.065 |
| 20.476 | 0.000 | 0.26 | 2.25 | 0.26 | 1.065 |
| 20.630 | 0.000 | 0.25 | 2.25 | 0.26 | 1.065 |
| 20.784 | 0.000 | 0.25 | 2.25 | 0.25 | 1.065 |
| 20.939 | 0.000 | 0.24 | 2.25 | 0.25 | 1.065 |
| 21.093 | 0.000 | 0.24 | 2.25 | 0.24 | 1.065 |
| 21.247 | 0.000 | 0.23 | 2.25 | 0.24 | 1.065 |
| 21.402 | 0.000 | 0.23 | 2.25 | 0.23 | 1.065 |
| 21.556 | 0.000 | 0.22 | 2.25 | 0.23 | 1.065 |
| 21.710 | 0.000 | 0.22 | 2.25 | 0.22 | 1.065 |
| 21.865 | 0.000 | 0.22 | 2.25 | 0.22 | 1.065 |
| 22.019 | 0.000 | 0.21 | 2.25 | 0.22 | 1.065 |
| 22.173 | 0.000 | 0.21 | 2.25 | 0.21 | 1.065 |
| 22.328 | 0.000 | 0.21 | 2.25 | 0.21 | 1.065 |
| 22.482 | 0.000 | 0.20 | 2.25 | 0.21 | 1.065 |
| 22.636 | 0.000 | 0.20 | 2.25 | 0.20 | 1.065 |
| 22.791 | 0.000 | 0.20 | 2.25 | 0.20 | 1.065 |
| 22.945 | 0.000 | 0.19 | 2.25 | 0.20 | 1.065 |
| 23.099 | 0.000 | 0.19 | 2.25 | 0.19 | 1.065 |
| 23.254 | 0.000 | 0.19 | 2.25 | 0.19 | 1.065 |
| 23.408 | 0.000 | 0.19 | 2.25 | 0.19 | 1.065 |
| 23.562 | 0.000 | 0.18 | 2.25 | 0.19 | 1.065 |
| 23.717 | 0.000 | 0.18 | 2.25 | 0.18 | 1.065 |
| 23.871 | 0.000 | 0.18 | 2.25 | 0.18 | 1.065 |
| 24.025 | 0.000 | 0.18 | 2.25 | 0.18 | 1.065 |
| 24.180 | 0.000 | 0.00 | 2.25 | 0.09 | 1.063 |
| 24.334 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.488 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.643 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.797 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.951 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |

---

```
******************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
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                            Analysis prepared by:

                               TAIT & ASSOCIATES


******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  WESTERN ALTON PARCEL - NORTH PARCEL
  PROPOSED CONDITION - STREAM A
  100 YEAR STORM
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.84
    TOTAL CATCHMENT AREA(ACRES) =   17.45
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.105
    LOW LOSS FRACTION = 0.456
    TIME OF CONCENTRATION(MIN.) =  9.26
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     4.81
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     3.38

******************************************************************************
  TIME     VOLUME       Q    0.       17.5      35.0      52.5      70.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.10      0.0030      0.70  Q         .         .         .         .
  0.26      0.0119      0.70  Q         .         .         .         .
  0.41      0.0208      0.71  Q         .         .         .         .
  0.57      0.0299      0.71  Q         .         .         .         .
  0.72      0.0389      0.71  Q         .         .         .         .
  0.88      0.0481      0.72  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.03 | 0.0572 | 0.72 | Q | . | . | . | . |
| 1.18 | 0.0665 | 0.73 | Q | . | . | . | . |
| 1.34 | 0.0758 | 0.73 | Q | . | . | . | . |
| 1.49 | 0.0851 | 0.74 | Q | . | . | . | . |
| 1.65 | 0.0946 | 0.74 | Q | . | . | . | . |
| 1.80 | 0.1041 | 0.75 | Q | . | . | . | . |
| 1.96 | 0.1136 | 0.75 | Q | . | . | . | . |
| 2.11 | 0.1232 | 0.76 | Q | . | . | . | . |
| 2.26 | 0.1329 | 0.76 | Q | . | . | . | . |
| 2.42 | 0.1427 | 0.77 | Q | . | . | . | . |
| 2.57 | 0.1525 | 0.77 | Q | . | . | . | . |
| 2.73 | 0.1624 | 0.78 | Q | . | . | . | . |
| 2.88 | 0.1724 | 0.79 | Q | . | . | . | . |
| 3.04 | 0.1824 | 0.79 | Q | . | . | . | . |
| 3.19 | 0.1925 | 0.80 | Q | . | . | . | . |
| 3.34 | 0.2027 | 0.80 | Q | . | . | . | . |
| 3.50 | 0.2130 | 0.81 | Q | . | . | . | . |
| 3.65 | 0.2233 | 0.81 | Q | . | . | . | . |
| 3.81 | 0.2337 | 0.82 | Q | . | . | . | . |
| 3.96 | 0.2442 | 0.83 | Q | . | . | . | . |
| 4.12 | 0.2548 | 0.83 | Q | . | . | . | . |
| 4.27 | 0.2655 | 0.84 | Q | . | . | . | . |
| 4.42 | 0.2763 | 0.85 | Q | . | . | . | . |
| 4.58 | 0.2871 | 0.85 | Q | . | . | . | . |
| 4.73 | 0.2981 | 0.86 | Q | . | . | . | . |
| 4.89 | 0.3091 | 0.87 | Q | . | . | . | . |
| 5.04 | 0.3203 | 0.88 | Q | . | . | . | . |
| 5.20 | 0.3315 | 0.88 | Q | . | . | . | . |
| 5.35 | 0.3428 | 0.89 | Q | . | . | . | . |
| 5.51 | 0.3543 | 0.90 | Q | . | . | . | . |
| 5.66 | 0.3658 | 0.91 | Q | . | . | . | . |
| 5.81 | 0.3774 | 0.92 | Q | . | . | . | . |
| 5.97 | 0.3892 | 0.93 | Q | . | . | . | . |
| 6.12 | 0.4011 | 0.93 | Q | . | . | . | . |
| 6.28 | 0.4131 | 0.95 | Q | . | . | . | . |
| 6.43 | 0.4252 | 0.95 | Q | . | . | . | . |
| 6.59 | 0.4374 | 0.96 | Q | . | . | . | . |
| 6.74 | 0.4497 | 0.97 | Q | . | . | . | . |
| 6.89 | 0.4622 | 0.99 | Q | . | . | . | . |
| 7.05 | 0.4748 | 0.99 | Q | . | . | . | . |
| 7.20 | 0.4876 | 1.01 | Q | . | . | . | . |
| 7.36 | 0.5005 | 1.01 | Q | . | . | . | . |
| 7.51 | 0.5135 | 1.03 | Q | . | . | . | . |
| 7.67 | 0.5267 | 1.04 | Q | . | . | . | . |
| 7.82 | 0.5400 | 1.05 | Q | . | . | . | . |
| 7.97 | 0.5535 | 1.06 | Q | . | . | . | . |
| 8.13 | 0.5671 | 1.08 | Q | . | . | . | . |
| 8.28 | 0.5809 | 1.09 | Q | . | . | . | . |
| 8.44 | 0.5949 | 1.11 | Q | . | . | . | . |
| 8.59 | 0.6091 | 1.11 | Q | . | . | . | . |
| 8.75 | 0.6234 | 1.13 | Q | . | . | . | . |
| 8.90 | 0.6379 | 1.14 | Q | . | . | . | . |

| | | | |
|---|---|---|---|
| 9.05 | 0.6527 | 1.17 | Q . . . . |
| 9.21 | 0.6676 | 1.18 | Q . . . . |
| 9.36 | 0.6827 | 1.20 | Q . . . . |
| 9.52 | 0.6981 | 1.21 | Q . . . . |
| 9.67 | 0.7137 | 1.23 | Q . . . . |
| 9.83 | 0.7295 | 1.25 | Q . . . . |
| 9.98 | 0.7456 | 1.27 | Q . . . . |
| 10.14 | 0.7619 | 1.29 | Q . . . . |
| 10.29 | 0.7785 | 1.31 | Q . . . . |
| 10.44 | 0.7954 | 1.33 | Q . . . . |
| 10.60 | 0.8125 | 1.36 | Q . . . . |
| 10.75 | 0.8300 | 1.38 | Q . . . . |
| 10.91 | 0.8478 | 1.41 | Q . . . . |
| 11.06 | 0.8659 | 1.43 | Q . . . . |
| 11.22 | 0.8843 | 1.47 | Q . . . . |
| 11.37 | 0.9032 | 1.49 | Q . . . . |
| 11.52 | 0.9224 | 1.53 | Q . . . . |
| 11.68 | 0.9420 | 1.55 | Q . . . . |
| 11.83 | 0.9621 | 1.60 | Q . . . . |
| 11.99 | 0.9826 | 1.62 | Q . . . . |
| 12.14 | 1.0071 | 2.22 | .Q . . . . |
| 12.30 | 1.0364 | 2.37 | .Q . . . . |
| 12.45 | 1.0674 | 2.49 | .Q . . . . |
| 12.60 | 1.0995 | 2.55 | .Q . . . . |
| 12.76 | 1.1329 | 2.68 | .Q . . . . |
| 12.91 | 1.1676 | 2.75 | .Q . . . . |
| 13.07 | 1.2037 | 2.91 | .Q . . . . |
| 13.22 | 1.2413 | 2.99 | .Q . . . . |
| 13.38 | 1.2805 | 3.17 | .Q . . . . |
| 13.53 | 1.3215 | 3.26 | .Q . . . . |
| 13.68 | 1.3645 | 3.48 | .Q . . . . |
| 13.84 | 1.4097 | 3.60 | . Q . . . . |
| 13.99 | 1.4572 | 3.86 | . Q . . . . |
| 14.15 | 1.5074 | 4.02 | . Q . . . . |
| 14.30 | 1.5608 | 4.36 | . Q . . . . |
| 14.46 | 1.6176 | 4.55 | . Q . . . . |
| 14.61 | 1.6784 | 4.98 | . Q . . . . |
| 14.77 | 1.7435 | 5.23 | . Q . . . . |
| 14.92 | 1.8141 | 5.83 | . Q . . . . |
| 15.07 | 1.8908 | 6.20 | . Q . . . . |
| 15.23 | 1.9757 | 7.12 | . Q . . . . |
| 15.38 | 2.0703 | 7.71 | . Q . . . . |
| 15.54 | 2.1711 | 8.11 | . Q . . . . |
| 15.69 | 2.2823 | 9.33 | . Q . . . . |
| 15.85 | 2.4306 | 13.93 | . Q . . . . |
| 16.00 | 2.6443 | 19.58 | .Q . . . . |
| 16.15 | 3.1656 | 62.17 | . . . . Q . |
| 16.31 | 3.6328 | 11.08 | . Q . . . . |
| 16.46 | 3.7535 | 7.84 | . Q . . . . |
| 16.62 | 3.8457 | 6.62 | . Q . . . . |
| 16.77 | 3.9231 | 5.51 | . Q . . . . |
| 16.93 | 3.9886 | 4.75 | . Q . . . . |

```
 17.08      4.0456      4.19  . Q       .         .         .         .
 17.23      4.0961      3.72  . Q       .         .         .         .
 17.39      4.1413      3.37  .Q        .         .         .         .
 17.54      4.1824      3.08  .Q        .         .         .         .
 17.70      4.2200      2.83  .Q        .         .         .         .
 17.85      4.2547      2.62  .Q        .         .         .         .
 18.01      4.2869      2.43  .Q        .         .         .         .
 18.16      4.3129      1.65  Q         .         .         .         .
 18.32      4.3334      1.57  Q         .         .         .         .
 18.47      4.3531      1.51  Q         .         .         .         .
 18.62      4.3719      1.45  Q         .         .         .         .
 18.78      4.3900      1.39  Q         .         .         .         .
 18.93      4.4075      1.35  Q         .         .         .         .
 19.09      4.4244      1.30  Q         .         .         .         .
 19.24      4.4407      1.26  Q         .         .         .         .
 19.40      4.4565      1.22  Q         .         .         .         .
 19.55      4.4719      1.19  Q         .         .         .         .
 19.70      4.4868      1.15  Q         .         .         .         .
 19.86      4.5013      1.12  Q         .         .         .         .
 20.01      4.5155      1.10  Q         .         .         .         .
 20.17      4.5293      1.07  Q         .         .         .         .
 20.32      4.5428      1.04  Q         .         .         .         .
 20.48      4.5560      1.02  Q         .         .         .         .
 20.63      4.5689      1.00  Q         .         .         .         .
 20.78      4.5815      0.98  Q         .         .         .         .
 20.94      4.5938      0.96  Q         .         .         .         .
 21.09      4.6059      0.94  Q         .         .         .         .
 21.25      4.6178      0.92  Q         .         .         .         .
 21.40      4.6295      0.90  Q         .         .         .         .
 21.56      4.6409      0.89  Q         .         .         .         .
 21.71      4.6521      0.87  Q         .         .         .         .
 21.86      4.6632      0.86  Q         .         .         .         .
 22.02      4.6740      0.84  Q         .         .         .         .
 22.17      4.6847      0.83  Q         .         .         .         .
 22.33      4.6952      0.82  Q         .         .         .         .
 22.48      4.7056      0.80  Q         .         .         .         .
 22.64      4.7157      0.79  Q         .         .         .         .
 22.79      4.7258      0.78  Q         .         .         .         .
 22.94      4.7357      0.77  Q         .         .         .         .
 23.10      4.7454      0.76  Q         .         .         .         .
 23.25      4.7551      0.75  Q         .         .         .         .
 23.41      4.7645      0.74  Q         .         .         .         .
 23.56      4.7739      0.73  Q         .         .         .         .
 23.72      4.7832      0.72  Q         .         .         .         .
 23.87      4.7923      0.71  Q         .         .         .         .
 24.03      4.8013      0.70  Q         .         .         .         .
 24.18      4.8058      0.00  Q         .         .         .         .
 ------------------------------------------------------------------------
-----------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
```

an instantaneous time duration)

| Percentile of Estimated Peak Flow Rate | Duration (minutes) |
|---|---|
| 0% | 1444.6 |
| 10% | 92.6 |
| 20% | 27.8 |
| 30% | 18.5 |
| 40% | 9.3 |
| 50% | 9.3 |
| 60% | 9.3 |
| 70% | 9.3 |
| 80% | 9.3 |
| 90% | 9.3 |

Problem Descriptions:
WESTERN ALTON PARCEL - NORTH PARCEL
PROPOSED CONDITION - STREAM A
100 YEAR STORM

==========

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.260
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
                INFLOW
                  |
                  |
                  |
                  V                __effective depth
            -------------          |   (and volume)
            |           |     |    |
            | detention |     |....V.............
            |   basin   |<-->|          outflow
            |           |     |.........________
            -------------     |         |   \
                  |           | storage |     basin outlet
                  V           -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 12
*BASIN-DEPTH STORAGE OUTFLOW **BASIN-DEPTH STORAGE OUTFLOW *

```
*   (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)   *
*      0.000      0.000      0.000**      1.000      0.447      0.000*
*      2.000      0.935      0.000**      2.250      1.063      0.000*
*      2.500      1.195     21.120**      3.000      1.466     22.100*
*      3.500      1.748     23.040**      4.000      2.041     23.950*
*      4.500      2.346     24.820**      5.000      2.662     25.660*
*      4.500      0.940     27.160**      5.000      1.101     28.370*
-----------------------------------------------------------------------
BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:
 INTERVAL   DEPTH   {S-O*DT/2}   {S+O*DT/2}
  NUMBER   (FEET)   (ACRE-FEET)  (ACRE-FEET)
      1     0.00       0.00000      0.00000
      2     1.00       0.44650      0.44650
      3     2.00       0.93470      0.93470
      4     2.25       1.06340      1.06340
      5     2.50       1.06011      1.32949
      6     3.00       1.32496      1.60684
      7     3.50       1.60106      1.89494
      8     4.00       1.88866      2.19414
      9     4.50       2.18781      2.50439
     10     5.00       2.49886      2.82614
     11     4.50       0.76679      1.11321
     12     5.00       0.92007      1.28193
WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)
-----------------------------------------------------------------------
DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
      OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
      AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.
```

| TIME (HRS) | DEAD-STORAGE FILLED(AF) | INFLOW (CFS) | EFFECTIVE DEPTH(FT) | OUTFLOW (CFS) | EFFECTIVE VOLUME(AF) |
|---|---|---|---|---|---|
| 0.104 | 0.000 | 0.70 | 0.02 | 0.00 | 0.009 |
| 0.258 | 0.000 | 0.70 | 0.04 | 0.00 | 0.018 |
| 0.412 | 0.000 | 0.71 | 0.06 | 0.00 | 0.027 |
| 0.567 | 0.000 | 0.71 | 0.08 | 0.00 | 0.036 |
| 0.721 | 0.000 | 0.71 | 0.10 | 0.00 | 0.045 |
| 0.875 | 0.000 | 0.72 | 0.12 | 0.00 | 0.054 |
| 1.030 | 0.000 | 0.72 | 0.14 | 0.00 | 0.063 |
| 1.184 | 0.000 | 0.73 | 0.16 | 0.00 | 0.073 |
| 1.338 | 0.000 | 0.73 | 0.18 | 0.00 | 0.082 |
| 1.493 | 0.000 | 0.74 | 0.20 | 0.00 | 0.091 |
| 1.647 | 0.000 | 0.74 | 0.23 | 0.00 | 0.101 |
| 1.801 | 0.000 | 0.75 | 0.25 | 0.00 | 0.110 |
| 1.956 | 0.000 | 0.75 | 0.27 | 0.00 | 0.120 |
| 2.110 | 0.000 | 0.76 | 0.29 | 0.00 | 0.130 |
| 2.264 | 0.000 | 0.76 | 0.31 | 0.00 | 0.139 |
| 2.419 | 0.000 | 0.77 | 0.33 | 0.00 | 0.149 |
| 2.573 | 0.000 | 0.77 | 0.36 | 0.00 | 0.159 |
| 2.727 | 0.000 | 0.78 | 0.38 | 0.00 | 0.169 |
| 2.882 | 0.000 | 0.79 | 0.40 | 0.00 | 0.179 |

| | | | | | |
|---|---|---|---|---|---|
| 3.036 | 0.000 | 0.79 | 0.42 | 0.00 | 0.189 |
| 3.190 | 0.000 | 0.80 | 0.45 | 0.00 | 0.199 |
| 3.345 | 0.000 | 0.80 | 0.47 | 0.00 | 0.209 |
| 3.499 | 0.000 | 0.81 | 0.49 | 0.00 | 0.220 |
| 3.653 | 0.000 | 0.81 | 0.52 | 0.00 | 0.230 |
| 3.808 | 0.000 | 0.82 | 0.54 | 0.00 | 0.240 |
| 3.962 | 0.000 | 0.83 | 0.56 | 0.00 | 0.251 |
| 4.116 | 0.000 | 0.83 | 0.59 | 0.00 | 0.262 |
| 4.271 | 0.000 | 0.84 | 0.61 | 0.00 | 0.272 |
| 4.425 | 0.000 | 0.85 | 0.63 | 0.00 | 0.283 |
| 4.579 | 0.000 | 0.85 | 0.66 | 0.00 | 0.294 |
| 4.734 | 0.000 | 0.86 | 0.68 | 0.00 | 0.305 |
| 4.888 | 0.000 | 0.87 | 0.71 | 0.00 | 0.316 |
| 5.042 | 0.000 | 0.88 | 0.73 | 0.00 | 0.327 |
| 5.197 | 0.000 | 0.88 | 0.76 | 0.00 | 0.339 |
| 5.351 | 0.000 | 0.89 | 0.78 | 0.00 | 0.350 |
| 5.505 | 0.000 | 0.90 | 0.81 | 0.00 | 0.361 |
| 5.660 | 0.000 | 0.91 | 0.84 | 0.00 | 0.373 |
| 5.814 | 0.000 | 0.92 | 0.86 | 0.00 | 0.385 |
| 5.968 | 0.000 | 0.93 | 0.89 | 0.00 | 0.397 |
| 6.123 | 0.000 | 0.93 | 0.91 | 0.00 | 0.408 |
| 6.277 | 0.000 | 0.95 | 0.94 | 0.00 | 0.421 |
| 6.431 | 0.000 | 0.95 | 0.97 | 0.00 | 0.433 |
| 6.586 | 0.000 | 0.96 | 1.00 | 0.00 | 0.445 |
| 6.740 | 0.000 | 0.97 | 1.02 | 0.00 | 0.457 |
| 6.894 | 0.000 | 0.99 | 1.05 | 0.00 | 0.470 |
| 7.049 | 0.000 | 0.99 | 1.07 | 0.00 | 0.483 |
| 7.203 | 0.000 | 1.01 | 1.10 | 0.00 | 0.495 |
| 7.357 | 0.000 | 1.01 | 1.13 | 0.00 | 0.508 |
| 7.512 | 0.000 | 1.03 | 1.15 | 0.00 | 0.522 |
| 7.666 | 0.000 | 1.04 | 1.18 | 0.00 | 0.535 |
| 7.820 | 0.000 | 1.05 | 1.21 | 0.00 | 0.548 |
| 7.975 | 0.000 | 1.06 | 1.24 | 0.00 | 0.562 |
| 8.129 | 0.000 | 1.08 | 1.26 | 0.00 | 0.575 |
| 8.283 | 0.000 | 1.09 | 1.29 | 0.00 | 0.589 |
| 8.438 | 0.000 | 1.11 | 1.32 | 0.00 | 0.603 |
| 8.592 | 0.000 | 1.11 | 1.35 | 0.00 | 0.618 |
| 8.746 | 0.000 | 1.13 | 1.38 | 0.00 | 0.632 |
| 8.901 | 0.000 | 1.14 | 1.41 | 0.00 | 0.647 |
| 9.055 | 0.000 | 1.17 | 1.44 | 0.00 | 0.662 |
| 9.209 | 0.000 | 1.18 | 1.47 | 0.00 | 0.677 |
| 9.364 | 0.000 | 1.20 | 1.50 | 0.00 | 0.692 |
| 9.518 | 0.000 | 1.21 | 1.53 | 0.00 | 0.707 |
| 9.672 | 0.000 | 1.23 | 1.57 | 0.00 | 0.723 |
| 9.827 | 0.000 | 1.25 | 1.60 | 0.00 | 0.739 |
| 9.981 | 0.000 | 1.27 | 1.63 | 0.00 | 0.755 |
| 10.135 | 0.000 | 1.29 | 1.67 | 0.00 | 0.772 |
| 10.290 | 0.000 | 1.31 | 1.70 | 0.00 | 0.788 |
| 10.444 | 0.000 | 1.33 | 1.73 | 0.00 | 0.805 |
| 10.598 | 0.000 | 1.36 | 1.77 | 0.00 | 0.823 |
| 10.753 | 0.000 | 1.38 | 1.81 | 0.00 | 0.840 |
| 10.907 | 0.000 | 1.41 | 1.84 | 0.00 | 0.858 |

| | | | | | |
|---|---|---|---|---|---|
| 11.061 | 0.000 | 1.43 | 1.88 | 0.00 | 0.876 |
| 11.216 | 0.000 | 1.47 | 1.92 | 0.00 | 0.895 |
| 11.370 | 0.000 | 1.49 | 1.96 | 0.00 | 0.914 |
| 11.524 | 0.000 | 1.53 | 2.00 | 0.00 | 0.934 |
| 11.679 | 0.000 | 1.55 | 2.04 | 0.00 | 0.953 |
| 11.833 | 0.000 | 1.60 | 2.08 | 0.00 | 0.974 |
| 11.987 | 0.000 | 1.62 | 2.12 | 0.00 | 0.994 |
| 12.142 | 0.000 | 2.22 | 2.17 | 0.00 | 1.023 |
| 12.296 | 0.000 | 2.37 | 2.23 | 0.00 | 1.053 |
| 12.450 | 0.000 | 2.49 | 2.27 | 0.85 | 1.074 |
| 12.605 | 0.000 | 2.55 | 2.28 | 2.13 | 1.079 |
| 12.759 | 0.000 | 2.68 | 2.28 | 2.62 | 1.080 |
| 12.913 | 0.000 | 2.75 | 2.28 | 2.72 | 1.081 |
| 13.068 | 0.000 | 2.91 | 2.28 | 2.83 | 1.081 |
| 13.222 | 0.000 | 2.99 | 2.29 | 2.95 | 1.082 |
| 13.376 | 0.000 | 3.17 | 2.29 | 3.08 | 1.083 |
| 13.531 | 0.000 | 3.26 | 2.29 | 3.22 | 1.084 |
| 13.685 | 0.000 | 3.48 | 2.29 | 3.37 | 1.085 |
| 13.839 | 0.000 | 3.60 | 2.29 | 3.54 | 1.086 |
| 13.994 | 0.000 | 3.86 | 2.30 | 3.73 | 1.087 |
| 14.148 | 0.000 | 4.02 | 2.30 | 3.94 | 1.088 |
| 14.302 | 0.000 | 4.36 | 2.30 | 4.19 | 1.091 |
| 14.457 | 0.000 | 4.55 | 2.30 | 4.46 | 1.092 |
| 14.611 | 0.000 | 4.98 | 2.31 | 4.77 | 1.094 |
| 14.765 | 0.000 | 5.23 | 2.31 | 5.11 | 1.096 |
| 14.920 | 0.000 | 5.83 | 2.32 | 5.54 | 1.100 |
| 15.074 | 0.000 | 6.20 | 2.32 | 6.02 | 1.102 |
| 15.228 | 0.000 | 7.12 | 2.33 | 6.66 | 1.108 |
| 15.383 | 0.000 | 7.71 | 2.34 | 7.42 | 1.111 |
| 15.537 | 0.000 | 8.11 | 2.35 | 7.92 | 1.114 |
| 15.691 | 0.000 | 9.33 | 2.36 | 8.73 | 1.122 |
| 15.846 | 0.000 | 13.93 | 2.42 | 11.66 | 1.150 |
| 16.000 | 0.000 | 19.58 | 2.48 | 16.82 | 1.186 |
| 16.154 | 0.000 | 62.17 | 3.43 | 21.28 | 1.707 |
| 16.309 | 0.000 | 11.08 | 3.17 | 22.66 | 1.560 |
| 16.463 | 0.000 | 7.84 | 2.84 | 22.10 | 1.378 |
| 16.617 | 0.000 | 6.62 | 2.49 | 21.20 | 1.192 |
| 16.772 | 0.000 | 5.51 | 2.31 | 12.98 | 1.097 |
| 16.926 | 0.000 | 4.75 | 2.31 | 5.04 | 1.093 |
| 17.080 | 0.000 | 4.19 | 2.30 | 4.46 | 1.089 |
| 17.235 | 0.000 | 3.72 | 2.29 | 3.95 | 1.087 |
| 17.389 | 0.000 | 3.37 | 2.29 | 3.54 | 1.084 |
| 17.543 | 0.000 | 3.08 | 2.29 | 3.22 | 1.083 |
| 17.698 | 0.000 | 2.83 | 2.28 | 2.95 | 1.081 |
| 17.852 | 0.000 | 2.62 | 2.28 | 2.72 | 1.080 |
| 18.006 | 0.000 | 2.43 | 2.28 | 2.52 | 1.079 |
| 18.161 | 0.000 | 1.65 | 2.27 | 2.03 | 1.074 |
| 18.315 | 0.000 | 1.57 | 2.27 | 1.60 | 1.073 |
| 18.469 | 0.000 | 1.51 | 2.27 | 1.54 | 1.073 |
| 18.624 | 0.000 | 1.45 | 2.27 | 1.48 | 1.072 |
| 18.778 | 0.000 | 1.39 | 2.27 | 1.42 | 1.072 |
| 18.932 | 0.000 | 1.35 | 2.27 | 1.37 | 1.072 |

| | | | | | |
|---|---|---|---|---|---|
| 19.087 | 0.000 | 1.30 | 2.27 | 1.32 | 1.071 |
| 19.241 | 0.000 | 1.26 | 2.26 | 1.28 | 1.071 |
| 19.395 | 0.000 | 1.22 | 2.26 | 1.24 | 1.071 |
| 19.550 | 0.000 | 1.19 | 2.26 | 1.20 | 1.071 |
| 19.704 | 0.000 | 1.15 | 2.26 | 1.17 | 1.071 |
| 19.858 | 0.000 | 1.12 | 2.26 | 1.14 | 1.070 |
| 20.013 | 0.000 | 1.10 | 2.26 | 1.11 | 1.070 |
| 20.167 | 0.000 | 1.07 | 2.26 | 1.08 | 1.070 |
| 20.321 | 0.000 | 1.04 | 2.26 | 1.06 | 1.070 |
| 20.476 | 0.000 | 1.02 | 2.26 | 1.03 | 1.070 |
| 20.630 | 0.000 | 1.00 | 2.26 | 1.01 | 1.070 |
| 20.784 | 0.000 | 0.98 | 2.26 | 0.99 | 1.069 |
| 20.939 | 0.000 | 0.96 | 2.26 | 0.97 | 1.069 |
| 21.093 | 0.000 | 0.94 | 2.26 | 0.95 | 1.069 |
| 21.247 | 0.000 | 0.92 | 2.26 | 0.93 | 1.069 |
| 21.402 | 0.000 | 0.90 | 2.26 | 0.91 | 1.069 |
| 21.556 | 0.000 | 0.89 | 2.26 | 0.90 | 1.069 |
| 21.710 | 0.000 | 0.87 | 2.26 | 0.88 | 1.069 |
| 21.865 | 0.000 | 0.86 | 2.26 | 0.87 | 1.069 |
| 22.019 | 0.000 | 0.84 | 2.26 | 0.85 | 1.069 |
| 22.173 | 0.000 | 0.83 | 2.26 | 0.84 | 1.069 |
| 22.328 | 0.000 | 0.82 | 2.26 | 0.82 | 1.068 |
| 22.482 | 0.000 | 0.80 | 2.26 | 0.81 | 1.068 |
| 22.636 | 0.000 | 0.79 | 2.26 | 0.80 | 1.068 |
| 22.791 | 0.000 | 0.78 | 2.26 | 0.79 | 1.068 |
| 22.945 | 0.000 | 0.77 | 2.26 | 0.78 | 1.068 |
| 23.099 | 0.000 | 0.76 | 2.26 | 0.76 | 1.068 |
| 23.254 | 0.000 | 0.75 | 2.26 | 0.75 | 1.068 |
| 23.408 | 0.000 | 0.74 | 2.26 | 0.74 | 1.068 |
| 23.562 | 0.000 | 0.73 | 2.26 | 0.73 | 1.068 |
| 23.717 | 0.000 | 0.72 | 2.26 | 0.72 | 1.068 |
| 23.871 | 0.000 | 0.71 | 2.26 | 0.72 | 1.068 |
| 24.025 | 0.000 | 0.70 | 2.26 | 0.71 | 1.068 |
| 24.180 | 0.000 | 0.00 | 2.25 | 0.35 | 1.063 |
| 24.334 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.488 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.643 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.797 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |
| 24.951 | 0.000 | 0.00 | 2.25 | 0.00 | 1.063 |

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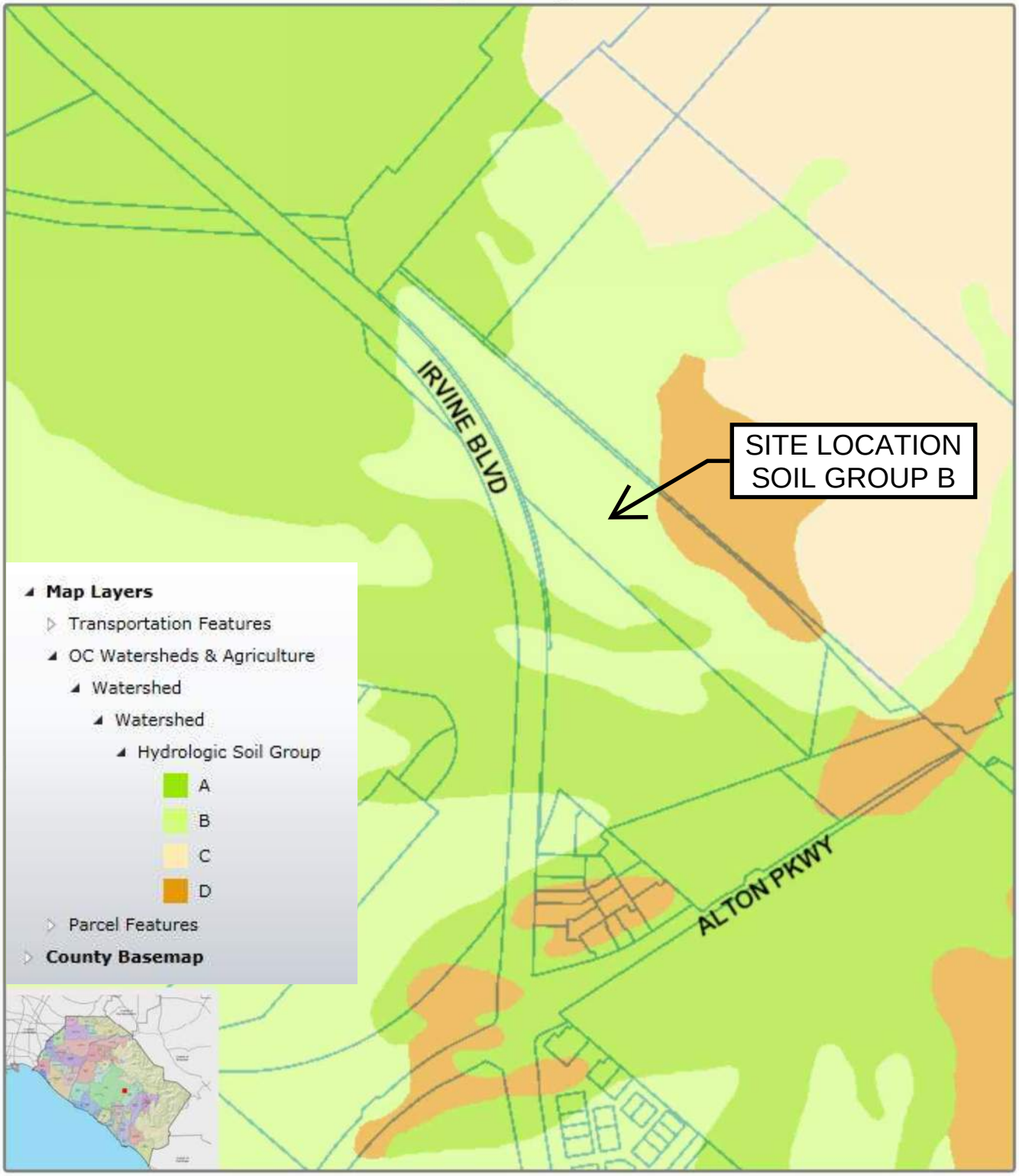
# Appendix D – Hydrologic Soils Group Map

See Attached Exhibit

# Orange County Public Works - Hydrologic Soils Group Map

Orange County, CA

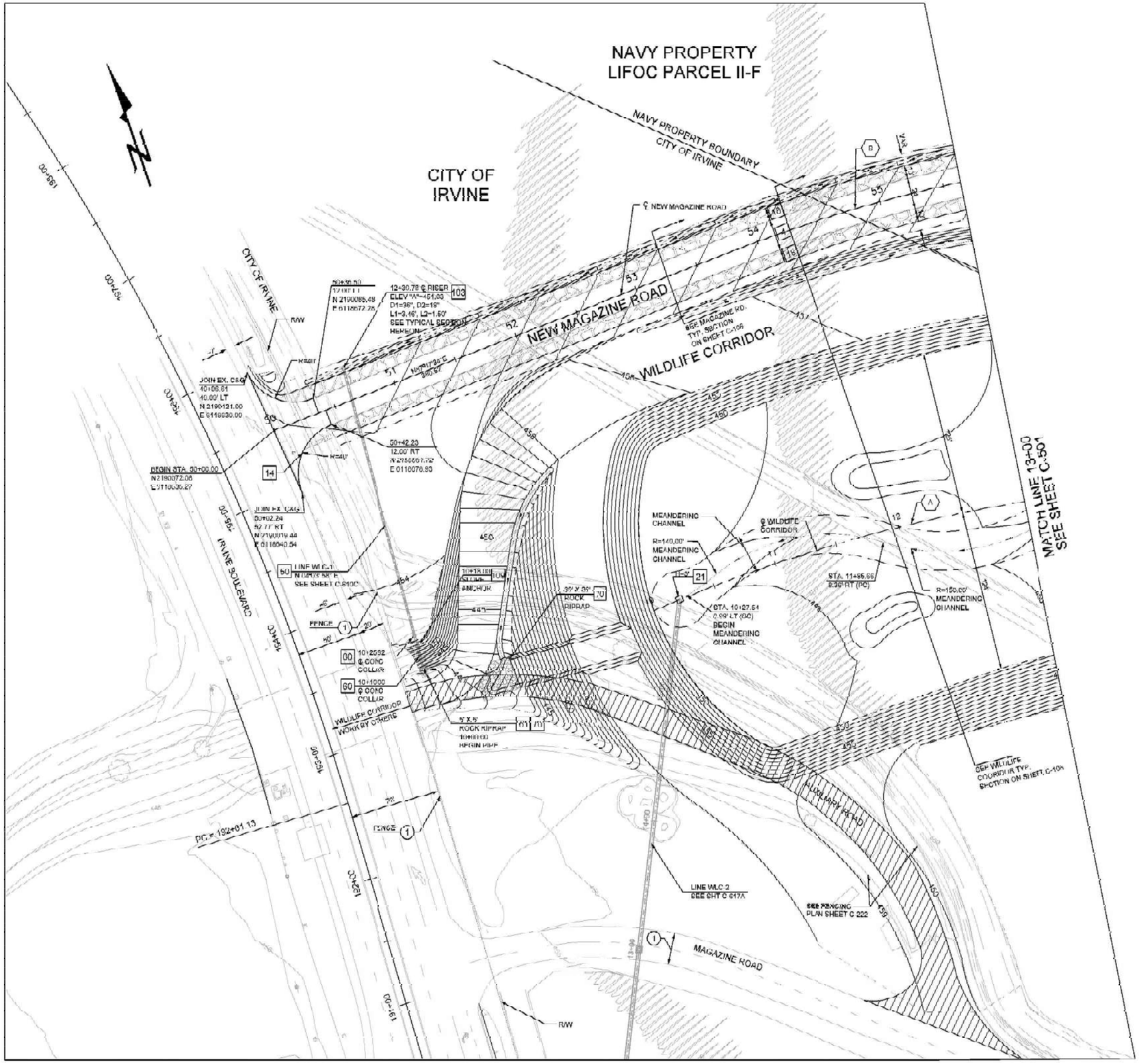



*Disclaimer: Map and parcel data are believed to be accurate, but accuracy is not guaranteed. This is not a legal document and should not be substituted for a title search,appraisal, survey, or for zoning verification.*

Map Scale
**1 inch = 660 feet**
11/26/2014

# Appendix E – Supporting Wildlife Corridor Storm Drain Exhibits

See Attached Exhibit



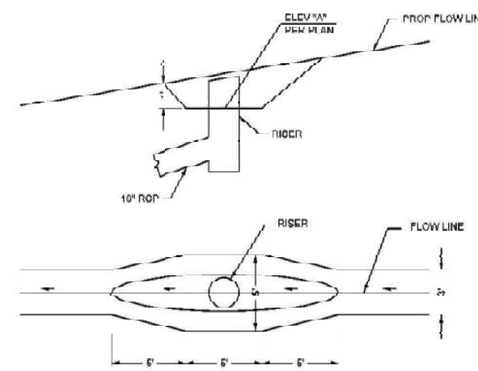

## CONSTRUCTION NOTES

### ROADWAY

- 4 CONSTRUCT 6" AC/ 1.5" AB, STRUCTURAL SECTION TO BE VERIFIED IN THE FIELD (NEW MAGAZINE ROAD)
- 14 CONSTRUCT "MODIFIED" CONCRETE DRIVEWAY APPROACH TYPE II PER CITY OF IRVINE STD. PLAN NO. 205 & PER DETAIL ON SHEET C-413
- 18 CONSTRUCT 4" AGGREGATE BASE SHOULDER OVER 95% COMPACTED SUBGRADE
- 21 INSTALL CHAIN LINK FENCE PER OCPW STD. PLAN 600-1-OC (H=10', UNLESS SHOWN OTHERWISE ON PLAN)
- 50 CONSTRUCT 18" RCP (D-LOAD PER PROFILE)
- 60 CONSTRUCT CONCRETE COLLAR PER CITY OF IRVINE STD. PLAN NO. 310
- 61 CONSTRUCT WING HEADWALL PER DETAIL ON SHEET C-640
- 70 CONSTRUCT LOOSE RIPRAP PAD PER OCPW STD. PLAN NO. 1809 AND DETAIL ON SHEET NO. C-614
- 100 CONSTRUCT INLET TYPE V PER OCPW STD PLAN NO. 1305
- 100 CONSTRUCT CONCRETE PIPE SLOPE ANCHOR PER OCPW STD PLAN NO. 1933

### LEGEND

(1) PROTECT IN PLACE




## RISER INLET TYPICAL SECTION

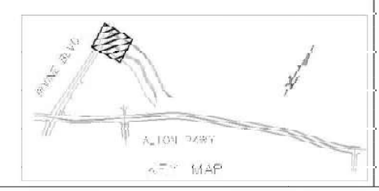
N.T.S.

| CURVE DATA | | | | | |
|---|---|---|---|---|---|
| NO. | Δ | R | L | T | REFERENCE |
| A | 51°30'30" | 1160.00 | 1009.05 | 573.60 | ℄ WLC |
| B | 38°38'12" | 1148.00 | 774.14 | 402.44 | ℄ MAG |

NOTE:
1. SEE PROFILES ON SHEETS C-505-506 AND 610C
2. CORRIDOR TO BE MAINTAINED BY THE CITY OF IRVINE UPON REGULATORY AGENCY SIGNOFF. SEE PROJECTS FINAL APPROVED HABITAT MITIGATION & MONITORING PROGRAM DATED MAY 27, 2011

40' 0' 40' 80'

GRAPHIC SCALE




RECORD DRAWINGS

RECORD DRAWING

| MARK | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| A | UPDATED WLC GRADING & SG | 07/13/11 | |
| B | RECORD DRAWINGS | 03/22/13 | |

COUNTY OF ORANGE CALIFORNIA

PREPARED UNDER THE RESPONSIBLE CHARGE OF: GARY L. VILLER, R.C.E. 56697, Exp. 6/30/10, CIVIL, STATE OF CALIFORNIA — DATE

DESIGNED BY: JC
DRAWN BY: SK
CHECKED BY:
DRAWING CODE:
FILE NAME: PLA-001-WLC-C-TSP1.CDWG-Sp
PLOT DATE: MARCH 2008
SCALE: 1"=40'

PREPARED BY: RBF CONSULTING

ORANGE COUNTY PUBLIC WORKS

ALTON PARKWAY IRVINE BLVD TO COMMERCENTRE DR
WILDLIFE CORRIDOR PLAN
STA. 10+00 - 13+00

Sheet Reference Number
C-500

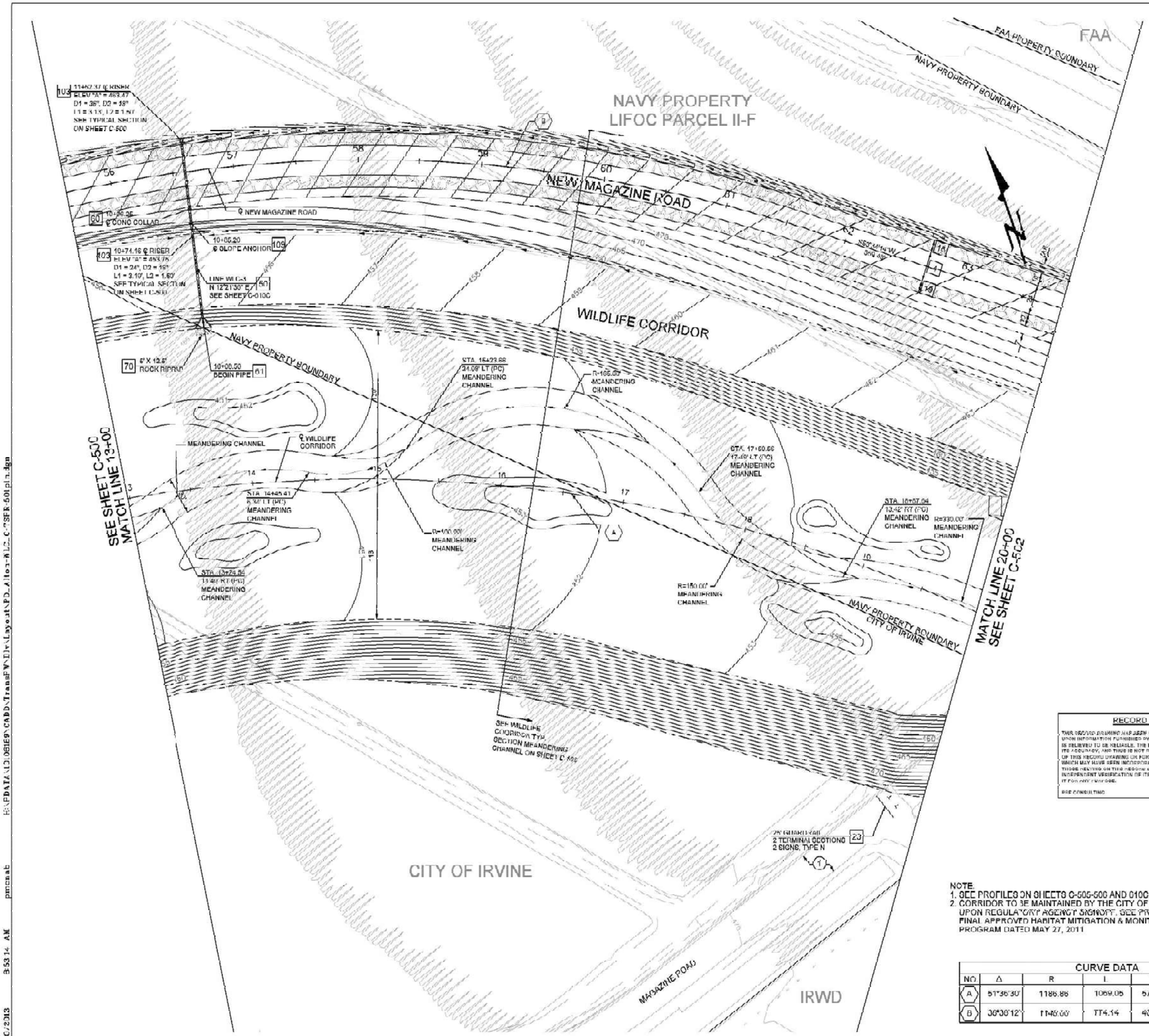
Sheet 60 of 130

CITY OF IRVINE
PLAN C-ECP: ECC459982-ENC

CITY OF IRVINE
PERMIT #: 2100-ACE

CITY OF LAKE FOREST
PLAN CHECK # B886-1182

3/20/2013 8:51:44 AM pmcnab H:\PDATA\DOGEP\CADD\TransFW\Div\Layout\PD_Alton-WLC-C-TSP1.60plot.dgn




## CONSTRUCTION NOTES

### ROADWAY

| | |
|---|---|
| 4 | CONSTRUCT 6" AC/11.5" AB, STRUCTURAL SECTION TO BE VERIFIED IN THE FIELD (NEW MAGAZINE ROAD) |
| 18 | CONSTRUCT 4" AGGREGATE BASE SHOULDER OVER 95% COMPACTED SUBGRADE |
| 23 | CONSTRUCT DEAD END SIGNING & METAL BEAM GUARD RAILING PER CITY OF IRVINE STD. PLANS NO. 400 & 401 |
| 50 | CONSTRUCT 18" RCP (D-LOAD PER PROFILE) |
| 60 | CONSTRUCT CONCRETE COLLAR PER CITY OF IRVINE STD. PLAN NO. 310 |
| 61 | CONSTRUCT WING HEADWALL PER DETAIL ON SHEET C-012 |
| 70 | CONSTRUCT LOOSE RIPRAP PAD PER OCPW STD. PLAN NO. 1809 AND DETAIL ON SHEET NO. C-014 |
| 109 | CONSTRUCT INLET TYPE V PER OCPW STD PLAN NO. 1305 |
| 109 | CONSTRUCT SLOPE ANCHOR PER OCPW STD PLAN NO. 1300 |

### LEGEND

(1) PROTECT IN PLACE.

NOTE:
1. SEE PROFILES ON SHEETS C-505-500 AND 010C
2. CORRIDOR TO BE MAINTAINED BY THE CITY OF IRVINE UPON REGULATORY AGENCY SIGNOFF. SEE PROJECTS FINAL APPROVED HABITAT MITIGATION & MONITORING PROGRAM DATED MAY 27, 2011

**RECORD DRAWING**

THIS RECORD DRAWING HAS BEEN PREPARED IN PART BASED UPON INFORMATION FURNISHED BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, THE ENGINEER CANNOT ASSURE ITS ACCURACY, NOR THUS IS NOT RESPONSIBLE FOR THE ACCURACY OF THIS RECORD DRAWING OR FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO IT AS A RESULT. THOSE RELYING ON THIS RECORD DRAWING ARE ADVISED TO OBTAIN INDEPENDENT VERIFICATION OF ITS ACCURACY BEFORE APPLYING IT FOR ANY PURPOSE.

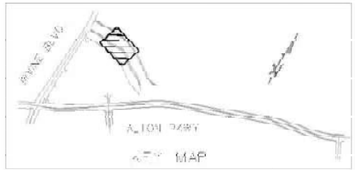
RBF CONSULTING DATE JUNE 2013

**RECORD DRAWINGS**

| | |
|---|---|
| CONTRACTOR: | SUNRY CONSTRUCTION |
| RESIDENT ENGINEER: | TIM NGUYEN |
| INSPECTOR: | MICHAEL RICHARDS |
| START DATE: | SEPTEMBER 2010 |
| COMPLETION DATE: | JUNE 2013 |

GRAPHIC SCALE (40' 0' 40' 80')

| CURVE DATA | | | | | |
|---|---|---|---|---|---|
| NO | Δ | R | L | T | REFERENCE |
| A | 51°36'30" | 1186.86 | 1069.05 | 573.86 | CL WLC |
| B | 38°30'12" | 1146.00' | 771.14 | 402.44 | CL WLC |




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR. |
|---|---|---|---|
| A | UPDATED NEW GRADING & 50 RECORD DRAWINGS | 07/16/13 03/22/13 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: GARY L. VILLER, No. 56697, Exp. 6/30/15, CIVIL, STATE OF CALIFORNIA — DATE

DESIGNED BY: JC
DRAWN BY: SK
CHECKED BY:
DRAWING 2232
FILE NAME: FE_Alton-WLC_FSPR-002nn004
PLOT DATE: MARCH 2015
SCALE: 1"=40'

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

ALTON PARKWAY
IRVINE BLVD TO
COMMERCENTRE DR

# WILDLIFE CORRIDOR PLAN

STA. 13+00 - 20+00

Sheet Reference Number

C-501

Sheet 61 of 130

CITY OF IRVINE
PLAN C-ECR: FEC4B9982-ENC

CITY OF IRVINE
PERMIT #2107-ACE

CITY OF LAKE FOREST
PLAN CHECK # B8866-1182

3/20/2013 8:53:14 AM pmcnab R:\PDATA\10\0616P\CADD\Trans\FW-Div\Layout\PD_Alton-WLC3-C-501.dwg

## CONSTRUCTION NOTES

### ROADWAY

- 4 CONSTRUCT 6" AC/11.5" AB, STRUCTURAL SECTION TO BE VERIFIED IN THE FIELD (NEW MAGAZINE ROAD)
- 18 CONSTRUCT 4" AGGREGATE BASE SHOULDER OVER 95% COMPACTED SUBGRADE
- 104 CONSTRUCT STEPPED GABION DROP STRUCTURE PER DETAIL ON SHEET C-010

### LEGEND

- (1) PROTECT IN PLACE
- (4) REMOVE MISCELLANEOUS ITEMS

NOTE:
1. SEE PROFILES ON SHEETS C-505-506 AND 610C
2. CORRIDOR TO BE MAINTAINED BY THE CITY OF IRVINE UPON REGULATORY AGENCY SIGNOFF, SEE PROJECTS FINAL APPROVED HABITAT MITIGATION & MONITORING PROGRAM DATED MAY 27, 2011

| CURVE DATA | | | | | |
|---|---|---|---|---|---|
| NO. | Δ | R | L | T | REFERENCE |
| A | 51°30'30" | 1100.00 | 1009.05 | 573.60 | CL WLC |
| B | 39°39'12" | 1148.00 | 774.14 | 402.44 | CL MAINT |

### RECORD DRAWING

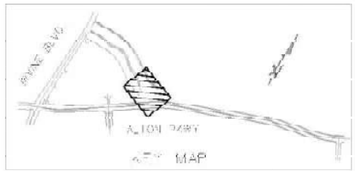
THIS RECORD DRAWING HAS BEEN PREPARED, IN PART, BASED UPON INFORMATION WHICH WAS OBTAINED FROM THIRD PARTY SOURCES IS BELIEVED TO BE RELIABLE. THE ENGINEER CANNOT ASSURE ITS ACCURACY, AND THUS IS NOT RESPONSIBLE FOR THE ACCURACY OF THIS RECORD DRAWING OR FOR ANY ERRORS OR OMISSION WHICH MAY HAVE BEEN INCORPORATED INTO IT AS A RESULT. THOSE RELYING ON THIS RECORD DRAWING ARE ADVISED TO OBTAIN INDEPENDENT VERIFICATION AS TO ITS ACCURACY BEFORE USING IT FOR ANY PURPOSE.

RBF CONSULTING DATE: JUNE 2013

### RECORD DRAWINGS

| | |
|---|---|
| CONTRACTOR: | SUKUT CONSTRUCTION |
| RESIDENT ENGINEER: | TIM NGUYEN |
| INSPECTOR: | MICHAEL ROMERO |
| START DATE: | SEPTEMBER 2012 |
| COMPLETION DATE: | JUNE 2013 |

4' 0' 4' 8'
GRAPHIC SCALE




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR. |
|---|---|---|---|
| A | UPDATED WLC DRAWING & SG RECORD DRAWINGS | 03/22/13 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: GARY L. VILLER, R.C.E. 56697, Exp. 6/30/10, CIVIL, STATE OF CALIFORNIA — DATE

DESIGNED BY: JC
DRAWN BY: SK
CHECKED BY:
DRAWING CODE:
FILE NAME: FC_Alta_WLC_TSPR 0C20mfCON
PLOT DATE: MARCH 2013
SCALE: 1"=40'

PREPARED BY: RBF CONSULTING

ORANGE COUNTY PUBLIC WORKS

ALTON PARKWAY IRVINE BLVD TO COMMERCENTRE DR
WILDLIFE CORRIDOR PLAN
STA. 20+00 - 20+69

Sheet Reference Number
C-502

Sheet 62 of 130

CITY OF IRVINE
CIP NO. C-ECP: FEC4B3982-ENVC
CITY OF IRVINE
PERMIT NO. 2-07-ACE
CITY OF LAKE FOREST
PLAN CHECK # 16846-1182

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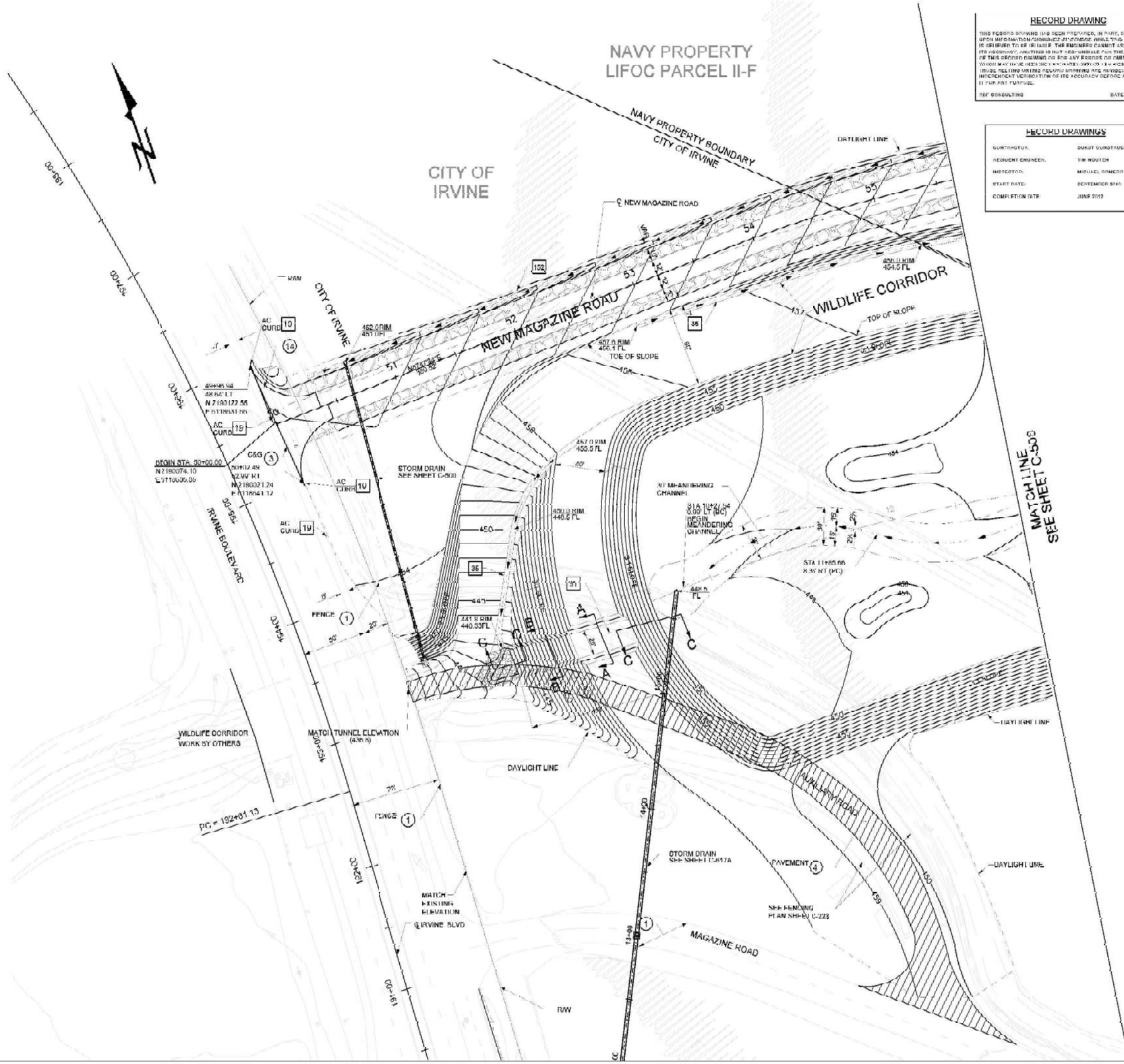



## RECORD DRAWING

THIS RECORD DRAWING HAS BEEN PREPARED, IN PART, BASED UPON INFORMATION SUBMITTED BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, THE ENGINEER CANNOT ASSUME ITS ACCURACY. ANYTHING IS NOT RESPONSIBLE FOR THE ACCURACY OF THIS RECORD DRAWING OR FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO THE RECORD. THOSE RELYING UPON THE RECORD DRAWING ARE ADVISED TO OBTAIN INDEPENDENT VERIFICATION OF ITS ACCURACY BEFORE APPLYING IT FOR ANY PURPOSE.

REF CONSULTING DATE APRIL 2015

## RECORD DRAWINGS

| | |
|---|---|
| CONTRACTOR: | DONUT CONSTRUCTION |
| REDIMENT ENGINEER: | TIM NOUTEN |
| INSPECTOR: | MIGUEL ROMERO |
| START DATE: | SEPTEMBER 2010 |
| COMPLETION DATE: | JUNE 2012 |

## CONSTRUCTION NOTES

### GRADING

19 SAWCUT

35 CONSTRUCT INTERCEPTOR DRAIN PER OCFW STD. PLAN NO. 1332

91 CONSTRUCT CONCRETE EMERGENCY SPILLWAY PER OCFW STD. PLAN NO. 1327 & DETAILS HEREON

142 CONSTRUCT VEGETATED SWALE PER DETAIL ON SHEET C-210 (NEW MAGAZINE ROAD)

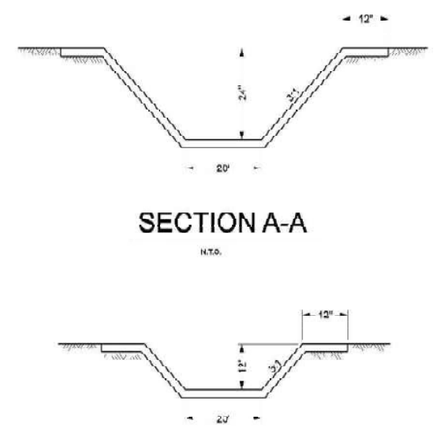
### LEGEND

1 PROTECT IN PLACE.

2 REMOVE

4 REMOVE MISCELLANEOUS ITEMS

14 RELOCATE TO LOCATION AS SHOWN

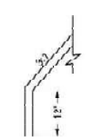



SECTION A-A

N.T.S.

SECTION B-B

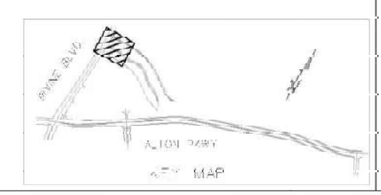
N.T.S.




SECTION C-C

N.T.S.

GRAPHIC SCALE




VICINITY MAP

COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR. |
|---|---|---|---|
| 1 | REVISED GRADING DESIGN | 07/11/11 | |
| 2 | RECORD DRAWINGS | 03/22/15 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: GARY L. VILLER, No. 56697, Exp. 6/30/10, CIVIL, STATE OF CALIFORNIA — DATE

CITY OF IRVINE
PLAN CHECK# EC0409982-ENC

CITY OF IRVINE
PERMIT # 2-1000-MCE

CITY OF LAKE FOREST
PLAN CHECK # B3866-1182

DESIGNED BY: JC
DRAWN BY: SK
CHECKED BY:
DRAWING CODE:
FILE NAME: P2_NBP-V.C.C-TSFR-507plan
PLOT DATE: MARCH 2015
SCALE: 1"=40'

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

ALTON PARKWAY
IRVINE BLVD TO COMMERCENTRE DR
WILDLIFE CORRIDOR
GRADING & REMOVAL PLAN
STA. 10+00 - 15+00

Sheet Reference Number

C-507



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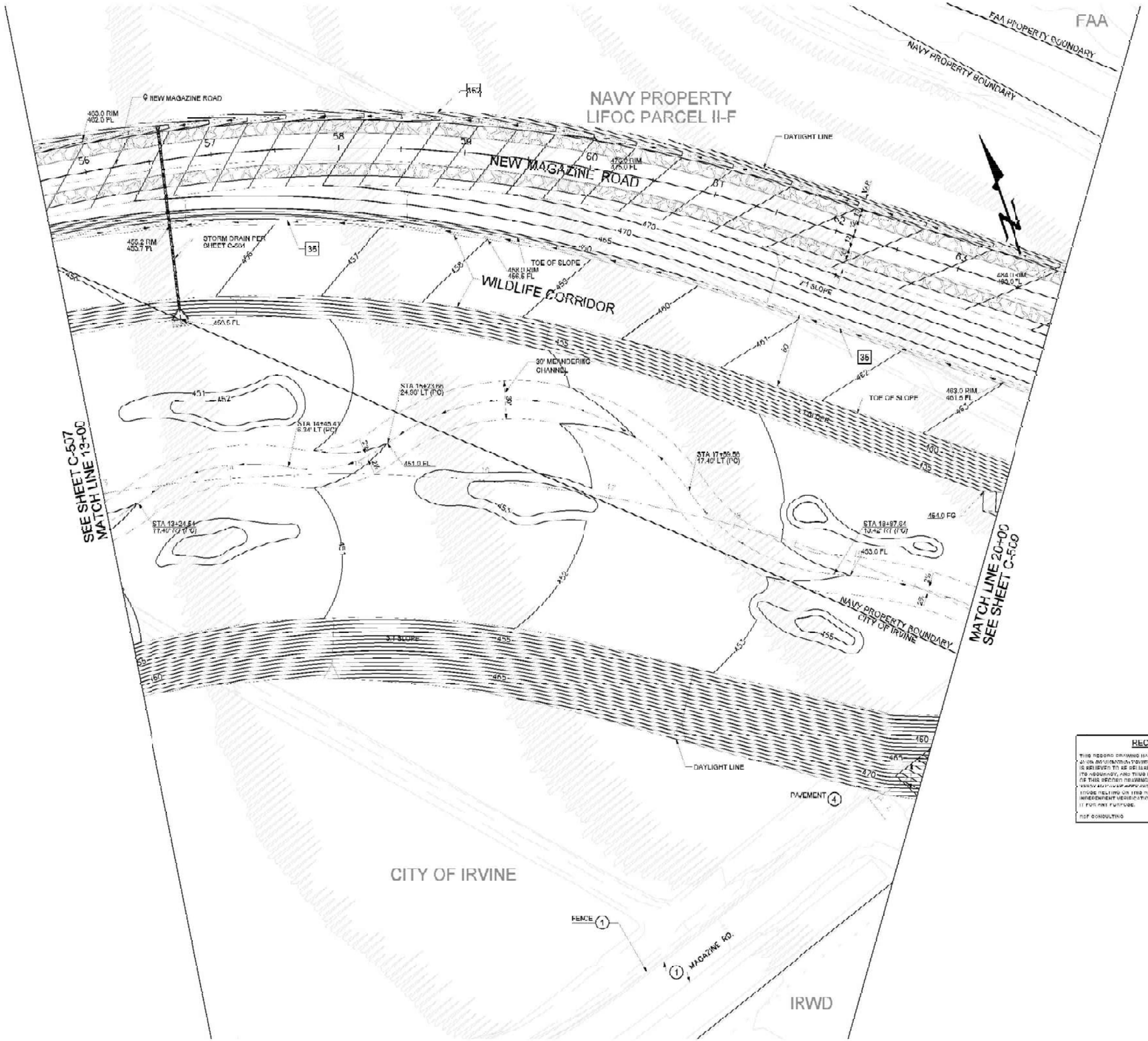


## CONSTRUCTION NOTES

### GRADING

35 CONSTRUCT INTERCEPTOR DRAIN PER OCPW STD. PLAN NO. 1332

15a CONSTRUCT VEGETATED SWALE PER DETAIL ON SHEET C 210 (NEW MAGAZINE ROAD)

### LEGEND

(1) PROTECT IN PLACE

(4) REMOVE MISCELLANEOUS ITEMS

**RECORD DRAWING**

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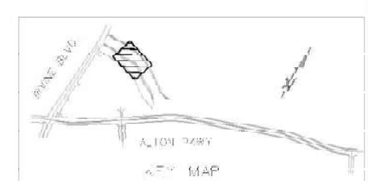
RBF CONSULTING DATE JUNE 2013

**RECORD DRAWINGS**

| | |
|---|---|
| CONTRACTOR: | SUNDT CONSTRUCTION |
| RESIDENT ENGINEER: | TIM ROUTEN |
| INSPECTOR: | MICHAEL ROMERO |
| START DATE: | SEPTEMBER 2010 |
| COMPLETION DATE: | JUNE 2013 |

GRAPHIC SCALE




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR. |
|---|---|---|---|
| 1 | REVISED GRADING DESIGN RECORD DRAWINGS | 07/01/11 03/22/13 | |

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CITY OF IRVINE PERMIT NO. 2-1000-ACE

CITY OF IRVINE PLAN CHECK# PCC-03992-ENC

CITY OF LAKE FOREST PLAN CHECK# 06-06-1182

DESIGNED BY: JC
DRAWN BY: SK
CHECKED BY:
DRAWING CODE:
FILE NAME: PE_Alton-WLC_FSPR-C03bmTC04
PLOT DATE: MARCH 2013
SCALE: 1"=40'

ORANGE COUNTY PUBLIC WORKS

PREPARED BY: RBF CONSULTING

ALTON PARKWAY IRVINE BLVD TO COMMERCENTRE DR
WILDLIFE CORRIDOR GRADING & REMOVAL PLAN
STA 13+00 - 20+00

Sheet Reference Number

C-508

Sheet 68 of 130

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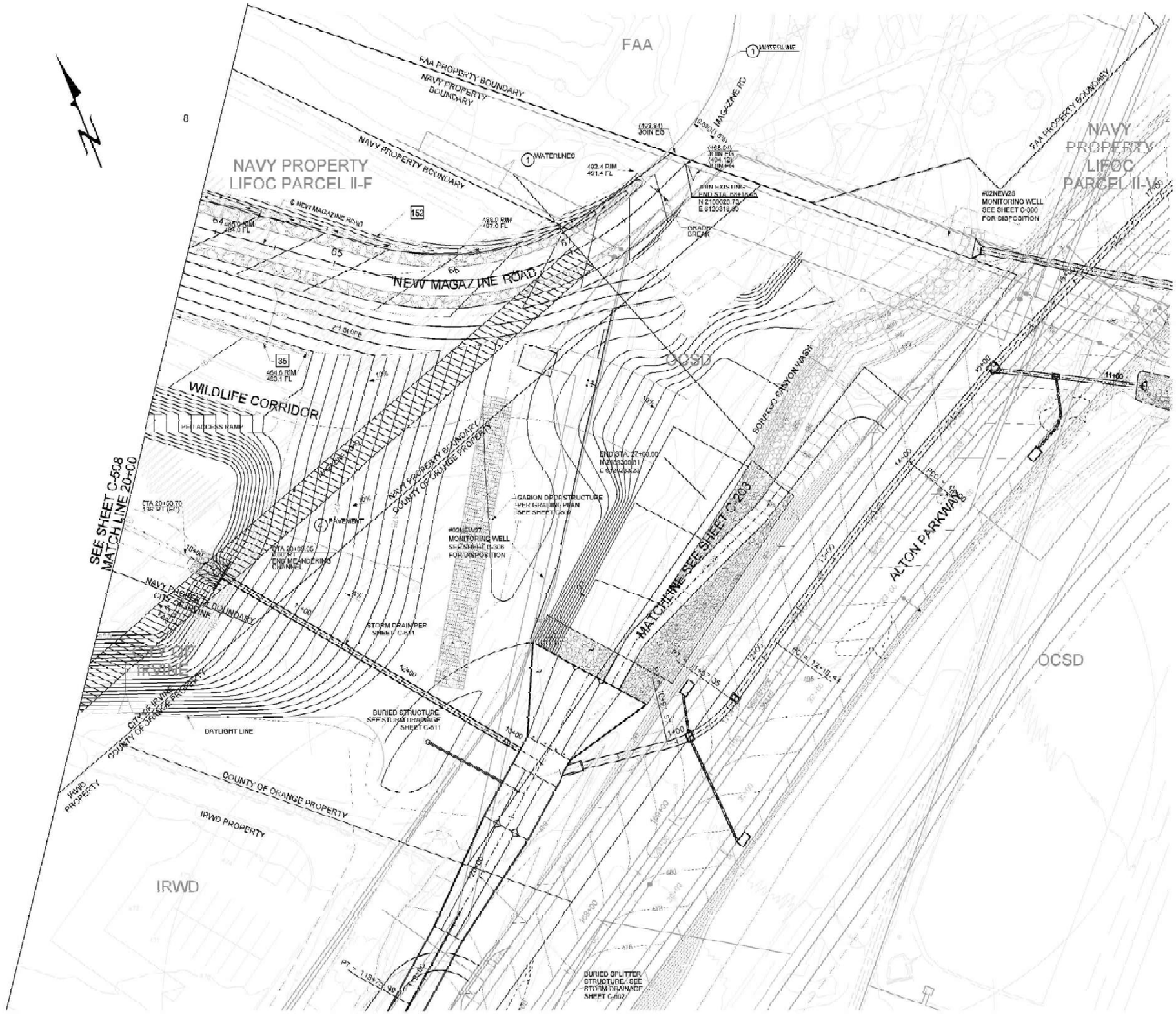


## CONSTRUCTION NOTES

### GRADING

35 CONSTRUCT INTERCEPTOR DRAIN PER OCPW STD. PLAN NO. 1332

152 CONSTRUCT VEGETATED SWALE PER DETAIL ON SHEET C-210 (NEW MAGAZINE ROAD)

## LEGEND

(1) PROTECT IN PLACE

(4) REMOVE MISCELLANEOUS ITEMS

### RECORD DRAWING

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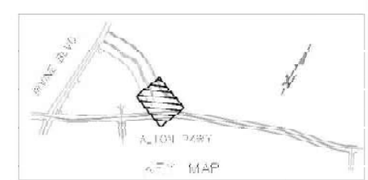
RBF CONSULTING DATE JUNE 2015

### RECORD DRAWINGS

| | |
|---|---|
| CONTRACTOR: | SUNIT CONSTRUCTION |
| RESIDENT ENGINEER: | TIM NGUYEN |
| INSPECTOR: | MICHAEL ROMERO |
| START DATE: | SEPTEMBER 2010 |
| COMPLETION DATE: | JUNE 2012 |




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR. |
|---|---|---|---|
| 1 | REVISED GRADING DESIGN | 07/16/11 | |
| 2 | RECORD DRAWINGS | 03/22/15 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: GARY L. VILLER, No. 56697, Exp. 6/30/16, CIVIL, STATE OF CALIFORNIA — DATE

DESIGNED BY: JE
DRAWN BY: SK
CHECKED BY:
DRAWING CODE:
PREPARED BY: RBF CONSULTING
FILE NAME: PG-A10-VIC_TSP2-509HDG4
PLOT DATE: MARCH 2016
SCALE: 1"=40'

ORANGE COUNTY PUBLIC WORKS

ALTON PARKWAY
IRVINE BLVD TO
COMMERCENTRE DR

# WILDLIFE CORRIDOR GRADING & REMOVAL PLAN

STA 20+00 - 23+69

Sheet Reference Number

C-509



CITY OF IRVINE
PLAN CHECK# PCC4-03992-ENC

CITY OF IRVINE
PERMIT #4-2700-ACE

CITY OF LAKE FOREST
PLAN CHECK # 16366-1182

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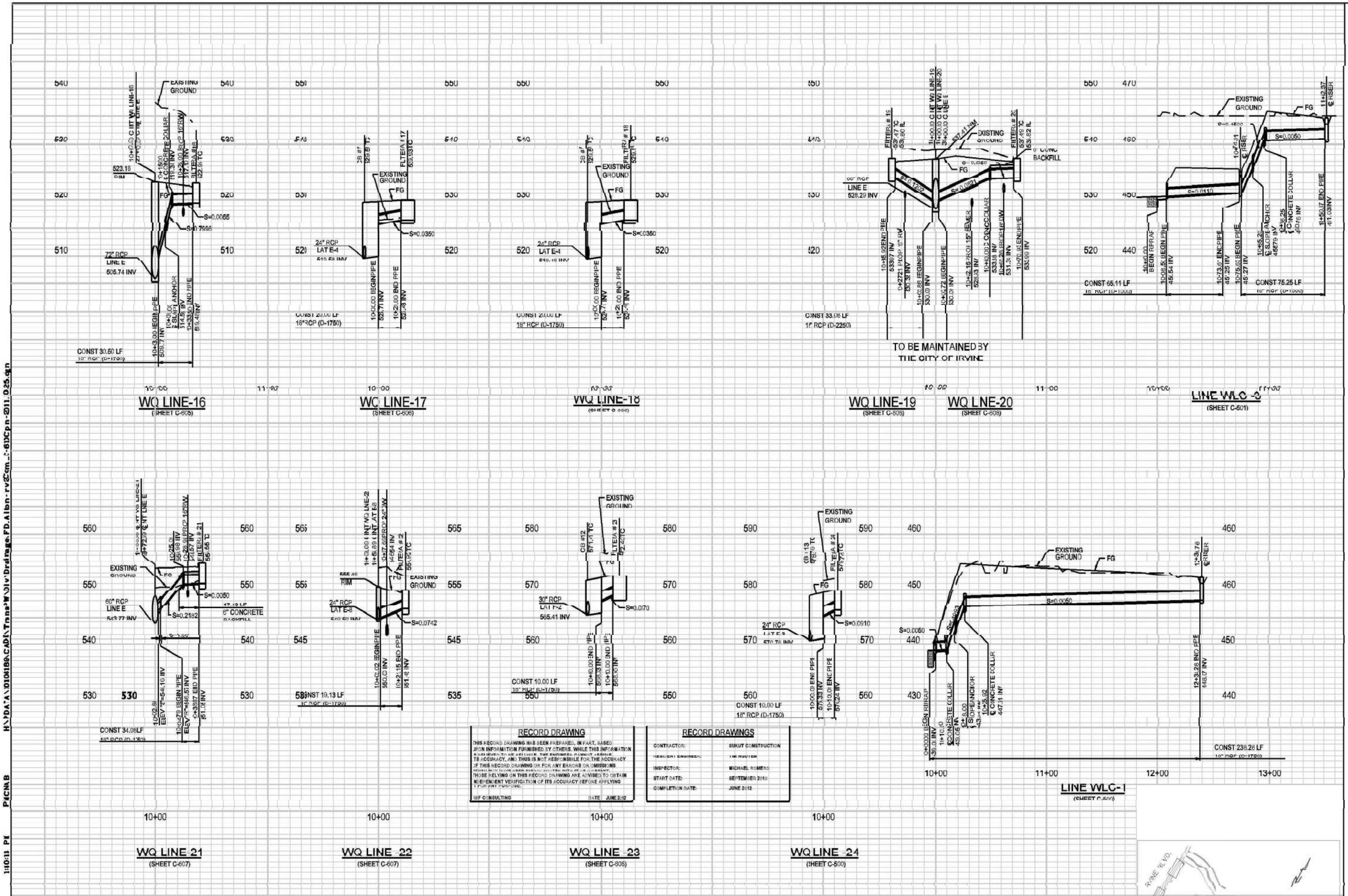


COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| 3 | UPDATE WLC FORCES | 07/3/11 | |
| 2 | REVISE WQ LINE-21 | 10/25/11 | |
| 1 | RECORD DRAWINGS | 03/22/13 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF
REGISTERED PROFESSIONAL ENGINEER STEVEN K. GIFFEN No. C042154 Exp. 03/31/12 CIVIL STATE OF CALIFORNIA
DATE 03/22/13

DESIGNED BY TMM
DRAWN BY EC
CHECKED BY SKG
DRAWING CODE:
PREPARED BY RBF CONSULTING
FILE NAME FD_Alton-rv2Cpn-2-6UCpn.dgn
PLOT DATE MARCH 2013
SCALE 1=40'

DRANGE COUNTY PUBLIC WORKS

ALTON PARKWAY IRVINE BLVD TO COMMERCENTRE DR

STORM DRAINAGE

Sheet Reference Number
C-610C

Sheet 610C of 130

CITY OF IRVINE
PLANCHECK #00408682ENG

CITY OF LAKE FORES
PLAN CHECK # 148564162

PERMIT# 47207-MCE

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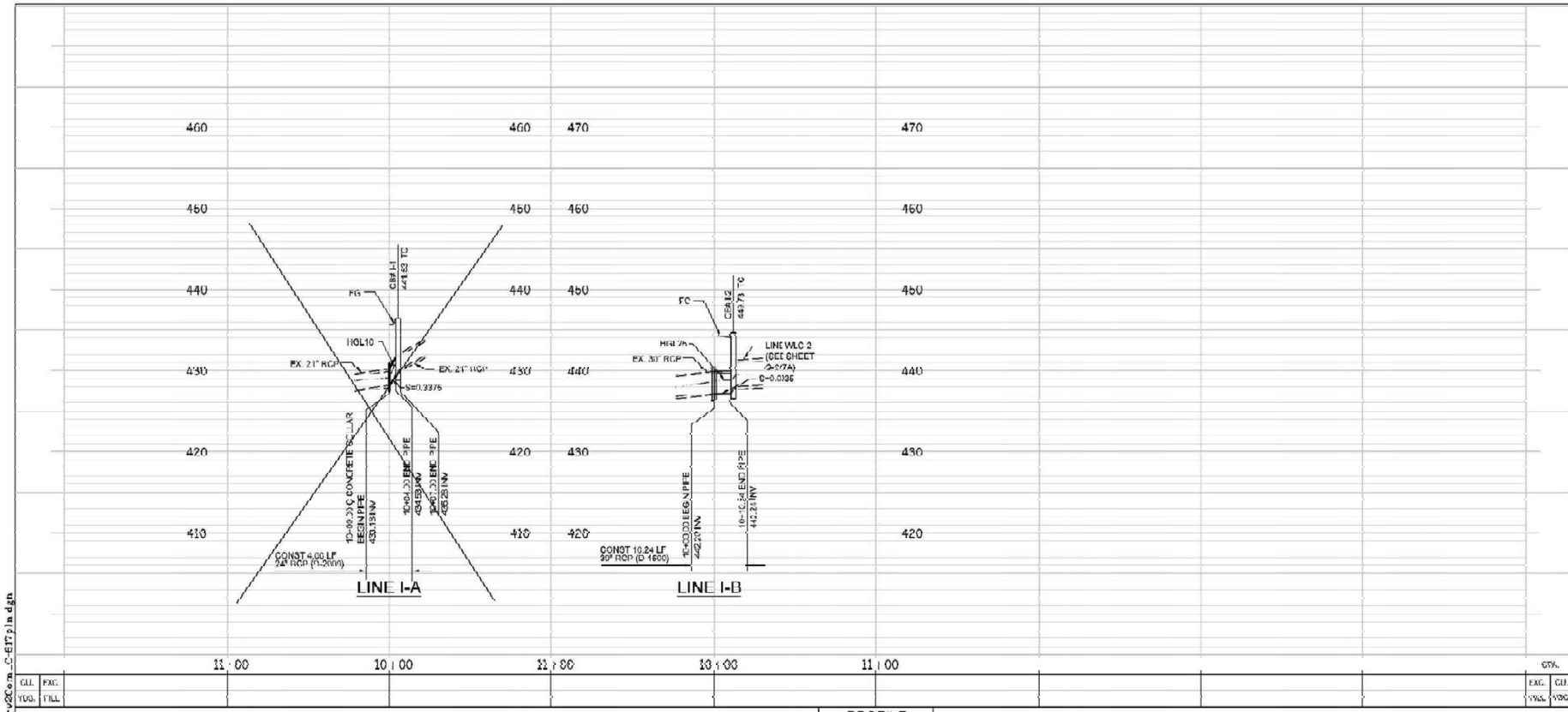
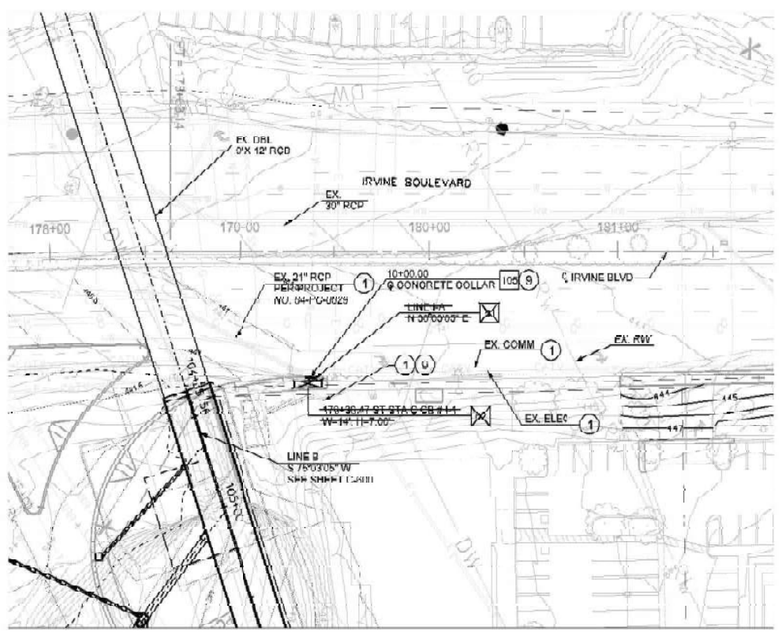
5/7/2013

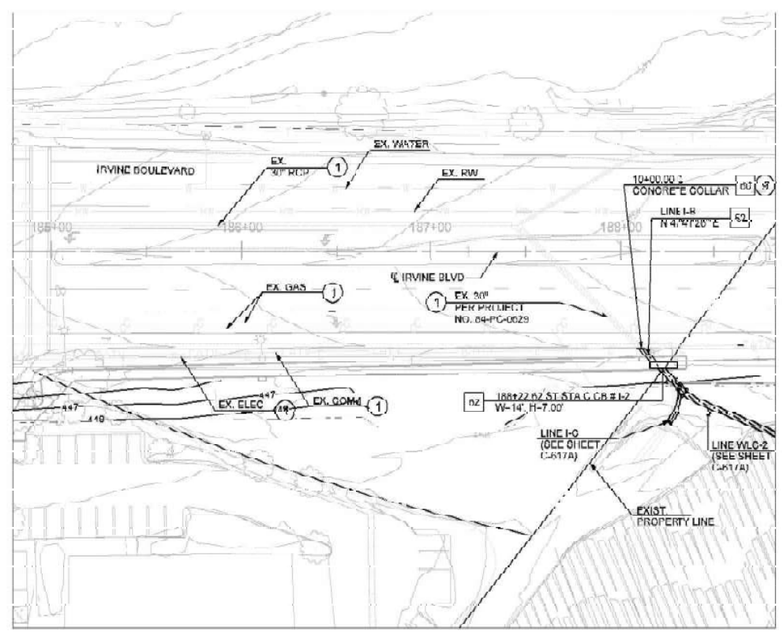



## CONSTRUCTION NOTES

### STORM DRAIN

- 51 CONSTRUCT 24" RCP (D-LOAD PER PROFILE)
- 52 CONSTRUCT 30" RCP (D-LOAD PER PROFILE)
- 00 CONSTRUCT CONCRETE COLLAR PER CITY OF IRVINE STD. PLAN NO. 310
- 62 CONSTRUCT CATCH BASIN TYPE II PER CITY OF IRVINE STD. PLAN NO. 301
- 106 CONSTRUCT MODIFIED CONCRETE COLLAR TYPE II PER DETAIL ON SHEET C-010




## LEGEND

1. PROTECT IN PLACE
2. REMOVE INTERFERRING PORTIONS OF DRAINAGE PIPE

| HYDRAULIC DATA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LINE | STATION | Diam | $Q_{10}$ | N | So | dn | dc | Vn | Vc | Sf | Fn |
| LINE I-A | 10+00.00 TO 10+04.00 | 24" | 17.0 | .013 | .3375 | 0.5 | 1.5 | 28.3 | 8.8 | .0050 | 8.7 |
| LINE I-B | 10+00.00 TO 10+10.24 | 30" | 19.7* | .013 | .0035 | 1.7 | 1.5 | 5.5 | 6.6 | .0023 | 0.8 |

* Q25

**RECORD DRAWING**

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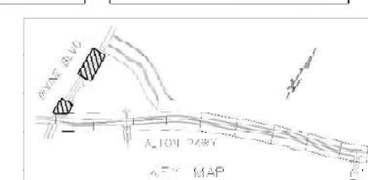
RBF CONSULTING DATE: JUNE 2012

**RECORD DRAWINGS**

| | |
|---|---|
| CONTRACTOR: | SHOEY CONSTRUCTION |
| RESIDENT ENGINEER: | TIM HOOVER |
| INSPECTOR: | MICHAEL RIVERO |
| START DATE: | SEPTEMBER 2010 |
| COMPLETION DATE: | JUNE 2012 |




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR. |
|---|---|---|---|
| 1 | RECORD DRAWINGS | 03/22/13 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: STEVEN K. GIFFEN, RCE No. C042154, Exp. 3/31/10, CIVIL, STATE OF CALIFORNIA — DATE

DESIGNED BY: TMO; DRAWN BY: SC; CHECKED BY: JMG; DRAWING CODE: ; SCALE: 1"=40'

PREPARED BY: RBF CONSULTING

TILE NAME: RD_A_STORM DRAIN_C-617.dgn; PLOT DATE: MARCH 2013

ORANGE COUNTY PUBLIC WORKS

ALTON PARKWAY IRVINE BLVD TO COMMERCENTRE DR

# STORM DRAINAGE

Sheet Reference Number

C-617



CITY OF IRVINE PLAN C-ECI# FEC459982-ENC

CITY OF IRVINE PERMIT # 27000-MCE

CITY OF LAKE FOREST PLAN CHECK # B3866-1182

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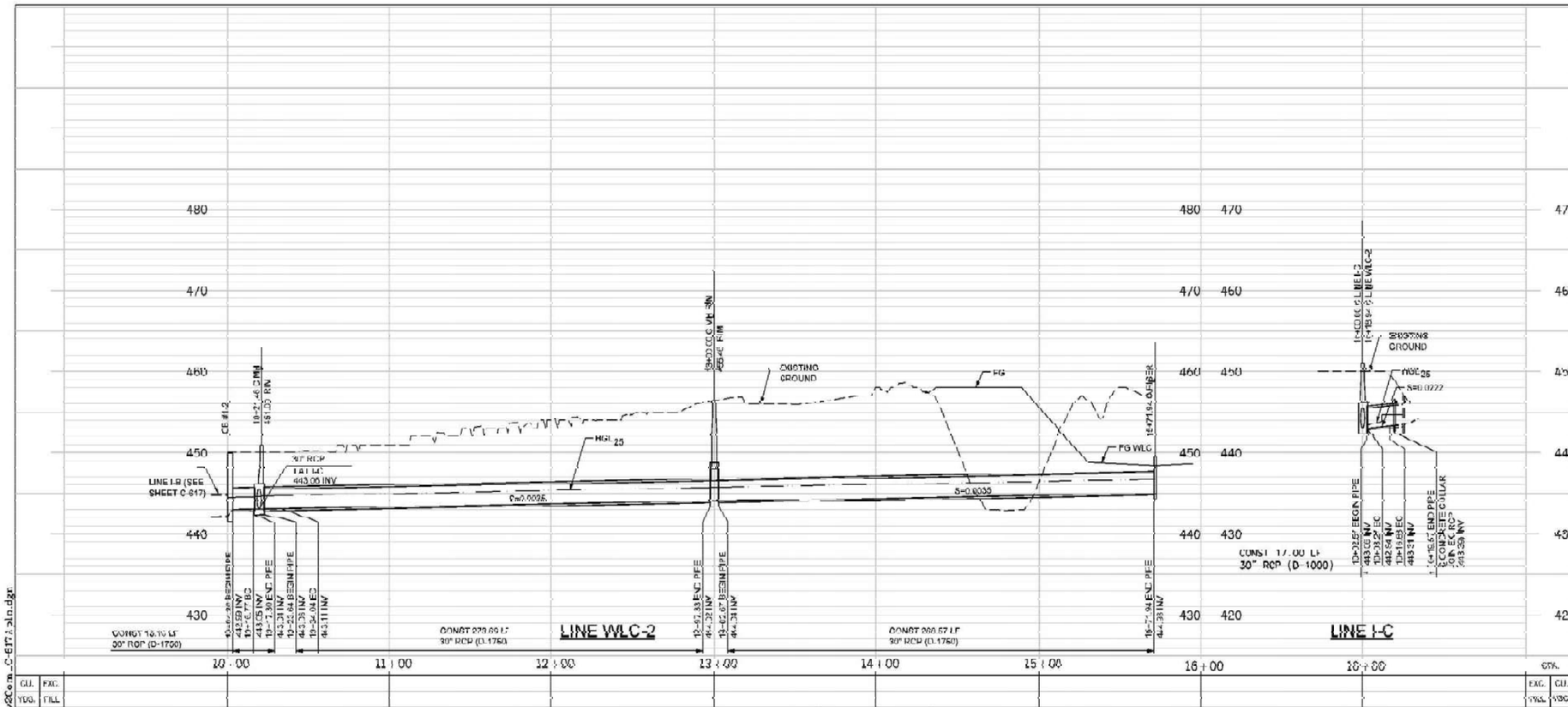


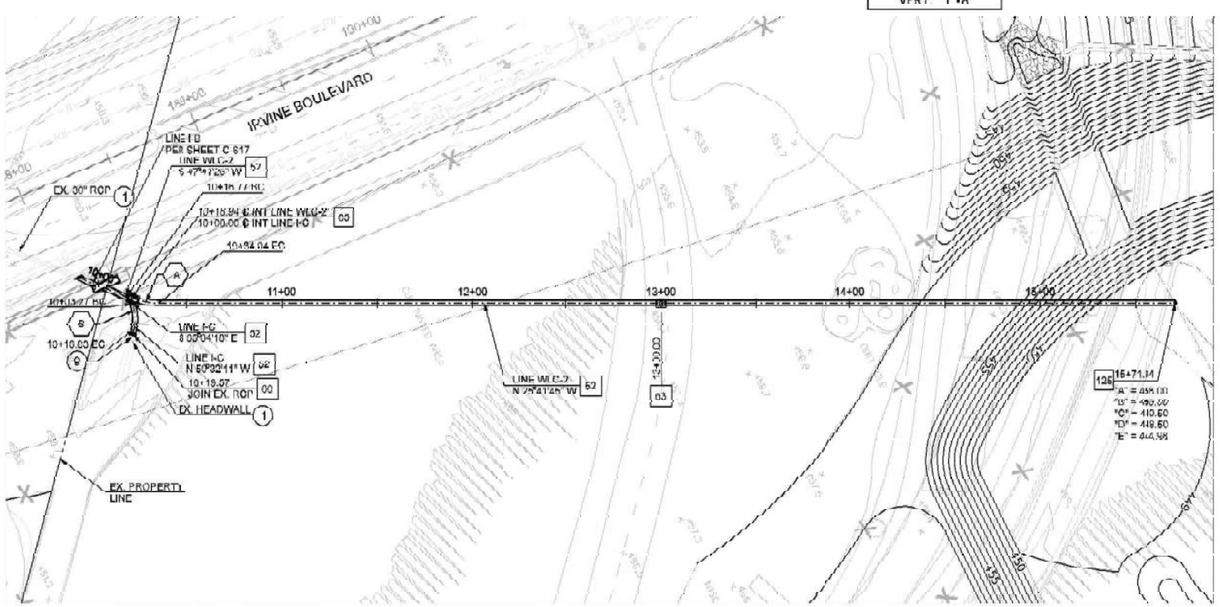


*NOTE: CONTRACTOR TO VERIFY HORIZONTAL AND VERTICAL LOCATION AT CONNECTION POINT

## CONSTRUCTION NOTES

### STORM DRAIN

- 52 CONSTRUCT 30" RCP (D-LOAD PER PROFILE)
- 60 CONSTRUCT CONCRETE COLLAR PER CITY OF IRVINE STD. PLAN NO. 310
- 63 CONSTRUCT JUNCTION STRUCTURE NO. I PER CITY OF IRVINE STD. PLAN NO. 306
- 65 CONSTRUCT JUNCTION STRUCTURE NO. III PER CITY OF IRVINE STD. PLAN NO. 308
- 126 INSTALL DESILTING BASIN PER DETAIL ON SHEET C-222 AND VALVES HEREON

LEGEND

- (1) PROTECT IN PLACE
- (2) REMOVE INTERFERRING PORTIONS OF DRAINAGE PIPE

CURVE DATA

| NO | Δ | R | L | T | REFERENCE |
|---|---|---|---|---|---|
| A | 24°50'44" | 45.00 | 17.27 | 8.74 | CL WLC-2 |
| B | 34°32'07" | 22.50 | 13.56 | 6.99 | CL I-C |

HYDRAULIC DATA

| LINE | STATION | Diam | $Q_{25}$ | N | So | da | do | Va | Ve | Sf | Sfc |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LINE WLC-2 | 10+00.00 TO 13+71.94 | 30" | 19.7 | .013 | .0035 | 1.7 | 2.3 | 5.5 | 0.0 | .00201 | 0.0 |
| LINE I-C | 10+00.00 TO 10+10.24 | 30" | 6.5 | .013 | .0100 | 0.0 | 0.0 | 7.5 | 0.9 | .0003 | 2.1 |

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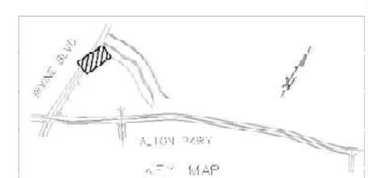
RBF CONSULTING DATE: JUNE 2012

**RECORD DRAWINGS**

| | |
|---|---|
| ARCHITECT: | WARYCH ARCHITECTURE |
| RESIDENT ENGINEER: | TIM NGUYEN |
| INSPECTOR: | MICHAEL GOMERO |
| START DATE: | SEPTEMBER 2010 |
| COMPLETION DATE: | JUNE 2012 |




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR. |
|---|---|---|---|
| 1 | RECORD DRAWINGS | 03/22/13 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: STEVEN K. GIFFEN, No. C64214, Exp. 3/31/13, CIVIL, STATE OF CALIFORNIA — DATE

ORANGE COUNTY PUBLIC WORKS

DESIGNED BY: TAM; DRAWN BY: BG; CHECKED BY: SKG; DRAWING CODE; FILE NAME: RC-Alton-IrvCom_C-617alt.dgn; PLOT DATE: MARCH 2013; SCALE: 1"=40'

PREPARED BY: RBF CONSULTING

ALTON PARKWAY IRVINE BLVD TO COMMERCENTER DR

STORM DRAINAGE

Sheet Reference Number

C-617A

Sheet 90 of 130

CITY OF IRVINE PLAN CHECK # PCC4B9982-ENC

CITY OF IRVINE PERMIT # 2-17000-MCE

CITY OF LAKE FOREST PLAN CHECK # B3B6-1182

3/25/2013 11:35:48 AM pmcnab E:\PDATA\DGN\CADD\TransFW\Div\Drainage\PD_Alton-IrvCom_C-617alt.dgn

# Preliminary Drainage Analysis

Western Alton Parcel

Southern Parcel

Irvine Boulevard

## Irvine, CA.

April 15, 2015

This Preliminary Drainage Analysis has been prepared by, and under the direction of, the undersigned, a duly Registered Civil Engineer in the State of California. Except as noted, the undersigned attests to the technical information contained herein, and has judged to be acceptable the qualifications of any technical specialists providing engineering data for this report, upon which findings, conclusions, and recommendations are based.


**D. Todd Schmieder, P.E.**
Registered Civil Engineer No. C37167
Exp.: 06/30/16


REGISTERED PROFESSIONAL ENGINEER
D. TODD SCHMIEDER
No. C37167
EXP. 6-30-16
CIVIL
STATE OF CALIFORNIA

*Prepared for:*

**Orange County Public Works**
County Executive Office – Land Development
445 Civic Center Drive West, 2nd Floor
Santa Ana, CA

Attn: Mr. James Campbell, Project Manager
714-667-9673

*Prepared by:*

TAIT
RISING TO THE CHALLENGE


**Tait & Associates, Inc.**
701 N. Parkcenter Drive
Santa Ana, CA 92705
(714) 560-8200


TAIT JOB # SP7531

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# Section 1 Purpose and Scope

This study presents an analysis of the hydrologic effects associated with the development of a 10.34 acre parcel for multi-family residential housing, in the City of Irvine, California, known as the South West Alton Parcel.

This study addresses runoff from the project site and its impact to the existing downstream storm drainage system. The study includes 25-year and 100-year storm calculations for both the existing and proposed condition. The study also details the general project characteristics, the design, criteria and methodology applied to the analysis of the project. The report provides a design analysis for the drainage facilities proposed as part of the project, with the drainage improvements being designed to mitigate all rainfall event frequencies up to a 24-hour, 25-year storm event. 24-hr, 100-year storm analysis is also included in this report to demonstrate the project will provide 100-year flood protection for all habitable structures.

This Hydrology Study fulfills the requirements of the Orange County Drainage Area Management Plan (DAMP 2011) and the Orange County Hydrology Manual (October 1986 and 1996 Addendum).

The plans and specifications in the Hydrology Study are not for construction purposes; the contractor shall refer to final approved construction documents for plans and specifications.

# Section 2 Project Information

## 2.1 Project Description

The proposed project involves the development of approximately 10.34 acres of multifamily residential dwelling units on a relatively triangular shaped property located within the City of Irvine.

### 2.1.1 Project Location

The project is located in the northeasterly quadrant of the former El Toro Marine Corps Air Station, northerly of the intersection of Alton Parkway and Irvine Boulevard, within the City of Irvine, California, as graphically shown in Figure 1, below. The site is separated from the North West Alton Parcel by an existing wildlife corridor.

**Figure 1 – Vicinity Map (Not To Scale)**

## 2.2 Hydrologic Setting

This section summarizes the project's size and location in the context of the larger watershed perspective, topography, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and other relevant hydrologic and environmental factors to be protected specific to the project area's watershed.

### 2.2.1 Watershed

The project site is located within the Santa Ana Region Hydrologic Unit as defined by the California Regional Water Quality Control Board, Region 8, and is tributary to the Newport Bay. Stormwater runoff from the site will be conveyed by an existing storm drain system in Irvine Boulevard that connects to Borrego Canyon Wash at the intersection of Irvine Boulevard and Alton Parkway.

The historical watershed drainage boundary for this area has been modified with the County's grading for the wildlife corridor that was completed in 2014 as part of the Alton Parkway roadway extension project. The ownership of the wildlife corridor property is eventually slated to be transferred to the City of Irvine.

The excavation for the wildlife corridor has resulted in a redirection of the offsite stormwater runoff northwest of the West Alton Parcel boundary into the wildlife corridor's drainage system and into the Agua Chinon Channel drainage system. The wildlife corridor drainage has an interim connection to the same existing storm drain line in Irvine Boulevard that will South West Alton Parcel will be draining into. Ultimately, the storm water runoff collected within the wildlife corridor will cross under Irvine Boulevard via the existing roadway bridge structure and continue southwest in a future drainage system through the City of Irvine's Great Park where it will eventually recollect to Borrego Canyon Wash near the southern boundary of the Great Park.

The existing wildlife crossing bridge structure in Irvine Boulevard is the "high point" in the roadway and serves as the dividing point for stormwater flows being directed into toward Borrego Canyon Wash and those to Agua Chinon Channel.

The portion of the offsite upstream drainage area that has been redirected to the Agua Chinon Channel drainage system (due to the wildlife corridor grading) flows off-site along the

northwest boundary of the West Alton Parcel (and the North West Alton Parcel) and is eventually collected in an existing unlined drainage swale that runs along the west side of Irvine Boulevard flowing northerly where it eventually discharges into an underground storm drain that crosses Irvine Boulevard and extends into the Great Park Neighborhoods east of Irvine Boulevard.

### 2.2.2 Existing Topography and Facilities

Although the topography of the project site is relatively flat, there is a consistent slope from the east to west sloping downward with ground surface elevations ranging from +479 to +450 feet above mean sea level. A private paved service road (former referred to as Magazine Road) provides access into the site off of Irvine Boulevard. Located adjacent to Irvine Boulevard and at the lowest elevation on the site is a small graded pond lined with rip-rap that serves as the project area's on-site collection point for existing storm runoff before discharging storm water into the existing storm drain line in Irvine Boulevard. Runoff discharging from the graded pond passes through a 30-inch RCP within a raised vertical headwall and discharges from the site to an existing 30-inch RCP located within Irvine Boulevard.

For the Wildlife Corridor the county installed an interim storm drain system to address storm water runoff prior to the ultimate extension of the wildlife corridor south under Irvine Boulevard and into the City of Irvine's Great Park. The interim storm drain system consists of a 30-inch RCP storm drain (designated as WCL-2 in the Alton Parkway Improvement Plans). This interim storm drain line collects runoff within the wildlife corridor and then extends through the South West Alton Parcel property and discharges into the 30-inch RCP that is located downstream of the existing site's graded pond. As part of the County's development of the South West Alton Parcel the storm water flow from the wildlife corridor will be rerouted around the development and connect to the existing 30" city storm drain line in Irvine Boulevard.

### 2.2.3 Adjacent Land Use

The project is bounded by Irvine Boulevard to the west, the Wildlife Corridor to the north, an Irvine Ranch Water District reservoir facility and an existing business park to the south.

### 2.2.4 Soil Conditions

The project site location resides within the hydrology soil group of A. The site location has been graphically shown on a Hydrologic Soil Group Map provided by Orange County Public Works, which has been included in the *Appendix E* section of this report.

### 2.2.5 Downstream Conditions

The project site discharges to an existing 30-inch RCP located within Irvine Boulevard (a City of Irvine Public Street and public storm drain line) and is tributary to the Orange County Flood Control District's Borrego Canyon Wash (located south of the project sites along Alton Parkway) and eventually joins the Agua Chinon Channel before discharging to the San Diego Creek and eventually the Upper Newport Bay.

The existing 30-inch RCP located within Irvine Boulevard receives runoff from 3 sources: the project site, a street catch basin serving a 0.81-acre segment of Irvine Boulevard, and through the interim wildlife corridor storm drain that traverse through the project site. See *Appendix D* for as-built plans of these existing facilities.

### 2.2.6 Existing Drainage Patterns

The existing on-site drainage pattern predominately consists of sheet flow across the site in an east to west direction and includes a shallow concentrated flow westward across the entirety of the barren site, as graphically shown on the Existing Hydrology Map in *Appendix A* of this report. The northern portion of the site discharges to Irvine Boulevard and the flows south along the unpaved roadside to a curb opening catch basin. The southern portion of the site drains to the graded pond adjacent to Irvine Boulevard. The catch basin and the graded pond discharge together through an existing 30-inch RCP storm drain in Irvine Boulevard.

### 2.2.7 Proposed Drainage Patterns

The proposed drainage pattern will essentially follow the existing drainage pattern as shown in the Conceptual Hydrology Map included in *Appendix A*. The 10.34 acres of proposed development will direct runoff westward through several storm drain systems to two main on-

site storm water detention basins. The on-site basins will eventually discharge to the existing 30-inch RCP in Irvine Boulevard that is currently serves as the site's existing stormwater conveyance system.

Based on limited infiltration percolation test results it is anticipated that the larger of the two proposed detention basins, Basin 2, will also provide an area for stormwater infiltration. Additional testing will be conducted in the final design to further investigate the site to determine if one of both detention basin can provide some infiltration capacity.

The stormwater flow from the wildlife corridor will be rerouted and connect to the existing city storm drain line in Irvine Boulevard, so it's volume of flow is not addressed in this report.

### 2.2.8 Impervious Cover

The existing site is approximately 10% impervious (the existing access road). Existing site cover consists of barren dirt except for the former Magazine Road, a paved asphalt service. The proposed site will include multifamily residential dwelling units, a small community park, a resident's clubhouse, a pool complex, parking lots, sidewalks, asphalt roads, landscape features, and multiple detention basins. The proposed site will be approximately 65% impervious.

# Section 3 Design Criteria and Methodology

This section summarizes the design criteria and methodology applied during the drainage analysis of the project site. The design criteria and methodology follow the Orange County Hydrology Manual dated October 1986.

## 3.1 Design Criteria

### 3.1.1 Drainage Design Criteria

The project storm drain facilities (inlets, culverts, detention, etc.) have been designed to conform to Orange County standards.

### 3.1.2 Flow-Based Numeric Sizing

2 Detention basins will be included in the design to ensure the post-development peak flow of the 25-year storm event remains below the existing 25-year storm event peak flow. The Detention basins have also been designed to fully contain the 100-year storm without overflowing and confirmed with the 100-year Detention basin analysis provided in *Appendix C.*

### 3.1.3 Runoff Calculation Method

Runoff calculations for this study were accomplished using the rational method in accordance with the recommendations of the Orange County Hydrology Manual.

A computer model was made using AES RATSCX and CH1 software with built-in methodology following the 1986 Orange County Hydrology Criterion. The RATSCX module was used to analyze and route runoff through each subarea using elevations, flow lengths, soil types, and area inputs to calculate peak flows developed during a 25-year and 100-year storm. The CH1 module was then used to produce hydrographs for each stream using Orange County Small Area Unit Hydrograph Method and then route the hydrograph produced flows within a flow-through basin model to produce a delayed flow basin hydrograph with user defined elevation-are-discharge relationships of each basin.

Design input criteria for the model were as follows:

Design Storm: 25-year, [100-year]

| | |
|---|---|
| Antecedent Moisture Condition (AMC): | II, [III] |
| SCS Soil Group: | A |
| Existing Land Use: | Barren – Native Poor Cover with paved access roadway (10% impervious) |
| Proposed Land Use: | Multifamily (65% impervious) |

In addition to the on-site flow calculations performed using AES software, runoff from an off-site 0.81 acre portion of Irvine Boulevard (referred to in this report as ST-1) was needed to analyze the capacity of the downstream 30-inch RCP within Irvine Boulevard. Runoff for this singular area was performed using the Rational Method in accordance with the Orange County Hydrology Manual. Precipitation intensity and time of concentration were calculated for a 25 year storm event using Figures B-3 and D-1 from the Orange County Hydrology Manual. These off-site calculations are available in *Appendix D*.

Full on-site AES RATSCX hydrologic calculations and values are included *Appendix B*. Proposed condition hydrographs and flow-through basin routing hydrographs are included in *Appendix C*.

### 3.1.4 Runoff and Detention

The proposed runoff for this project is limited to the existing 25-year storm peak runoff rate. Using AES RATSCX software, the existing and proposed peak flow rates were calculated to be 19.54 cfs and 31.24 cfs. To ensure post-development peak flow rates are not higher than the existing peak flows, 2 detention basins will be incorporated into the site's design which will reduce on-site peak runoff to 19.54 cfs or less.

The detention basins will allow ponding to reach a depth of roughly 4 feet. Each basin is purposely oversized in the current design to allow for possible future changes to basin purpose and functionality concerning possible LID treatment and aesthetic options. Outflow from each detention basin will include a flow limiting device such a weir or appropriately sized pipe as to limit discharge to the allowable peak rate. Basin 2 is currently designed to provide a dual purpose of detention and infiltration for LID requirements. Detention basin analysis was performed using runoff hydrographs produced in the AES CH1 program with the Orange County Hydrology Manual's modified Pul's method for flow-through basins. Runoff hydrographs and detention basin calculations are included in *Appendix C*. The detention basins and overall site drainage were also analyzed for the 100-year storm event as an additional measure of safety and to assess the size and performance of the basins under severe conditions. 100-year storm runoff hydrographs and detention basin calculations are also included in *Appendix C*.

Final detention system designs will be determined during the design and preparation of final construction documents. For the purpose of this preliminary study, a combined total of 62,800 cubic feet of detention is provided with the multiple detention basins.

### 3.1.5 LID and Treatment Control

Within the Santa Ana Regional Water Quality Control Board jurisdiction, the Fourth Term MS4 Permit has been adopted with specific requirements for new development and significant redevelopment stormwater control. Low impact development (LID) is a stormwater management strategy that emphasizes conservation and use of existing site features integrated with distributed stormwater controls that are designed to more closely mimic natural hydrologic patterns of undeveloped sites than traditional stormwater management controls. LID best management practices (BMPs) must me selected based on a hierarchy of controls and sized to capture the maximum feasible portion of the Design Capture Volume (DCV) (e.g. retention), before attempting to address the remaining volume with the next lower priority control (biotreatment). The DCV is governed by Hydraulic Conditions of Concern (HCOCs) as determined in the project WQMP, the effect of which is to treat a larger percentage of runoff equal to the difference between the pre- and post-development runoff volume.

Available options for on-site stormwater retention include the use of infiltration BMPs, harvest and use BMPs, and Evapotranspiration BMPs, in order of selection priority. These stormwater retention options are occasionally deemed infeasible on a project specific basis for a number of reasons including the location of groundwater, risk of groundwater pollution, geotechnical hazards, adjacent land uses, and site soil conditions among others.

Biotreatment BMPs provide a variety of treatment mechanisms to remove both suspended and dissolved pollutants in urban stormwater runoff. All biotreatment BMPs may be volume-based (storage a key design component) and are designed to treat and discharge urban stormwater runoff to a downstream conveyance system. Biotreatment BMPs can be designed to promote infiltration and evapotranspiration even though they are treat-and-release BMPs. If necessary to mitigate risks to structures, human health, or other concerns, a biotreatment BMP may also be lined to prevent infiltration of urban stormwater runoff into underlying soils. Examples of biotreatment BMPs include rain gardens, vegetated swales, retention ponds, constructed wetlands, detention basin, and proprietary biotreatment devices such as the Filterra and/or Modular Wetland systems.

Initial review of the Western Alton Parcel suggests retention is not be feasible for the entire site therefore, for the purpose of this Preliminary Drainage Analysis, a combination of infiltration and biotreatment BMPs will be used in the conceptual design of this project. Refer to the project WQMP for further details regarding LID and BMP use and selection.

# Section 4 Hydrology and Drainage Analysis

This section summarizes the quantitative hydrologic analysis of the existing and proposed conditions of the site.

## 4.1 Drainage Delineation

*Appendix A* of this report contains the existing condition hydrology map and a conceptual hydrology map for the proposed condition. Both the existing and proposed hydrology maps show the drainage subareas and flow paths correlating to AES runoff calculations.

## 4.2 Summary of Results*

Based on the results of this study, the project mitigation measures proposed will prevent an increase in runoff. Therefore, the proposed project improvements will not have an adverse effect on the downstream storm drain system. A summary of results has been included in Table 1 below.

**Table 1 - Summary of On-site Results**

| | Area (ac) | Impervious % | Peak 25 yr Flow Q25 (cfs) | Peak 100 yr Flow Q100 (cfs) | Detention Storage* (cf) |
|---|---|---|---|---|---|
| Existing | 10.34 | 10 | 19.54 | 26.35 | - |
| Proposed (No detention) | 10.34 | 65 | 31.24 | 40.56 | - |
| Proposed (w/ detention) | | | 8.52 | 18.06 | 62,800 |

* This analysis for the Post-Development Condition shall be considered to be a planning tool only to help guide the developer and the architect in creating a land use plan. Additional design analysis is required to determine the Post Development Condition requirements for stormwater detention and treatment.

In regards to the 30-inch RCP Lateral A1 within Irvine Boulevard acting as the solitary site outfall, this study has determined through research of record drawings and hydrologic

calculations that it has sufficient capacity to handle the proposed runoff demand. Table 2 below summarizes capacity and demand of the 30-inch RCP Lateral A1.

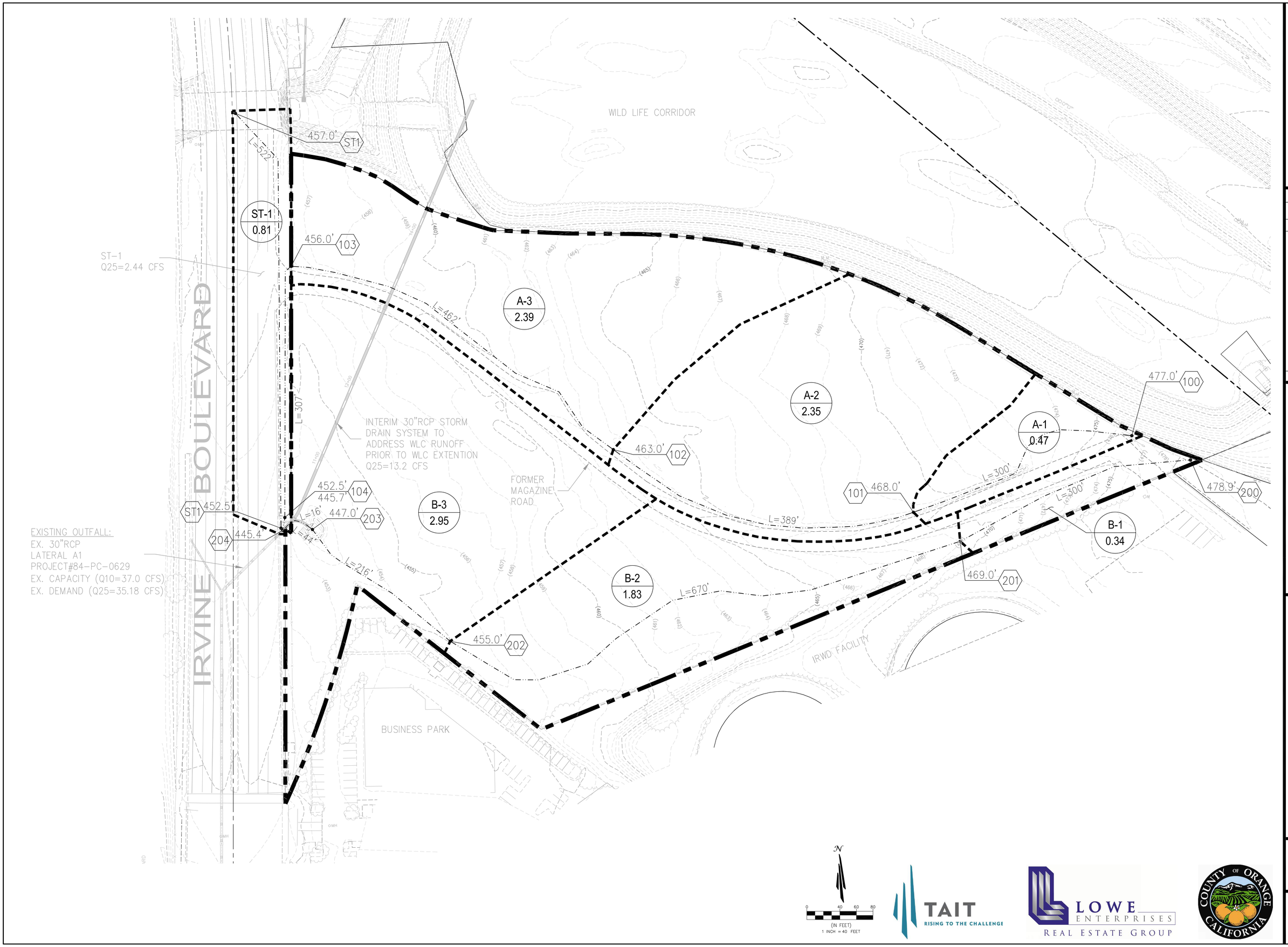
**Table 2 - Summary of downstream 30-inch RCP Lateral A1.**

| Receiving Runoff Sources | DEMAND **$Q_{25}$ (cfs)** | | CAPACITY* **$Q_{10}$ (cfs)** |
|---|---|---|---|
| | Existing | Proposed | |
| Wild Life Corr. SD (WLC-2) | 13.2 | 13.2 | -- |
| 0.81 ac portion of Irvine Blvd. | 2.44 | 2.44 | -- |
| Project Site | 19.54 | 8.52 | -- |
| **TOTAL** | **35.18** | **24.16** | **37.0 *** |

*Peak 10 year storm flow capacity was found on record drawings of project #84-PC-0629. The peak 25 year storm flow of WLC-2 was found on Alton Parkway Construction Plans dated April 2009 on sheets C-617 and C-617A. $Q_{25}$ of Line WLC-2 was determined by subtracting Line I-C (6.5 cfs) from the total downstream flow of Line I-B (19.7 cfs). Record drawings depicting these stormdrain systems included in *Appendix D*.

## THIS STUDY SHALL NOT BE USED FOR FINAL DESIGN.

# APPENDIX

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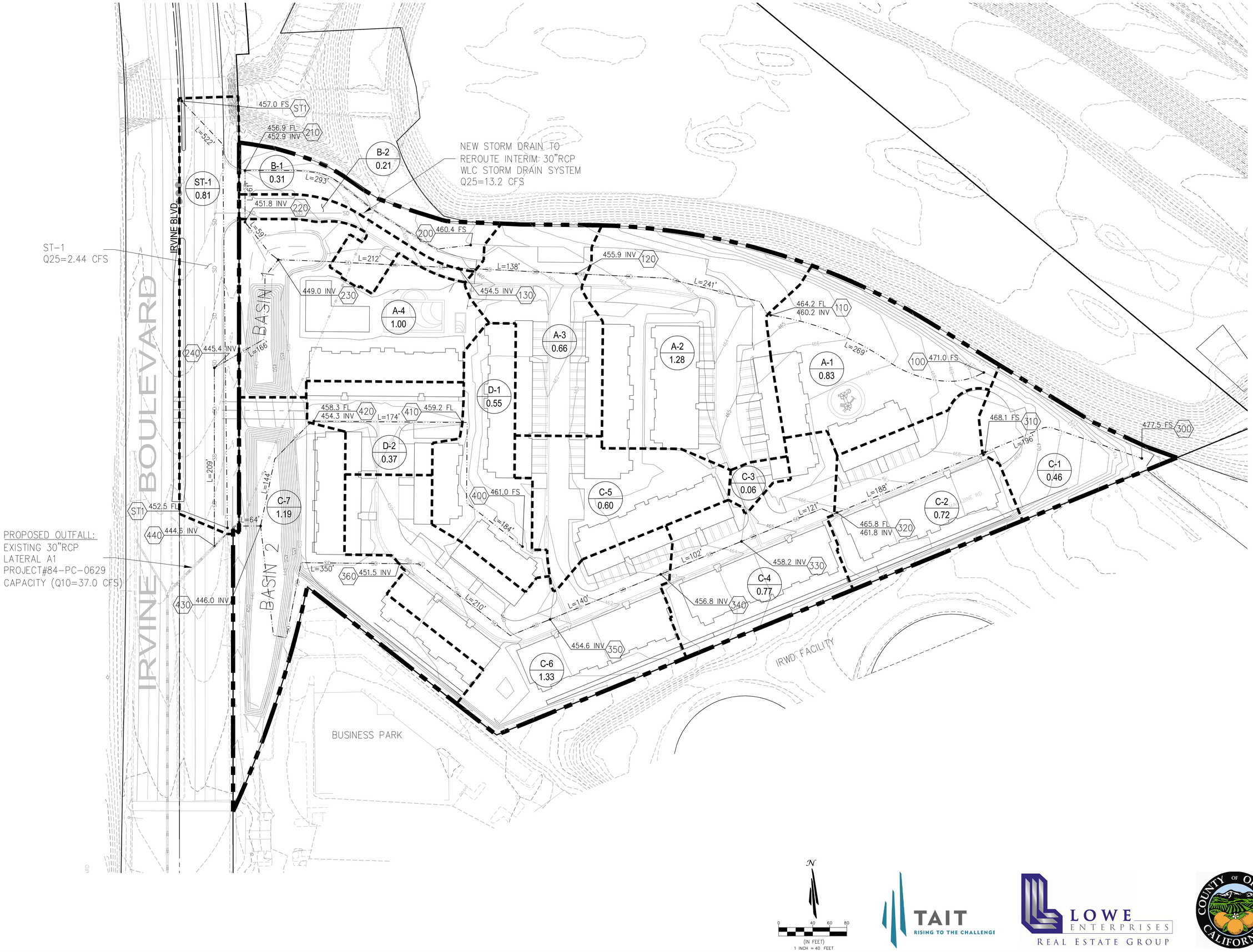
|---|---|---|---|---|
| | REVISIONS | | | |

# EXISTING CONDITION HYDROLOGY MAP

WESTERN ALTON PARCEL - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2015.11.25
CHECKED:
DATE:
REVISION #: --
DATE: --
JOB NO: SP7531

Nov 25, 2015 - 3:42pm by rhaskin K:\Drawings\SP\SP7531 Lowe El Toro\Eng\Alton Parcels\Hydrology\SP7531-SWAP-HYD-PRE.dwg

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|---|---|---|---|---|
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# PROPOSED CONDITION HYDROLOGY MAP

WESTERN ALTON PARCEL - ORANGE COUNTY
LOWE ENTERPRISES REAL ESTATE GROUP
UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE
IRVINE, CALIFORNIA

DRAWN: RH
DATE: 2016.04.14
CHECKED:
DATE:
REVISION #: --
DATE:
JOB NO: SP7531

Apr 14, 2016 – 2:22pm by rhoskin \\192.168.3.1\cad\Drawings\SP\SP7531 Lowe El Toro\Eng\Alton Parcels\Hydrology\SP7531-SWAP-HYD-POST.dwg

# Appendix A – Hydrology Maps

See Attached Exhibits.

# Appendix B – AES Rational Method Calculations

See Attached Exhibit

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - SOUTH PARCEL
EXISTING CONDITION
25 YEAR STORM

 ----------------------------------------------------------------------------
   FILE NAME: SWAPX25A.DAT
   TIME/DATE OF STUDY: 14:33 11/25/2015
 ============================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

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

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

```
       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    477.00  DOWNSTREAM(FEET) =    468.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.615
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.332
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        0.47      0.40     0.900    32    9.62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =      1.26
  TOTAL AREA(ACRES) =      0.47   PEAK FLOW RATE(CFS) =      1.26

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    468.00  DOWNSTREAM(FEET) =    463.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   389.00   CHANNEL SLOPE =  0.0129
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.908
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        2.35      0.40     0.900    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.96
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.48
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   2.61
  Tc(MIN.) =   12.23
```

```
  SUBAREA AREA(ACRES) =     2.35       SUBAREA RUNOFF(CFS) =    5.39
  EFFECTIVE AREA(ACRES) =      2.82     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        2.8         PEAK FLOW RATE(CFS) =       6.47

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =   2.87
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     689.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    463.00  DOWNSTREAM(FEET) =    456.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   462.00   CHANNEL SLOPE =  0.0152
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.637
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        2.39      0.40     0.900    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.34
  AVERAGE FLOW DEPTH(FEET) =   0.57   TRAVEL TIME(MIN.) =   2.30
  Tc(MIN.) =   14.53
  SUBAREA AREA(ACRES) =     2.39       SUBAREA RUNOFF(CFS) =    4.90
  EFFECTIVE AREA(ACRES) =      5.21     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        5.2         PEAK FLOW RATE(CFS) =      10.68

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.62   FLOW VELOCITY(FEET/SEC.) =   3.52
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1151.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    456.00  DOWNSTREAM(FEET) =    452.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   307.00   CHANNEL SLOPE =  0.0114
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      10.68
  FLOW VELOCITY(FEET/SEC.) =   2.08   FLOW DEPTH(FEET) =   0.44
```

```
  TRAVEL TIME(MIN.) =   2.47   Tc(MIN.) =   17.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    1458.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    204.00 IS CODE =  46
----------------------------------------------------------------------------
  >>>>>COMPUTE BOX-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED BOX SIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.70  DOWNSTREAM(FEET) =   445.40
  FLOW LENGTH(FEET) =    16.00   MANNING'S N =  0.013
  GIVEN BOX BASEWIDTH(FEET) =   3.00   GIVEN BOX HEIGHT(FEET) =   6.50
  FLOWDEPTH IN BOX IS  0.45 FEET   BOX-FLOW VELOCITY(FEET/SEC.) =   7.82
  BOX-FLOW(CFS) =      10.68
  BOX-FLOW TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   17.03
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    204.00 =    1474.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 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.) =   17.03
  RAINFALL INTENSITY(INCH/HR) =   2.41
  AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.90
  EFFECTIVE STREAM AREA(ACRES) =       5.21
  TOTAL STREAM AREA(ACRES) =       5.21
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.68

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    478.90  DOWNSTREAM(FEET) =    469.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.434
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.368
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        0.34      0.40     0.900    32    9.43
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
```

```
  SUBAREA RUNOFF(CFS) =      0.92
  TOTAL AREA(ACRES) =      0.34   PEAK FLOW RATE(CFS) =      0.92

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    469.00  DOWNSTREAM(FEET) =    455.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   670.00   CHANNEL SLOPE =  0.0209
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  30.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.434
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        1.83      0.40     0.900    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.67
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.53
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   7.31
  Tc(MIN.) =   16.75
  SUBAREA AREA(ACRES) =     1.83       SUBAREA RUNOFF(CFS) =    3.42
  EFFECTIVE AREA(ACRES) =      2.17     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        2.2         PEAK FLOW RATE(CFS) =       4.05

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.16   FLOW VELOCITY(FEET/SEC.) =   1.75
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     970.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    455.00  DOWNSTREAM(FEET) =    447.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   216.00   CHANNEL SLOPE =  0.0370
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.327
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        2.95      0.40     0.900    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
```

```
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.66
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.61
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   1.38
  Tc(MIN.) =   18.13
  SUBAREA AREA(ACRES) =     2.95       SUBAREA RUNOFF(CFS) =    5.22
  EFFECTIVE AREA(ACRES) =      5.12     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        5.1         PEAK FLOW RATE(CFS) =       9.06

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.22   FLOW VELOCITY(FEET/SEC.) =   2.89
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1186.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   447.00  DOWNSTREAM(FEET) =   445.40
  FLOW LENGTH(FEET) =    44.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS   7.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.25
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.06
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   18.20
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    1230.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 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.) =   18.20
  RAINFALL INTENSITY(INCH/HR) =   2.32
  AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.90
  EFFECTIVE STREAM AREA(ACRES) =       5.12
  TOTAL STREAM AREA(ACRES) =       5.12
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       9.06

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       10.68   17.03    2.411  0.40( 0.36) 0.90       5.2     100.00
      2        9.06   18.20    2.322  0.40( 0.36) 0.90       5.1     200.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       19.54   17.03    2.411  0.40( 0.36) 0.90      10.0     100.00
      2       19.28   18.20    2.322  0.40( 0.36) 0.90      10.3     200.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      19.54    Tc(MIN.) =    17.03
  EFFECTIVE AREA(ACRES) =      10.00   AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =       10.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    204.00 =    1474.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       10.3  TC(MIN.) =     17.03
  EFFECTIVE AREA(ACRES) =     10.00  AREA-AVERAGED Fm(INCH/HR)=  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap = 0.900
  PEAK FLOW RATE(CFS)   =      19.54

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       19.54   17.03    2.411  0.40( 0.36) 0.90      10.0     100.00
      2       19.28   18.20    2.322  0.40( 0.36) 0.90      10.3     200.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - SOUTH PARCEL
PROPOSED CONDITION
25 YEAR STORM

 ----------------------------------------------------------------------------
   FILE NAME: SWAPQ25.DAT
   TIME/DATE OF STUDY: 15:02 11/25/2015
 ============================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =   25.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

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

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.40
```

```
       30-MINUTES         0.87
        1-HOUR            1.15
        3-HOUR            1.94
        6-HOUR            2.71
       24-HOUR            4.49
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   269.00
  ELEVATION DATA: UPSTREAM(FEET) =    471.00  DOWNSTREAM(FEET) =    464.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.041
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.974
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.83      0.40     0.350    32    7.04
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      2.86
  TOTAL AREA(ACRES) =      0.83   PEAK FLOW RATE(CFS) =      2.86

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   460.20  DOWNSTREAM(FEET) =   455.90
  FLOW LENGTH(FEET) =   241.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.00
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.86
  PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =    7.71
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =     510.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.71
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.775
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.28      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.28      SUBAREA RUNOFF(CFS) =    4.19
  EFFECTIVE AREA(ACRES) =      2.11   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.1       PEAK FLOW RATE(CFS) =       6.90

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   455.90  DOWNSTREAM(FEET) =   454.50
  FLOW LENGTH(FEET) =   138.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.12
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.90
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    8.09
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =     648.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.09
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.675
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.66      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.66      SUBAREA RUNOFF(CFS) =    2.10
  EFFECTIVE AREA(ACRES) =      2.77   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.8       PEAK FLOW RATE(CFS) =       8.81

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   454.50  DOWNSTREAM(FEET) =   449.00
  FLOW LENGTH(FEET) =   212.00   MANNING'S N =  0.013
```

```
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.30
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.81
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    8.47
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    230.00 =     860.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.47
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.580
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.00      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.00      SUBAREA RUNOFF(CFS) =    3.10
  EFFECTIVE AREA(ACRES) =      3.77   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.8       PEAK FLOW RATE(CFS) =      11.67

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.47
  RAINFALL INTENSITY(INCH/HR) =   3.58
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       3.77
  TOTAL STREAM AREA(ACRES) =       3.77
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      11.67

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   293.00
  ELEVATION DATA: UPSTREAM(FEET) =    460.40  DOWNSTREAM(FEET) =    456.90

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

```
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.465
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.581
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.31      0.40     0.350    32    8.46
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      0.96
  TOTAL AREA(ACRES) =      0.31   PEAK FLOW RATE(CFS) =      0.96

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   452.90  DOWNSTREAM(FEET) =   451.80
  FLOW LENGTH(FEET) =    61.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.39
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.96
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =    8.70
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    220.00 =     354.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.70
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.526
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.21      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.21      SUBAREA RUNOFF(CFS) =    0.64
  EFFECTIVE AREA(ACRES) =      0.52   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =       1.58

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.80  DOWNSTREAM(FEET) =   449.00
```

```
  FLOW LENGTH(FEET) =    59.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.17
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.58
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    8.83
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     413.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.83
  RAINFALL INTENSITY(INCH/HR) =   3.50
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       0.52
  TOTAL STREAM AREA(ACRES) =       0.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.58

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       11.67    8.47    3.580  0.40( 0.14) 0.35       3.8     100.00
      2        1.58    8.83    3.495  0.40( 0.14) 0.35       0.5     200.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       13.23    8.47    3.580  0.40( 0.14) 0.35       4.3     100.00
      2       12.97    8.83    3.495  0.40( 0.14) 0.35       4.3     200.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.23    Tc(MIN.) =     8.47
  EFFECTIVE AREA(ACRES) =       4.27   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    230.00 =     860.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   445.40
  FLOW LENGTH(FEET) =   166.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.40
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.23
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    8.76
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    240.00 =    1026.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    440.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.40  DOWNSTREAM(FEET) =   444.60
  FLOW LENGTH(FEET) =   209.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.82
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.23
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    9.48
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    440.00 =    1235.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    440.00 TO NODE    440.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   196.00
  ELEVATION DATA: UPSTREAM(FEET) =    477.50  DOWNSTREAM(FEET) =    468.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.458
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.590
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.46      0.40     0.350    32    5.46
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      1.84
  TOTAL AREA(ACRES) =      0.46   PEAK FLOW RATE(CFS) =      1.84
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    468.10
  DOWNSTREAM NODE ELEVATION(FEET) =    465.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   188.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.150
  PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02200
  MAXIMUM DEPTH(FEET) =   0.50
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.145
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.72      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.14
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.90
  AVERAGE FLOW DEPTH(FEET) =   0.26   FLOOD WIDTH(FEET) =   11.67
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.08   Tc(MIN.) =    6.54
  SUBAREA AREA(ACRES) =    0.72       SUBAREA RUNOFF(CFS) =    2.59
  EFFECTIVE AREA(ACRES) =    1.18     AREA-AVERAGED Fm(INCH/HR) =   0.14
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.35
  TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       4.25

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOOD WIDTH(FEET) =   14.06
  FLOW VELOCITY(FEET/SEC.) =   3.00   DEPTH*VELOCITY(FT*FT/SEC) =   0.87
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =     384.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   461.80  DOWNSTREAM(FEET) =   458.20
  FLOW LENGTH(FEET) =   121.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.06
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.25
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    6.79
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =     505.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.79
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.057
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.06      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.06      SUBAREA RUNOFF(CFS) =    0.21
  EFFECTIVE AREA(ACRES) =      1.24   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.2       PEAK FLOW RATE(CFS) =       4.37

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    340.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   458.20  DOWNSTREAM(FEET) =   456.80
  FLOW LENGTH(FEET) =   102.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.13
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.37
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =    7.07
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    340.00 =     607.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.07
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.966
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.77      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.77      SUBAREA RUNOFF(CFS) =    2.65
  EFFECTIVE AREA(ACRES) =      2.01   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.0       PEAK FLOW RATE(CFS) =       6.92

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    350.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   456.80  DOWNSTREAM(FEET) =   454.60
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.25
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.92
  PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =    7.39
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    350.00 =     747.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    350.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.39
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.868
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.60      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    2.01
  EFFECTIVE AREA(ACRES) =      2.61   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.6       PEAK FLOW RATE(CFS) =       8.76

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   454.60  DOWNSTREAM(FEET) =   451.50
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.46
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.76
  PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =    7.86
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    360.00 =     957.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    360.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =    7.86
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.735
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.33      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.33      SUBAREA RUNOFF(CFS) =    4.30
  EFFECTIVE AREA(ACRES) =      3.94   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.9       PEAK FLOW RATE(CFS) =      12.75

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    430.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.50  DOWNSTREAM(FEET) =   446.00
  FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.41
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.75
  PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =    8.55
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    430.00 =    1307.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.55
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.561
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.19      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.19      SUBAREA RUNOFF(CFS) =    3.66
  EFFECTIVE AREA(ACRES) =      5.13   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        5.1       PEAK FLOW RATE(CFS) =      15.79

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.55
  RAINFALL INTENSITY(INCH/HR) =   3.56
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       5.13
  TOTAL STREAM AREA(ACRES) =       5.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      15.79

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   184.00
  ELEVATION DATA: UPSTREAM(FEET) =    461.00  DOWNSTREAM(FEET) =    459.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.314
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.890
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.55      0.40     0.350    32    7.31
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      1.86
  TOTAL AREA(ACRES) =      0.55   PEAK FLOW RATE(CFS) =      1.86

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    459.20
  DOWNSTREAM NODE ELEVATION(FEET) =    458.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.150
  PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02200
  MAXIMUM DEPTH(FEET) =   0.50
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.495
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.37      0.40     0.350    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.42
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.91
```

```
  AVERAGE FLOW DEPTH(FEET) =   0.28   FLOOD WIDTH(FEET) =   13.03
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.52   Tc(MIN.) =    8.83
  SUBAREA AREA(ACRES) =    0.37       SUBAREA RUNOFF(CFS) =    1.12
  EFFECTIVE AREA(ACRES) =    0.92     AREA-AVERAGED Fm(INCH/HR) =   0.14
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.35
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       2.78

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOOD WIDTH(FEET) =   14.06
  FLOW VELOCITY(FEET/SEC.) =   1.96   DEPTH*VELOCITY(FT*FT/SEC) =   0.57
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =     358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   454.30  DOWNSTREAM(FEET) =   446.00
  FLOW LENGTH(FEET) =   144.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.04
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.78
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =    9.10
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    430.00 =     502.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.10
  RAINFALL INTENSITY(INCH/HR) =   3.44
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       0.92
  TOTAL STREAM AREA(ACRES) =       0.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.78

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       15.79    8.55    3.561  0.40( 0.14) 0.35       5.1     300.00
      2        2.78    9.10    3.437  0.40( 0.14) 0.35       0.9     400.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       18.50    8.55    3.561  0.40( 0.14) 0.35       6.0     300.00
      2       18.00    9.10    3.437  0.40( 0.14) 0.35       6.1     400.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      18.50    Tc(MIN.) =     8.55
  EFFECTIVE AREA(ACRES) =       5.99   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        6.1
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    430.00 =    1307.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    440.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   446.00  DOWNSTREAM(FEET) =   444.60
  FLOW LENGTH(FEET) =    64.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.34
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.50
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    8.65
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    440.00 =    1371.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    440.00 TO NODE    440.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       18.50    8.65    3.537  0.40( 0.14) 0.35       6.0     300.00
      2       18.00    9.20    3.415  0.40( 0.14) 0.35       6.1     400.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    440.00 =    1371.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       13.23    9.48    3.358  0.40( 0.14) 0.35       4.3     100.00
      2       12.97    9.85    3.286  0.40( 0.14) 0.35       4.3     200.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    440.00 =    1235.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
```

```
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       31.24    8.65    3.537  0.40( 0.14) 0.35       9.9     300.00
    2       31.07    9.20    3.415  0.40( 0.14) 0.35      10.2     400.00
    3       30.92    9.48    3.358  0.40( 0.14) 0.35      10.3     100.00
    4       30.26    9.85    3.286  0.40( 0.14) 0.35      10.3     200.00
  TOTAL AREA(ACRES) =        10.3

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       31.24  Tc(MIN.) =    8.652
 EFFECTIVE AREA(ACRES) =      9.89  AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
 TOTAL AREA(ACRES) =       10.3
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    440.00 =    1371.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       10.3  TC(MIN.) =      8.65
 EFFECTIVE AREA(ACRES) =      9.89  AREA-AVERAGED Fm(INCH/HR)=  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap = 0.350
 PEAK FLOW RATE(CFS)   =      31.24

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       31.24    8.65    3.537  0.40( 0.14) 0.35       9.9     300.00
    2       31.07    9.20    3.415  0.40( 0.14) 0.35      10.2     400.00
    3       30.92    9.48    3.358  0.40( 0.14) 0.35      10.3     100.00
    4       30.26    9.85    3.286  0.40( 0.14) 0.35      10.3     200.00
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - SOUTH PARCEL
EXISTING CONDITION
100 YEAR STORM

 ----------------------------------------------------------------------------
   FILE NAME: SWAPX100.DAT
   TIME/DATE OF STUDY: 12:04 04/14/2016
 ============================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

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

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

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        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    477.00  DOWNSTREAM(FEET) =    468.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.615
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.254
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        0.47      0.40     0.900    52    9.62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =      1.65
  TOTAL AREA(ACRES) =      0.47   PEAK FLOW RATE(CFS) =      1.65

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    468.00  DOWNSTREAM(FEET) =    463.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   389.00   CHANNEL SLOPE =  0.0129
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.743
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        2.35      0.40     0.900    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.24
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.70
  AVERAGE FLOW DEPTH(FEET) =   0.45   TRAVEL TIME(MIN.) =   2.40
  Tc(MIN.) =   12.02
```

```
  SUBAREA AREA(ACRES) =     2.35       SUBAREA RUNOFF(CFS) =    7.16
  EFFECTIVE AREA(ACRES) =      2.82     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        2.8         PEAK FLOW RATE(CFS) =       8.59

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.58   FLOW VELOCITY(FEET/SEC.) =   3.10
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     689.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    463.00  DOWNSTREAM(FEET) =    456.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   462.00   CHANNEL SLOPE =  0.0152
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.410
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        2.39      0.40     0.900    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.87
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.62
  AVERAGE FLOW DEPTH(FEET) =   0.66   TRAVEL TIME(MIN.) =   2.13
  Tc(MIN.) =   14.15
  SUBAREA AREA(ACRES) =     2.39       SUBAREA RUNOFF(CFS) =    6.56
  EFFECTIVE AREA(ACRES) =      5.21     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        5.2         PEAK FLOW RATE(CFS) =      14.30

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.73   FLOW VELOCITY(FEET/SEC.) =   3.79
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1151.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    456.00  DOWNSTREAM(FEET) =    452.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   307.00   CHANNEL SLOPE =  0.0114
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      14.30
  FLOW VELOCITY(FEET/SEC.) =   2.25   FLOW DEPTH(FEET) =   0.49
```

```
  TRAVEL TIME(MIN.) =   2.27   Tc(MIN.) =   16.42
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    1458.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    204.00 IS CODE =  46
----------------------------------------------------------------------------
  >>>>>COMPUTE BOX-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED BOX SIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.70  DOWNSTREAM(FEET) =   445.40
  FLOW LENGTH(FEET) =    16.00   MANNING'S N =  0.013
  GIVEN BOX BASEWIDTH(FEET) =   3.00   GIVEN BOX HEIGHT(FEET) =   6.50
  FLOWDEPTH IN BOX IS  0.55 FEET   BOX-FLOW VELOCITY(FEET/SEC.) =   8.60
  BOX-FLOW(CFS) =      14.30
  BOX-FLOW TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   16.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    204.00 =    1474.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 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.) =   16.45
  RAINFALL INTENSITY(INCH/HR) =   3.13
  AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.90
  EFFECTIVE STREAM AREA(ACRES) =       5.21
  TOTAL STREAM AREA(ACRES) =       5.21
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      14.30

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =    478.90  DOWNSTREAM(FEET) =    469.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.434
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.301
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        0.34      0.40     0.900    52    9.43
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
```

```
  SUBAREA RUNOFF(CFS) =      1.21
  TOTAL AREA(ACRES) =      0.34   PEAK FLOW RATE(CFS) =      1.21

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    469.00  DOWNSTREAM(FEET) =    455.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   670.00   CHANNEL SLOPE =  0.0209
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  30.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.163
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        1.83      0.40     0.900    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.56
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.67
  AVERAGE FLOW DEPTH(FEET) =   0.15   TRAVEL TIME(MIN.) =   6.69
  Tc(MIN.) =   16.12
  SUBAREA AREA(ACRES) =     1.83       SUBAREA RUNOFF(CFS) =    4.62
  EFFECTIVE AREA(ACRES) =      2.17     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        2.2         PEAK FLOW RATE(CFS) =       5.47

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.19   FLOW VELOCITY(FEET/SEC.) =   1.89
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     970.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    455.00  DOWNSTREAM(FEET) =    447.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   216.00   CHANNEL SLOPE =  0.0370
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.031
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         A        2.95      0.40     0.900    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
```

```
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.02
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.88
  AVERAGE FLOW DEPTH(FEET) =   0.22   TRAVEL TIME(MIN.) =   1.25
  Tc(MIN.) =   17.37
  SUBAREA AREA(ACRES) =     2.95       SUBAREA RUNOFF(CFS) =    7.09
  EFFECTIVE AREA(ACRES) =      5.12     AREA-AVERAGED Fm(INCH/HR) =   0.36
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.90
  TOTAL AREA(ACRES) =        5.1         PEAK FLOW RATE(CFS) =      12.31

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.26   FLOW VELOCITY(FEET/SEC.) =   3.17
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1186.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   447.00  DOWNSTREAM(FEET) =   445.40
  FLOW LENGTH(FEET) =    44.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS   8.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.19
  GIVEN PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.31
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   17.44
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    1230.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 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.) =   17.44
  RAINFALL INTENSITY(INCH/HR) =   3.02
  AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.90
  EFFECTIVE STREAM AREA(ACRES) =       5.12
  TOTAL STREAM AREA(ACRES) =       5.12
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.31

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       14.30   16.45    3.128  0.40( 0.36) 0.90       5.2     100.00
      2       12.31   17.44    3.024  0.40( 0.36) 0.90       5.1     200.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       26.35   16.45    3.128  0.40( 0.36) 0.90      10.0     100.00
      2       26.07   17.44    3.024  0.40( 0.36) 0.90      10.3     200.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.35    Tc(MIN.) =    16.45
  EFFECTIVE AREA(ACRES) =      10.04   AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =       10.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    204.00 =    1474.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       10.3  TC(MIN.) =     16.45
  EFFECTIVE AREA(ACRES) =     10.04  AREA-AVERAGED Fm(INCH/HR)=  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap = 0.900
  PEAK FLOW RATE(CFS)   =      26.35

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       26.35   16.45    3.128  0.40( 0.36) 0.90      10.0     100.00
      2       26.07   17.44    3.024  0.40( 0.36) 0.90      10.3     200.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

TAIT & ASSOCIATES, INC.
WESTERN ALTON PARCEL - SOUTH PARCEL
PROPOSED CONDITION
100 YEAR STORM

 ---------------------------------------------------------------------------
   FILE NAME: SWAPQ100.DAT
   TIME/DATE OF STUDY: 12:05 04/14/2016
 ===========================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ===========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
   *DATA BANK RAINFALL USED*
   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
 ===  =====  =========  =================  ======  ===== ====== ===== =======
   1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

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

   UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
     WATERSHED LAG = 0.80 * Tc
     USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
     2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
     FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
     SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
```

```
        30-MINUTES         1.09
         1-HOUR            1.45
         3-HOUR            2.43
         6-HOUR            3.36
        24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   269.00
  ELEVATION DATA: UPSTREAM(FEET) =    471.00  DOWNSTREAM(FEET) =    464.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.041
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.085
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.83      0.40     0.350    52    7.04
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      3.69
  TOTAL AREA(ACRES) =      0.83   PEAK FLOW RATE(CFS) =      3.69

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   460.20  DOWNSTREAM(FEET) =   455.90
  FLOW LENGTH(FEET) =   241.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.45
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.69
  PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =    7.66
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =     510.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.66
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.844
```

```
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.28      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.28      SUBAREA RUNOFF(CFS) =    5.42
  EFFECTIVE AREA(ACRES) =      2.11   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.1       PEAK FLOW RATE(CFS) =       8.93

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   455.90  DOWNSTREAM(FEET) =   454.50
  FLOW LENGTH(FEET) =   138.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.42
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.93
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =    8.02
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =     648.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.02
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.719
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.66      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.66      SUBAREA RUNOFF(CFS) =    2.72
  EFFECTIVE AREA(ACRES) =      2.77   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.8       PEAK FLOW RATE(CFS) =      11.42

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   454.50  DOWNSTREAM(FEET) =   449.00
  FLOW LENGTH(FEET) =   212.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.86
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.42
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =    8.38
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    230.00 =     860.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.38
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.602
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.00      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.00      SUBAREA RUNOFF(CFS) =    4.02
  EFFECTIVE AREA(ACRES) =      3.77   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.8       PEAK FLOW RATE(CFS) =      15.14

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.38
  RAINFALL INTENSITY(INCH/HR) =   4.60
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       3.77
  TOTAL STREAM AREA(ACRES) =       3.77
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      15.14

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   293.00
  ELEVATION DATA: UPSTREAM(FEET) =    460.40  DOWNSTREAM(FEET) =    456.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.465
```

```
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.576
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.31      0.40     0.350    52    8.46
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.31   PEAK FLOW RATE(CFS) =      1.24

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   452.90  DOWNSTREAM(FEET) =   451.80
  FLOW LENGTH(FEET) =    61.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.73
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.24
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    8.68
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    220.00 =     354.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.68
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.511
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.21      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.21      SUBAREA RUNOFF(CFS) =    0.83
  EFFECTIVE AREA(ACRES) =      0.52   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =       2.05

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.80  DOWNSTREAM(FEET) =   449.00
  FLOW LENGTH(FEET) =    59.00   MANNING'S N =  0.013
```

```
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.73
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.05
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    8.81
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     413.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.81
  RAINFALL INTENSITY(INCH/HR) =   4.47
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       0.52
  TOTAL STREAM AREA(ACRES) =       0.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.05

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       15.14    8.38    4.602  0.40( 0.14) 0.35       3.8     100.00
      2        2.05    8.81    4.473  0.40( 0.14) 0.35       0.5     200.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       17.14    8.38    4.602  0.40( 0.14) 0.35       4.3     100.00
      2       16.75    8.81    4.473  0.40( 0.14) 0.35       4.3     200.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.14    Tc(MIN.) =     8.38
  EFFECTIVE AREA(ACRES) =       4.26   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    230.00 =     860.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   445.40
  FLOW LENGTH(FEET) =   166.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.16
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.14
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =    8.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    240.00 =    1026.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    440.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.40  DOWNSTREAM(FEET) =   444.60
  FLOW LENGTH(FEET) =   209.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.20
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.14
  PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =    9.32
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    440.00 =    1235.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    440.00 TO NODE    440.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   196.00
  ELEVATION DATA: UPSTREAM(FEET) =    477.50  DOWNSTREAM(FEET) =    468.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.458
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.884
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.46      0.40     0.350    52    5.46
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      2.38
  TOTAL AREA(ACRES) =      0.46   PEAK FLOW RATE(CFS) =      2.38
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    468.10
  DOWNSTREAM NODE ELEVATION(FEET) =    465.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   188.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.150
  PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02200
  MAXIMUM DEPTH(FEET) =   0.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.317
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.72      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.05
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.97
  AVERAGE FLOW DEPTH(FEET) =   0.29   FLOOD WIDTH(FEET) =   13.72
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.06   Tc(MIN.) =    6.51
  SUBAREA AREA(ACRES) =    0.72       SUBAREA RUNOFF(CFS) =    3.35
  EFFECTIVE AREA(ACRES) =    1.18     AREA-AVERAGED Fm(INCH/HR) =   0.14
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.35
  TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       5.50

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.31   FLOOD WIDTH(FEET) =   16.22
  FLOW VELOCITY(FEET/SEC.) =   3.09   DEPTH*VELOCITY(FT*FT/SEC) =   0.97
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =     384.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   461.80  DOWNSTREAM(FEET) =   458.20
  FLOW LENGTH(FEET) =   121.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.65
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.50
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =    6.75
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =     505.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =    6.75
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.211
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.06      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.06      SUBAREA RUNOFF(CFS) =    0.27
  EFFECTIVE AREA(ACRES) =      1.24   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.2       PEAK FLOW RATE(CFS) =       5.66

******************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    340.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   458.20  DOWNSTREAM(FEET) =   456.80
  FLOW LENGTH(FEET) =   102.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.56
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.66
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    7.01
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    340.00 =     607.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =  81
------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =    7.01
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.099
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.77      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.77      SUBAREA RUNOFF(CFS) =    3.44
  EFFECTIVE AREA(ACRES) =      2.01   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.0       PEAK FLOW RATE(CFS) =       8.97

******************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    350.00 IS CODE =  31
------------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   456.80  DOWNSTREAM(FEET) =   454.60
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.69
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.97
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    7.31
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    350.00 =     747.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    350.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =    7.31
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.977
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.60      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    2.61
  EFFECTIVE AREA(ACRES) =      2.61   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        2.6       PEAK FLOW RATE(CFS) =      11.36

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   454.60  DOWNSTREAM(FEET) =   451.50
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.79
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.36
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    7.76
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    360.00 =     957.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    360.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =    7.76
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.810
```

```
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.33      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.33      SUBAREA RUNOFF(CFS) =    5.59
  EFFECTIVE AREA(ACRES) =      3.94   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        3.9       PEAK FLOW RATE(CFS) =      16.56

****************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    430.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.50  DOWNSTREAM(FEET) =   446.00
  FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.84
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.56
  PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =    8.42
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    430.00 =    1307.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.42
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.590
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        1.19      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.19      SUBAREA RUNOFF(CFS) =    4.77
  EFFECTIVE AREA(ACRES) =      5.13   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        5.1       PEAK FLOW RATE(CFS) =      20.55

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.42
```

```
  RAINFALL INTENSITY(INCH/HR) =   4.59
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       5.13
  TOTAL STREAM AREA(ACRES) =       5.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      20.55

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   184.00
  ELEVATION DATA: UPSTREAM(FEET) =    461.00  DOWNSTREAM(FEET) =    459.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.314
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.976
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               A        0.55      0.40     0.350    52    7.31
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      2.39
  TOTAL AREA(ACRES) =      0.55   PEAK FLOW RATE(CFS) =      2.39

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    459.20
  DOWNSTREAM NODE ELEVATION(FEET) =    458.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.150
  PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02200
  MAXIMUM DEPTH(FEET) =   0.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.479
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS               A        0.37      0.40     0.350    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.12
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.97
  AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =   15.08
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.47   Tc(MIN.) =    8.79
```

```
  SUBAREA AREA(ACRES) =    0.37       SUBAREA RUNOFF(CFS) =    1.44
  EFFECTIVE AREA(ACRES) =    0.92     AREA-AVERAGED Fm(INCH/HR) =   0.14
  AREA-AVERAGED Fp(INCH/HR) =   0.40  AREA-AVERAGED Ap =   0.35
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       3.59

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.32   FLOOD WIDTH(FEET) =   16.33
  FLOW VELOCITY(FEET/SEC.) =   2.00   DEPTH*VELOCITY(FT*FT/SEC) =   0.63
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =     358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   454.30  DOWNSTREAM(FEET) =   446.00
  FLOW LENGTH(FEET) =   144.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.74
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.59
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    9.03
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    430.00 =     502.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.03
  RAINFALL INTENSITY(INCH/HR) =   4.41
  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  0.35
  EFFECTIVE STREAM AREA(ACRES) =       0.92
  TOTAL STREAM AREA(ACRES) =       0.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.59

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       20.55    8.42    4.590  0.40( 0.14) 0.35       5.1     300.00
      2        3.59    9.03    4.409  0.40( 0.14) 0.35       0.9     400.00

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

```
  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       24.04    8.42    4.590  0.40( 0.14) 0.35       6.0     300.00
      2       23.30    9.03    4.409  0.40( 0.14) 0.35       6.1     400.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      24.04    Tc(MIN.) =     8.42
  EFFECTIVE AREA(ACRES) =       5.99   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        6.1
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    430.00 =    1307.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    440.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   446.00  DOWNSTREAM(FEET) =   444.60
  FLOW LENGTH(FEET) =    64.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.11
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.04
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    8.52
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    440.00 =    1371.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    440.00 TO NODE    440.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       24.04    8.52    4.560  0.40( 0.14) 0.35       6.0     300.00
      2       23.30    9.13    4.382  0.40( 0.14) 0.35       6.1     400.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    440.00 =    1371.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       17.14    9.32    4.330  0.40( 0.14) 0.35       4.3     100.00
      2       16.75    9.75    4.220  0.40( 0.14) 0.35       4.3     200.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    440.00 =    1235.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       40.56    8.52    4.560  0.40( 0.14) 0.35       9.9     300.00
```

```
     2       40.30    9.13    4.382  0.40( 0.14) 0.35      10.2     400.00
     3       40.16    9.32    4.330  0.40( 0.14) 0.35      10.3     100.00
     4       39.16    9.75    4.220  0.40( 0.14) 0.35      10.3     200.00
   TOTAL AREA(ACRES) =        10.3

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       40.56  Tc(MIN.) =    8.516
  EFFECTIVE AREA(ACRES) =      9.88  AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =       10.3
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    440.00 =    1371.00 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       10.3  TC(MIN.) =      8.52
  EFFECTIVE AREA(ACRES) =      9.88  AREA-AVERAGED Fm(INCH/HR)=  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.40  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =      40.56

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       40.56    8.52    4.560  0.40( 0.14) 0.35       9.9     300.00
      2       40.30    9.13    4.382  0.40( 0.14) 0.35      10.2     400.00
      3       40.16    9.32    4.330  0.40( 0.14) 0.35      10.3     100.00
      4       39.16    9.75    4.220  0.40( 0.14) 0.35      10.3     200.00
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

# Appendix C – Proposed Condition Hydrograph and Detention Basin Calculations

See Attached Exhibit

**SP7531** **Western Alton Parcel - South Parcel - HYDROGRAPH PARAMETERS**
**AES CH1 - Small Area Unit Hydrograph/Detention Basin Analysis**

**SWAP** **25 year storm**

| | AREA | CN | S | Ia | Y | Ybar | Total A | Fm | Tc | Qp coef. |
|---|---|---|---|---|---|---|---|---|---|---|
| BASIN 1 | A+B | 32 | 21.250 | 4.250 | 0.001 | 0.999 | 4.29 | 0.14 | 8.47 | 0.90 |
| BASIN 2 | C+D | 32 | 21.250 | 4.250 | 0.001 | 0.999 | 6.05 | 0.14 | 8.55 | 0.90 |
| | P24 | 4.49 | | | | | 10.34 | | | |

**100 year storm**

| | AREA | CN | S | Ia | Y | Ybar | Total A | Fm | Tc | Qp coef. |
|---|---|---|---|---|---|---|---|---|---|---|
| BASIN 1 | A+B | 52 | 9.231 | 1.846 | 0.131 | 0.869 | 4.29 | 0.14 | 8.38 | 0.90 |
| BASIN 2 | C+D | 52 | 9.231 | 1.846 | 0.131 | 0.869 | 6.05 | 0.14 | 8.42 | 0.90 |
| | P24 | 5.63 | | | | | 10.34 | | | |

**Basin 1**

| | |
|---|---|
| circular orifice diameter (in) = | 15 |
| orifice center elevation = | 449 |
| inlet lip elevation = | 449 |

| Elevation | Area (sf) | Area (ac) | Inc. Vol (af) | Total. Vol (af) | Discharge Q (cfs) | Depth |
|---|---|---|---|---|---|---|
| 449 | 1617 | 0.0371 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 449.5 | 1856 | 0.0426 | 0.0199 | 0.0199 | 4.53 | 0.50 |
| 450 | 2109 | 0.0484 | 0.0228 | 0.0427 | 6.40 | 1.00 |
| 450.5 | 2363 | 0.0542 | 0.0257 | 0.0684 | 7.84 | 1.50 |
| 451 | 2631 | 0.0604 | 0.0287 | 0.0970 | 9.05 | 2.00 |
| 451.5 | 2901 | 0.0666 | 0.0317 | 0.1288 | 10.12 | 2.50 |
| 452 | 3184 | 0.0731 | 0.0349 | 0.1637 | 11.09 | 3.00 |
| 452.5 | 3469 | 0.0796 | 0.0382 | 0.2019 | 11.98 | 3.50 |
| 453 | 3767 | 0.0865 | 0.0415 | 0.2434 | 12.80 | 4.00 |
| 453.5 | 4067 | 0.0934 | 0.0450 | 0.2884 | 13.58 | 4.50 |
| 454 | 4383 | 0.1006 | 0.0485 | 0.3369 | 14.31 | 5.00 |

$$Qw = CLHw^{1.5}$$

$$Qo = KA\sqrt{2gHo}$$

Qw = Weir Outflow (cfs)
C = Weir Coef., 3.5
L = Weir Width (ft)
Hw = Water height above Weir (ft)

Qo = Orifice Outflow (cfs)
Ho = Water height above orifice center (ft)
K = Orifice flow coef., 0.65
A = Cross sectional area of orifice (ft^2)
g = gravitational accel., 32.2 ft/sec^2

**Basin 2**

| | | | |
|---|---|---|---|
| circular orifice diameter (in) = | 24 | | |
| orifice center elevation = | 450.9 | | |
| inlet lip elevation = | 450.9 | 0.7337 | Dead Space Storage Vol (af) |

| Elevation | Area (sf) | Area (ac) | Inc. Vol (af) | Total. Vol (af) | Discharge Q (cfs) | Depth | Eff. Vol above outlet | Eff. Depth above outlet |
|---|---|---|---|---|---|---|---|---|
| 448 | 9036 | 0.2074 | 0.0000 | 0.0000 | 0.00 | 0.00 | | |
| 448.5 | 9709 | 0.2229 | 0.1076 | 0.1076 | 0.00 | 0.50 | | |
| 449 | 10390 | 0.2385 | 0.1154 | 0.2229 | 0.00 | 1.00 | | |
| 449.5 | 11078 | 0.2543 | 0.1232 | 0.3461 | 0.00 | 1.50 | | |
| 450 | 11775 | 0.2703 | 0.1312 | 0.4773 | 0.00 | 2.00 | | |
| 450.5 | 12479 | 0.2865 | 0.1392 | 0.6165 | 0.00 | 2.50 | | |
| 450.9 | 13047 | 0.2995 | 0.1172 | 0.7337 | 0.00 | 2.90 | | |
| 451 | 13190 | 0.3028 | 0.0301 | 0.7638 | 0.70 | 3.00 | 0.0301 | 0.1 |
| 451.5 | 13910 | 0.3193 | 0.1555 | 0.9193 | 10.22 | 3.50 | 0.1856 | 0.6 |
| 452 | 14637 | 0.3360 | 0.1638 | 1.0832 | 17.19 | 4.00 | 0.3495 | 1.1 |

```
*****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
=============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

SWAP
BASIN 1 -  AREAS A + B
PROPOSED CONDTION - 25 YEAR STORM

*****************************************************************************
-----------------------------------------------------------------------------

 Problem Descriptions:



-----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    4.29
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.140
    LOW LOSS FRACTION = 0.999
    TIME OF CONCENTRATION(MIN.) =  8.47
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  25
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.87
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.15
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.94
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.71
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  4.49

-----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.60
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.00

*****************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
-----------------------------------------------------------------------------
  0.05      0.0000      0.00  Q         .         .         .         .
  0.19      0.0000      0.00  Q         .         .         .         .
  0.33      0.0000      0.00  Q         .         .         .         .
  0.47      0.0000      0.00  Q         .         .         .         .
  0.61      0.0000      0.00  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.75 | 0.0000 | 0.00 | Q | . | . | . | . |
| 0.90 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.04 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.18 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.32 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.46 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.60 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.74 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.88 | 0.0000 | 0.00 | Q | . | . | . | . |
| 2.02 | 0.0000 | 0.00 | Q | . | . | . | . |
| 2.17 | 0.0000 | 0.00 | Q | . | . | . | . |
| 2.31 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.45 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.59 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.73 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.87 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.01 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.15 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.29 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.44 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.58 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.72 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.86 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.00 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.14 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.28 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.42 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.57 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.71 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.85 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.99 | 0.0001 | 0.00 | Q | . | . | . | . |
| 5.13 | 0.0001 | 0.00 | Q | . | . | . | . |
| 5.27 | 0.0001 | 0.00 | Q | . | . | . | . |
| 5.41 | 0.0001 | 0.00 | Q | . | . | . | . |
| 5.55 | 0.0001 | 0.00 | Q | . | . | . | . |
| 5.69 | 0.0001 | 0.00 | Q | . | . | . | . |
| 5.84 | 0.0001 | 0.00 | Q | . | . | . | . |
| 5.98 | 0.0001 | 0.00 | Q | . | . | . | . |
| 6.12 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.26 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.40 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.54 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.68 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.82 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.97 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.11 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.25 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.39 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.53 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.67 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.81 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.95 | 0.0002 | 0.00 | Q | . | . | . | . |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8.09 | 0.0002 | 0.00 | Q | . | . | . | . |
| 8.24 | 0.0002 | 0.00 | Q | . | . | . | . |
| 8.38 | 0.0002 | 0.00 | Q | . | . | . | . |
| 8.52 | 0.0002 | 0.00 | Q | . | . | . | . |
| 8.66 | 0.0002 | 0.00 | Q | . | . | . | . |
| 8.80 | 0.0002 | 0.00 | Q | . | . | . | . |
| 8.94 | 0.0002 | 0.00 | Q | . | . | . | . |
| 9.08 | 0.0002 | 0.00 | Q | . | . | . | . |
| 9.22 | 0.0003 | 0.00 | Q | . | . | . | . |
| 9.37 | 0.0003 | 0.00 | Q | . | . | . | . |
| 9.51 | 0.0003 | 0.00 | Q | . | . | . | . |
| 9.65 | 0.0003 | 0.00 | Q | . | . | . | . |
| 9.79 | 0.0003 | 0.00 | Q | . | . | . | . |
| 9.93 | 0.0003 | 0.00 | Q | . | . | . | . |
| 10.07 | 0.0003 | 0.00 | Q | . | . | . | . |
| 10.21 | 0.0003 | 0.00 | Q | . | . | . | . |
| 10.35 | 0.0003 | 0.00 | Q | . | . | . | . |
| 10.49 | 0.0003 | 0.00 | Q | . | . | . | . |
| 10.64 | 0.0003 | 0.00 | Q | . | . | . | . |
| 10.78 | 0.0003 | 0.00 | Q | . | . | . | . |
| 10.92 | 0.0003 | 0.00 | Q | . | . | . | . |
| 11.06 | 0.0004 | 0.01 | Q | . | . | . | . |
| 11.20 | 0.0005 | 0.01 | Q | . | . | . | . |
| 11.34 | 0.0008 | 0.03 | Q | . | . | . | . |
| 11.48 | 0.0011 | 0.04 | Q | . | . | . | . |
| 11.62 | 0.0016 | 0.05 | Q | . | . | . | . |
| 11.76 | 0.0023 | 0.06 | Q | . | . | . | . |
| 11.91 | 0.0031 | 0.08 | Q | . | . | . | . |
| 12.05 | 0.0040 | 0.09 | Q | . | . | . | . |
| 12.19 | 0.0063 | 0.31 | Q | . | . | . | . |
| 12.33 | 0.0100 | 0.32 | Q | . | . | . | . |
| 12.47 | 0.0139 | 0.34 | Q | . | . | . | . |
| 12.61 | 0.0180 | 0.36 | Q | . | . | . | . |
| 12.75 | 0.0223 | 0.38 | Q | . | . | . | . |
| 12.89 | 0.0269 | 0.40 | Q | . | . | . | . |
| 13.04 | 0.0317 | 0.43 | Q | . | . | . | . |
| 13.18 | 0.0367 | 0.44 | Q | . | . | . | . |
| 13.32 | 0.0421 | 0.48 | Q | . | . | . | . |
| 13.46 | 0.0477 | 0.49 | Q | . | . | . | . |
| 13.60 | 0.0537 | 0.53 | .Q | . | . | . | . |
| 13.74 | 0.0601 | 0.56 | .Q | . | . | . | . |
| 13.88 | 0.0668 | 0.60 | .Q | . | . | . | . |
| 14.02 | 0.0740 | 0.63 | .Q | . | . | . | . |
| 14.16 | 0.0816 | 0.67 | .Q | . | . | . | . |
| 14.31 | 0.0896 | 0.70 | .Q | . | . | . | . |
| 14.45 | 0.0982 | 0.78 | .Q | . | . | . | . |
| 14.59 | 0.1075 | 0.82 | .Q | . | . | . | . |
| 14.73 | 0.1176 | 0.91 | .Q | . | . | . | . |
| 14.87 | 0.1285 | 0.97 | .Q | . | . | . | . |
| 15.01 | 0.1406 | 1.10 | . Q | . | . | . | . |
| 15.15 | 0.1539 | 1.18 | . Q | . | . | . | . |
| 15.29 | 0.1688 | 1.38 | . Q | . | . | . | . |

| | | | |
|---|---|---|---|
| 15.44 | 0.1855 | 1.48 | . Q . . . . |
| 15.58 | 0.2032 | 1.54 | . Q . . . . |
| 15.72 | 0.2227 | 1.81 | . Q . . . . |
| 15.86 | 0.2510 | 3.03 | . Q . . . . |
| 16.00 | 0.2936 | 4.28 | . Q . . . . |
| 16.14 | 0.3956 | 13.21 | . . . Q . . |
| 16.28 | 0.4861 | 2.31 | . Q . . . . |
| 16.42 | 0.5074 | 1.34 | . Q . . . . |
| 16.56 | 0.5227 | 1.27 | . Q . . . . |
| 16.71 | 0.5361 | 1.03 | . Q . . . . |
| 16.85 | 0.5471 | 0.86 | .Q . . . . |
| 16.99 | 0.5565 | 0.74 | .Q . . . . |
| 17.13 | 0.5646 | 0.65 | .Q . . . . |
| 17.27 | 0.5718 | 0.58 | .Q . . . . |
| 17.41 | 0.5781 | 0.51 | .Q . . . . |
| 17.55 | 0.5838 | 0.46 | Q . . . . |
| 17.69 | 0.5889 | 0.41 | Q . . . . |
| 17.84 | 0.5934 | 0.37 | Q . . . . |
| 17.98 | 0.5975 | 0.33 | Q . . . . |
| 18.12 | 0.6006 | 0.20 | Q . . . . |
| 18.26 | 0.6022 | 0.07 | Q . . . . |
| 18.40 | 0.6028 | 0.04 | Q . . . . |
| 18.54 | 0.6032 | 0.02 | Q . . . . |
| 18.68 | 0.6033 | 0.00 | Q . . . . |
| 18.82 | 0.6033 | 0.00 | Q . . . . |
| 18.96 | 0.6033 | 0.00 | Q . . . . |
| 19.11 | 0.6033 | 0.00 | Q . . . . |
| 19.25 | 0.6033 | 0.00 | Q . . . . |
| 19.39 | 0.6034 | 0.00 | Q . . . . |
| 19.53 | 0.6034 | 0.00 | Q . . . . |
| 19.67 | 0.6034 | 0.00 | Q . . . . |
| 19.81 | 0.6034 | 0.00 | Q . . . . |
| 19.95 | 0.6034 | 0.00 | Q . . . . |
| 20.09 | 0.6034 | 0.00 | Q . . . . |
| 20.23 | 0.6034 | 0.00 | Q . . . . |
| 20.38 | 0.6034 | 0.00 | Q . . . . |
| 20.52 | 0.6034 | 0.00 | Q . . . . |
| 20.66 | 0.6034 | 0.00 | Q . . . . |
| 20.80 | 0.6034 | 0.00 | Q . . . . |
| 20.94 | 0.6034 | 0.00 | Q . . . . |
| 21.08 | 0.6034 | 0.00 | Q . . . . |
| 21.22 | 0.6034 | 0.00 | Q . . . . |
| 21.36 | 0.6034 | 0.00 | Q . . . . |
| 21.51 | 0.6034 | 0.00 | Q . . . . |
| 21.65 | 0.6034 | 0.00 | Q . . . . |
| 21.79 | 0.6034 | 0.00 | Q . . . . |
| 21.93 | 0.6034 | 0.00 | Q . . . . |
| 22.07 | 0.6034 | 0.00 | Q . . . . |
| 22.21 | 0.6034 | 0.00 | Q . . . . |
| 22.35 | 0.6034 | 0.00 | Q . . . . |
| 22.49 | 0.6034 | 0.00 | Q . . . . |
| 22.63 | 0.6035 | 0.00 | Q . . . . |

```
  22.78      0.6035      0.00  Q         .         .         .         .
  22.92      0.6035      0.00  Q         .         .         .         .
  23.06      0.6035      0.00  Q         .         .         .         .
  23.20      0.6035      0.00  Q         .         .         .         .
  23.34      0.6035      0.00  Q         .         .         .         .
  23.48      0.6035      0.00  Q         .         .         .         .
  23.62      0.6035      0.00  Q         .         .         .         .
  23.76      0.6035      0.00  Q         .         .         .         .
  23.91      0.6035      0.00  Q         .         .         .         .
  24.05      0.6035      0.00  Q         .         .         .         .
  24.19      0.6035      0.00  Q         .         .         .         .
 ---------------------------------------------------------------------------
-----------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    ========================                =========
               0%                            1448.4
              10%                              76.2
              20%                              25.4
              30%                              16.9
              40%                               8.5
              50%                               8.5
              60%                               8.5
              70%                               8.5
              80%                               8.5
              90%                               8.5

  Problem Descriptions:




===========================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =    8.470
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                     INFLOW
                       |
                       |
```

```
                 |
                 V                __effective depth
            -------------         |   (and volume)
            |           |    |    |
            | detention |    |....V.............
            |   basin   |<-->|          outflow
            |           |    |.........________
            -------------    |         |   \
                  |          | storage |     basin outlet
                  V          -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 11

| *BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) ** | **BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) * |
|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.000** | 0.500 | 0.020 | 4.530* |
| 1.000 | 0.043 | 6.400** | 1.500 | 0.068 | 7.840* |
| 2.000 | 0.097 | 9.050** | 2.500 | 0.129 | 10.120* |
| 3.000 | 0.164 | 11.090** | 3.500 | 0.202 | 11.980* |
| 4.000 | 0.243 | 12.800** | 4.500 | 0.288 | 13.580* |
| 5.000 | 0.337 | 14.310** | | | |

---

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

| INTERVAL NUMBER | DEPTH (FEET) | {S-O*DT/2} (ACRE-FEET) | {S+O*DT/2} (ACRE-FEET) |
|---|---|---|---|
| 1 | 0.00 | 0.00000 | 0.00000 |
| 2 | 0.50 | -0.00653 | 0.04633 |
| 3 | 1.00 | 0.00537 | 0.08003 |
| 4 | 1.50 | 0.02267 | 0.11413 |
| 5 | 2.00 | 0.04421 | 0.14979 |
| 6 | 2.50 | 0.06977 | 0.18783 |
| 7 | 3.00 | 0.09901 | 0.22839 |
| 8 | 3.50 | 0.13202 | 0.27178 |
| 9 | 4.00 | 0.16873 | 0.31807 |
| 10 | 4.50 | 0.20918 | 0.36762 |
| 11 | 5.00 | 0.25342 | 0.42038 |

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

---

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

| TIME (HRS) | DEAD-STORAGE FILLED(AF) | INFLOW (CFS) | EFFECTIVE DEPTH(FT) | OUTFLOW (CFS) | EFFECTIVE VOLUME(AF) |
|---|---|---|---|---|---|
| 0.048 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.189 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.330 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.472 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 0.613 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.754 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.895 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.036 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.177 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.319 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.460 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.601 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.742 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.883 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.024 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.166 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.307 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.448 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.589 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.730 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.871 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.013 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.154 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.295 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.436 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.577 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.718 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.860 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.001 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.142 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.283 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.424 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.565 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.707 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.848 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.989 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.130 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.271 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.412 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.554 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.695 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.836 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.977 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.118 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.259 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.401 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.542 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.683 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.824 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.965 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.106 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.248 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.389 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.530 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.671 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.812 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 7.953 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.095 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.236 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.377 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.518 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.659 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.800 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.942 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.083 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.224 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.365 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.506 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.648 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.789 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.930 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.071 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.212 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.353 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.495 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.636 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.777 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.918 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 11.059 | 0.000 | 0.01 | 0.00 | 0.00 | 0.000 |
| 11.200 | 0.000 | 0.01 | 0.00 | 0.01 | 0.000 |
| 11.342 | 0.000 | 0.03 | 0.00 | 0.02 | 0.000 |
| 11.483 | 0.000 | 0.04 | 0.00 | 0.04 | 0.000 |
| 11.624 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 11.765 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 11.906 | 0.000 | 0.08 | 0.01 | 0.08 | 0.000 |
| 12.047 | 0.000 | 0.09 | 0.01 | 0.09 | 0.000 |
| 12.189 | 0.000 | 0.31 | 0.04 | 0.23 | 0.002 |
| 12.330 | 0.000 | 0.32 | 0.04 | 0.36 | 0.002 |
| 12.471 | 0.000 | 0.34 | 0.04 | 0.38 | 0.002 |
| 12.612 | 0.000 | 0.36 | 0.04 | 0.40 | 0.002 |
| 12.753 | 0.000 | 0.38 | 0.05 | 0.42 | 0.002 |
| 12.894 | 0.000 | 0.40 | 0.05 | 0.44 | 0.002 |
| 13.036 | 0.000 | 0.43 | 0.05 | 0.47 | 0.002 |
| 13.177 | 0.000 | 0.44 | 0.06 | 0.49 | 0.002 |
| 13.318 | 0.000 | 0.48 | 0.06 | 0.52 | 0.002 |
| 13.459 | 0.000 | 0.49 | 0.06 | 0.55 | 0.002 |
| 13.600 | 0.000 | 0.53 | 0.07 | 0.59 | 0.003 |
| 13.741 | 0.000 | 0.56 | 0.07 | 0.62 | 0.003 |
| 13.883 | 0.000 | 0.60 | 0.08 | 0.66 | 0.003 |
| 14.024 | 0.000 | 0.63 | 0.08 | 0.70 | 0.003 |
| 14.165 | 0.000 | 0.67 | 0.08 | 0.74 | 0.003 |
| 14.306 | 0.000 | 0.70 | 0.09 | 0.78 | 0.004 |
| 14.447 | 0.000 | 0.78 | 0.10 | 0.84 | 0.004 |
| 14.588 | 0.000 | 0.82 | 0.10 | 0.91 | 0.004 |
| 14.730 | 0.000 | 0.91 | 0.11 | 0.99 | 0.005 |
| 14.871 | 0.000 | 0.97 | 0.12 | 1.07 | 0.005 |
| 15.012 | 0.000 | 1.10 | 0.14 | 1.18 | 0.006 |
| 15.153 | 0.000 | 1.18 | 0.15 | 1.30 | 0.006 |

| | | | | | |
|---|---|---|---|---|---|
| 15.294 | 0.000 | 1.38 | 0.17 | 1.46 | 0.007 |
| 15.435 | 0.000 | 1.48 | 0.19 | 1.63 | 0.007 |
| 15.577 | 0.000 | 1.54 | 0.19 | 1.73 | 0.008 |
| 15.718 | 0.000 | 1.81 | 0.23 | 1.91 | 0.009 |
| 15.859 | 0.000 | 3.03 | 0.38 | 2.76 | 0.015 |
| 16.000 | 0.000 | 4.28 | 0.55 | 4.09 | 0.022 |
| 16.141 | 0.000 | 13.21 | 2.06 | 6.95 | 0.101 |
| 16.282 | 0.000 | 2.31 | 0.91 | 7.62 | 0.039 |
| 16.424 | 0.000 | 1.34 | 0.20 | 3.96 | 0.008 |
| 16.565 | 0.000 | 1.27 | 0.16 | 1.65 | 0.006 |
| 16.706 | 0.000 | 1.03 | 0.13 | 1.31 | 0.005 |
| 16.847 | 0.000 | 0.86 | 0.11 | 1.08 | 0.004 |
| 16.988 | 0.000 | 0.74 | 0.09 | 0.91 | 0.004 |
| 17.129 | 0.000 | 0.65 | 0.08 | 0.79 | 0.003 |
| 17.271 | 0.000 | 0.58 | 0.07 | 0.70 | 0.003 |
| 17.412 | 0.000 | 0.51 | 0.06 | 0.62 | 0.003 |
| 17.553 | 0.000 | 0.46 | 0.06 | 0.55 | 0.002 |
| 17.694 | 0.000 | 0.41 | 0.05 | 0.50 | 0.002 |
| 17.835 | 0.000 | 0.37 | 0.05 | 0.45 | 0.002 |
| 17.976 | 0.000 | 0.33 | 0.04 | 0.40 | 0.002 |
| 18.118 | 0.000 | 0.20 | 0.02 | 0.30 | 0.001 |
| 18.259 | 0.000 | 0.07 | 0.01 | 0.15 | 0.000 |
| 18.400 | 0.000 | 0.04 | 0.01 | 0.06 | 0.000 |
| 18.541 | 0.000 | 0.02 | 0.00 | 0.04 | 0.000 |
| 18.682 | 0.000 | 0.00 | 0.00 | 0.01 | 0.000 |
| 18.823 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 18.965 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 19.106 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 19.247 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 19.388 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 19.529 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 19.670 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 19.812 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 19.953 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 20.094 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 20.235 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 20.376 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 20.517 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 20.659 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 20.800 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 20.941 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 21.082 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 21.223 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 21.364 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 21.505 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 21.647 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 21.788 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 21.929 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 22.070 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 22.211 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 22.353 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 22.494 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 22.635 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 22.776 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 22.917 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 23.058 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 23.199 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 23.341 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 23.482 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 23.623 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 23.764 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 23.905 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 24.047 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 24.188 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 24.329 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

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*****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
=============================================================================
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                              Analysis prepared by:


SWAP
BASIN 1 -  AREAS A + B
PROPOSED CONDTION - 100 YEAR STORM

 *****************************************************************************
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  Problem Descriptions:



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     RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
     TOTAL CATCHMENT AREA(ACRES) =    4.29
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.140
     LOW LOSS FRACTION = 0.869
     TIME OF CONCENTRATION(MIN.) =  8.38
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) = 100
        5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
        1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
        3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
        6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
       24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

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     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.92
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.10

 *****************************************************************************
   TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
  (HOURS)    (AF)      (CFS)
 -----------------------------------------------------------------------------
   0.08      0.0000      0.00  Q         .         .         .         .
   0.22      0.0003      0.04  Q         .         .         .         .
   0.36      0.0008      0.04  Q         .         .         .         .
   0.50      0.0013      0.04  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.64 | 0.0018 | 0.05 | Q | . | . | . | . |
| 0.78 | 0.0023 | 0.05 | Q | . | . | . | . |
| 0.92 | 0.0029 | 0.05 | Q | . | . | . | . |
| 1.06 | 0.0034 | 0.05 | Q | . | . | . | . |
| 1.20 | 0.0039 | 0.05 | Q | . | . | . | . |
| 1.33 | 0.0044 | 0.05 | Q | . | . | . | . |
| 1.47 | 0.0050 | 0.05 | Q | . | . | . | . |
| 1.61 | 0.0055 | 0.05 | Q | . | . | . | . |
| 1.75 | 0.0061 | 0.05 | Q | . | . | . | . |
| 1.89 | 0.0066 | 0.05 | Q | . | . | . | . |
| 2.03 | 0.0072 | 0.05 | Q | . | . | . | . |
| 2.17 | 0.0077 | 0.05 | Q | . | . | . | . |
| 2.31 | 0.0083 | 0.05 | Q | . | . | . | . |
| 2.45 | 0.0088 | 0.05 | Q | . | . | . | . |
| 2.59 | 0.0094 | 0.05 | Q | . | . | . | . |
| 2.73 | 0.0100 | 0.05 | Q | . | . | . | . |
| 2.87 | 0.0105 | 0.05 | Q | . | . | . | . |
| 3.01 | 0.0111 | 0.05 | Q | . | . | . | . |
| 3.15 | 0.0117 | 0.05 | Q | . | . | . | . |
| 3.29 | 0.0123 | 0.05 | Q | . | . | . | . |
| 3.43 | 0.0129 | 0.05 | Q | . | . | . | . |
| 3.57 | 0.0135 | 0.05 | Q | . | . | . | . |
| 3.71 | 0.0141 | 0.05 | Q | . | . | . | . |
| 3.85 | 0.0147 | 0.05 | Q | . | . | . | . |
| 3.99 | 0.0153 | 0.05 | Q | . | . | . | . |
| 4.13 | 0.0159 | 0.05 | Q | . | . | . | . |
| 4.27 | 0.0165 | 0.05 | Q | . | . | . | . |
| 4.41 | 0.0171 | 0.05 | Q | . | . | . | . |
| 4.55 | 0.0177 | 0.05 | Q | . | . | . | . |
| 4.69 | 0.0184 | 0.05 | Q | . | . | . | . |
| 4.83 | 0.0190 | 0.05 | Q | . | . | . | . |
| 4.97 | 0.0196 | 0.06 | Q | . | . | . | . |
| 5.11 | 0.0203 | 0.06 | Q | . | . | . | . |
| 5.25 | 0.0209 | 0.06 | Q | . | . | . | . |
| 5.39 | 0.0216 | 0.06 | Q | . | . | . | . |
| 5.53 | 0.0222 | 0.06 | Q | . | . | . | . |
| 5.66 | 0.0229 | 0.06 | Q | . | . | . | . |
| 5.80 | 0.0236 | 0.06 | Q | . | . | . | . |
| 5.94 | 0.0242 | 0.06 | Q | . | . | . | . |
| 6.08 | 0.0249 | 0.06 | Q | . | . | . | . |
| 6.22 | 0.0256 | 0.06 | Q | . | . | . | . |
| 6.36 | 0.0263 | 0.06 | Q | . | . | . | . |
| 6.50 | 0.0270 | 0.06 | Q | . | . | . | . |
| 6.64 | 0.0277 | 0.06 | Q | . | . | . | . |
| 6.78 | 0.0284 | 0.06 | Q | . | . | . | . |
| 6.92 | 0.0291 | 0.06 | Q | . | . | . | . |
| 7.06 | 0.0299 | 0.06 | Q | . | . | . | . |
| 7.20 | 0.0306 | 0.06 | Q | . | . | . | . |
| 7.34 | 0.0313 | 0.06 | Q | . | . | . | . |
| 7.48 | 0.0321 | 0.07 | Q | . | . | . | . |
| 7.62 | 0.0328 | 0.07 | Q | . | . | . | . |
| 7.76 | 0.0336 | 0.07 | Q | . | . | . | . |

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 7.90      0.0344      0.07  Q          .          .          .          .
 8.04      0.0351      0.07  Q          .          .          .          .
 8.18      0.0359      0.07  Q          .          .          .          .
 8.32      0.0367      0.07  Q          .          .          .          .
 8.46      0.0375      0.07  Q          .          .          .          .
 8.60      0.0383      0.07  Q          .          .          .          .
 8.74      0.0392      0.07  Q          .          .          .          .
 8.88      0.0400      0.07  Q          .          .          .          .
 9.02      0.0408      0.07  Q          .          .          .          .
 9.16      0.0417      0.07  Q          .          .          .          .
 9.30      0.0426      0.08  Q          .          .          .          .
 9.44      0.0434      0.08  Q          .          .          .          .
 9.58      0.0443      0.08  Q          .          .          .          .
 9.72      0.0452      0.08  Q          .          .          .          .
 9.85      0.0461      0.08  Q          .          .          .          .
 9.99      0.0471      0.08  Q          .          .          .          .
10.13      0.0480      0.08  Q          .          .          .          .
10.27      0.0490      0.10  Q          .          .          .          .
10.41      0.0502      0.10  Q          .          .          .          .
10.55      0.0514      0.12  Q          .          .          .          .
10.69      0.0528      0.12  Q          .          .          .          .
10.83      0.0543      0.14  Q          .          .          .          .
10.97      0.0560      0.14  Q          .          .          .          .
11.11      0.0577      0.16  Q          .          .          .          .
11.25      0.0596      0.17  Q          .          .          .          .
11.39      0.0617      0.19  Q          .          .          .          .
11.53      0.0639      0.20  Q          .          .          .          .
11.67      0.0663      0.22  Q          .          .          .          .
11.81      0.0688      0.23  Q          .          .          .          .
11.95      0.0715      0.25  Q          .          .          .          .
12.09      0.0744      0.26  Q          .          .          .          .
12.23      0.0788      0.49  Q          .          .          .          .
12.37      0.0845      0.50  .Q         .          .          .          .
12.51      0.0904      0.53  .Q         .          .          .          .
12.65      0.0967      0.55  .Q         .          .          .          .
12.79      0.1032      0.58  .Q         .          .          .          .
12.93      0.1099      0.60  .Q         .          .          .          .
13.07      0.1170      0.63  .Q         .          .          .          .
13.21      0.1244      0.65  .Q         .          .          .          .
13.35      0.1322      0.69  .Q         .          .          .          .
13.49      0.1403      0.72  .Q         .          .          .          .
13.63      0.1489      0.77  .Q         .          .          .          .
13.77      0.1579      0.79  .Q         .          .          .          .
13.90      0.1674      0.85  .Q         .          .          .          .
14.04      0.1775      0.89  .Q         .          .          .          .
14.18      0.1882      0.97  .Q         .          .          .          .
14.32      0.1995      1.01  . Q        .          .          .          .
14.46      0.2117      1.10  . Q        .          .          .          .
14.60      0.2247      1.15  . Q        .          .          .          .
14.74      0.2386      1.27  . Q        .          .          .          .
14.88      0.2537      1.34  . Q        .          .          .          .
15.02      0.2701      1.51  .  Q       .          .          .          .
```

| | | | |
|---|---|---|---|
| 15.16 | 0.2881 | 1.61 | . Q . . . . |
| 15.30 | 0.3081 | 1.86 | . Q . . . . |
| 15.44 | 0.3303 | 1.98 | . Q . . . . |
| 15.58 | 0.3541 | 2.15 | . Q . . . . |
| 15.72 | 0.3810 | 2.49 | . Q . . . . |
| 15.86 | 0.4172 | 3.78 | . Q . . . . |
| 16.00 | 0.4699 | 5.36 | . Q . . . |
| 16.14 | 0.6004 | 17.25 | . . . . Q . |
| 16.28 | 0.7172 | 2.99 | . Q . . . . |
| 16.42 | 0.7454 | 1.90 | . Q . . . . |
| 16.56 | 0.7664 | 1.73 | . Q . . . . |
| 16.70 | 0.7845 | 1.42 | . Q . . . . |
| 16.84 | 0.7997 | 1.21 | . Q . . . . |
| 16.98 | 0.8127 | 1.05 | . Q . . . . |
| 17.12 | 0.8241 | 0.92 | .Q . . . . |
| 17.26 | 0.8342 | 0.82 | .Q . . . . |
| 17.40 | 0.8432 | 0.74 | .Q . . . . |
| 17.54 | 0.8514 | 0.67 | .Q . . . . |
| 17.68 | 0.8588 | 0.61 | .Q . . . . |
| 17.82 | 0.8656 | 0.56 | .Q . . . . |
| 17.96 | 0.8718 | 0.52 | .Q . . . . |
| 18.09 | 0.8775 | 0.47 | Q . . . . |
| 18.23 | 0.8815 | 0.24 | Q . . . . |
| 18.37 | 0.8841 | 0.21 | Q . . . . |
| 18.51 | 0.8863 | 0.18 | Q . . . . |
| 18.65 | 0.8882 | 0.15 | Q . . . . |
| 18.79 | 0.8898 | 0.13 | Q . . . . |
| 18.93 | 0.8912 | 0.11 | Q . . . . |
| 19.07 | 0.8924 | 0.09 | Q . . . . |
| 19.21 | 0.8933 | 0.08 | Q . . . . |
| 19.35 | 0.8942 | 0.08 | Q . . . . |
| 19.49 | 0.8951 | 0.08 | Q . . . . |
| 19.63 | 0.8960 | 0.07 | Q . . . . |
| 19.77 | 0.8968 | 0.07 | Q . . . . |
| 19.91 | 0.8977 | 0.07 | Q . . . . |
| 20.05 | 0.8985 | 0.07 | Q . . . . |
| 20.19 | 0.8993 | 0.07 | Q . . . . |
| 20.33 | 0.9000 | 0.07 | Q . . . . |
| 20.47 | 0.9008 | 0.06 | Q . . . . |
| 20.61 | 0.9015 | 0.06 | Q . . . . |
| 20.75 | 0.9023 | 0.06 | Q . . . . |
| 20.89 | 0.9030 | 0.06 | Q . . . . |
| 21.03 | 0.9037 | 0.06 | Q . . . . |
| 21.17 | 0.9044 | 0.06 | Q . . . . |
| 21.31 | 0.9050 | 0.06 | Q . . . . |
| 21.45 | 0.9057 | 0.06 | Q . . . . |
| 21.59 | 0.9063 | 0.06 | Q . . . . |
| 21.73 | 0.9070 | 0.06 | Q . . . . |
| 21.87 | 0.9076 | 0.05 | Q . . . . |
| 22.01 | 0.9082 | 0.05 | Q . . . . |
| 22.15 | 0.9089 | 0.05 | Q . . . . |
| 22.28 | 0.9095 | 0.05 | Q . . . . |

```
  22.42      0.9101      0.05  Q         .         .         .         .
  22.56      0.9106      0.05  Q         .         .         .         .
  22.70      0.9112      0.05  Q         .         .         .         .
  22.84      0.9118      0.05  Q         .         .         .         .
  22.98      0.9124      0.05  Q         .         .         .         .
  23.12      0.9129      0.05  Q         .         .         .         .
  23.26      0.9135      0.05  Q         .         .         .         .
  23.40      0.9140      0.05  Q         .         .         .         .
  23.54      0.9146      0.05  Q         .         .         .         .
  23.68      0.9151      0.05  Q         .         .         .         .
  23.82      0.9156      0.05  Q         .         .         .         .
  23.96      0.9161      0.04  Q         .         .         .         .
  24.10      0.9166      0.04  Q         .         .         .         .
  24.24      0.9169      0.00  Q         .         .         .         .
 ------------------------------------------------------------------------
-------------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    ======================                  =========
               0%                            1441.4
              10%                              75.4
              20%                              25.1
              30%                              16.8
              40%                               8.4
              50%                               8.4
              60%                               8.4
              70%                               8.4
              80%                               8.4
              90%                               8.4

  Problem Descriptions:




===========================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =    8.380
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00
```

```
                INFLOW
                  |
                  |
                  |
                  V                __effective depth
            -------------          |   (and volume)
            |           |    |     |
            | detention |    |....V.............
            |   basin   |<-->|          outflow
            |           |    |.........________
            -------------    |         |   \
                  |          | storage |     basin outlet
                  V          -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 11

| *BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) | ** | BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) | * |
|---|---|---|---|---|---|---|---|
| * 0.000 | 0.000 | 0.000 | ** | 0.500 | 0.020 | 4.530 | * |
| * 1.000 | 0.043 | 6.400 | ** | 1.500 | 0.068 | 7.840 | * |
| * 2.000 | 0.097 | 9.050 | ** | 2.500 | 0.129 | 10.120 | * |
| * 3.000 | 0.164 | 11.090 | ** | 3.500 | 0.202 | 11.980 | * |
| * 4.000 | 0.243 | 12.800 | ** | 4.500 | 0.288 | 13.580 | * |
| * 5.000 | 0.337 | 14.310 | ** | | | | |

---

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

| INTERVAL NUMBER | DEPTH (FEET) | {S-O*DT/2} (ACRE-FEET) | {S+O*DT/2} (ACRE-FEET) |
|---|---|---|---|
| 1 | 0.00 | 0.00000 | 0.00000 |
| 2 | 0.50 | -0.00624 | 0.04604 |
| 3 | 1.00 | 0.00576 | 0.07964 |
| 4 | 1.50 | 0.02315 | 0.11365 |
| 5 | 2.00 | 0.04477 | 0.14923 |
| 6 | 2.50 | 0.07039 | 0.18721 |
| 7 | 3.00 | 0.09970 | 0.22770 |
| 8 | 3.50 | 0.13276 | 0.27104 |
| 9 | 4.00 | 0.16953 | 0.31727 |
| 10 | 4.50 | 0.21003 | 0.36677 |
| 11 | 5.00 | 0.25431 | 0.41949 |

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

---

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

| TIME (HRS) | DEAD-STORAGE FILLED(AF) | INFLOW (CFS) | EFFECTIVE DEPTH(FT) | OUTFLOW (CFS) | EFFECTIVE VOLUME(AF) |
|---|---|---|---|---|---|
| 0.078 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 0.218 | 0.000 | 0.04 | 0.01 | 0.03 | 0.000 |
| 0.357 | 0.000 | 0.04 | 0.01 | 0.05 | 0.000 |
| 0.497 | 0.000 | 0.04 | 0.01 | 0.05 | 0.000 |
| 0.637 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 0.776 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 0.916 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 1.056 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 1.195 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 1.335 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 1.475 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 1.614 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 1.754 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 1.894 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 2.033 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 2.173 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 2.313 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 2.452 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 2.592 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 2.732 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 2.871 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.011 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.151 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.290 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.430 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.570 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.709 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.849 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 3.989 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 4.128 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 4.268 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 4.408 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 4.547 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 4.687 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 4.827 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 4.966 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 5.106 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 5.246 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 5.385 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 5.525 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 5.665 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 5.804 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 5.944 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 6.084 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 6.223 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 6.363 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 6.503 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 6.642 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 6.782 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 6.922 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 7.061 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 7.201 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 7.341 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 7.480 | 0.000 | 0.07 | 0.01 | 0.07 | 0.000 |
| 7.620 | 0.000 | 0.07 | 0.01 | 0.07 | 0.000 |
| 7.760 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 7.899 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 8.039 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 8.179 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 8.318 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 8.458 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 8.598 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 8.737 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 8.877 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 9.017 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 9.156 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 9.296 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 9.436 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 9.575 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 9.715 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 9.855 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 9.994 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 10.134 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 10.274 | 0.000 | 0.10 | 0.01 | 0.10 | 0.000 |
| 10.413 | 0.000 | 0.10 | 0.01 | 0.11 | 0.001 |
| 10.553 | 0.000 | 0.12 | 0.01 | 0.12 | 0.001 |
| 10.693 | 0.000 | 0.12 | 0.02 | 0.14 | 0.001 |
| 10.832 | 0.000 | 0.14 | 0.02 | 0.15 | 0.001 |
| 10.972 | 0.000 | 0.14 | 0.02 | 0.16 | 0.001 |
| 11.112 | 0.000 | 0.16 | 0.02 | 0.17 | 0.001 |
| 11.251 | 0.000 | 0.17 | 0.02 | 0.19 | 0.001 |
| 11.391 | 0.000 | 0.19 | 0.02 | 0.20 | 0.001 |
| 11.531 | 0.000 | 0.20 | 0.02 | 0.22 | 0.001 |
| 11.670 | 0.000 | 0.22 | 0.03 | 0.23 | 0.001 |
| 11.810 | 0.000 | 0.23 | 0.03 | 0.25 | 0.001 |
| 11.950 | 0.000 | 0.25 | 0.03 | 0.27 | 0.001 |
| 12.089 | 0.000 | 0.26 | 0.03 | 0.29 | 0.001 |
| 12.229 | 0.000 | 0.49 | 0.06 | 0.42 | 0.002 |
| 12.369 | 0.000 | 0.50 | 0.06 | 0.56 | 0.003 |
| 12.508 | 0.000 | 0.53 | 0.07 | 0.59 | 0.003 |
| 12.648 | 0.000 | 0.55 | 0.07 | 0.61 | 0.003 |
| 12.788 | 0.000 | 0.58 | 0.07 | 0.64 | 0.003 |
| 12.927 | 0.000 | 0.60 | 0.07 | 0.67 | 0.003 |
| 13.067 | 0.000 | 0.63 | 0.08 | 0.70 | 0.003 |
| 13.207 | 0.000 | 0.65 | 0.08 | 0.73 | 0.003 |
| 13.346 | 0.000 | 0.69 | 0.09 | 0.76 | 0.003 |
| 13.486 | 0.000 | 0.72 | 0.09 | 0.80 | 0.004 |
| 13.626 | 0.000 | 0.77 | 0.10 | 0.84 | 0.004 |
| 13.765 | 0.000 | 0.79 | 0.10 | 0.89 | 0.004 |
| 13.905 | 0.000 | 0.85 | 0.11 | 0.94 | 0.004 |
| 14.045 | 0.000 | 0.89 | 0.11 | 0.99 | 0.004 |
| 14.184 | 0.000 | 0.97 | 0.12 | 1.05 | 0.005 |
| 14.324 | 0.000 | 1.01 | 0.13 | 1.12 | 0.005 |
| 14.464 | 0.000 | 1.10 | 0.14 | 1.20 | 0.005 |
| 14.603 | 0.000 | 1.15 | 0.14 | 1.28 | 0.006 |

| | | | | | |
|---|---|---|---|---|---|
| 14.743 | 0.000 | 1.27 | 0.16 | 1.37 | 0.006 |
| 14.883 | 0.000 | 1.34 | 0.17 | 1.48 | 0.007 |
| 15.022 | 0.000 | 1.51 | 0.19 | 1.62 | 0.008 |
| 15.162 | 0.000 | 1.61 | 0.20 | 1.77 | 0.008 |
| 15.302 | 0.000 | 1.86 | 0.23 | 1.97 | 0.009 |
| 15.441 | 0.000 | 1.98 | 0.25 | 2.18 | 0.010 |
| 15.581 | 0.000 | 2.15 | 0.27 | 2.35 | 0.011 |
| 15.721 | 0.000 | 2.49 | 0.31 | 2.64 | 0.012 |
| 15.860 | 0.000 | 3.78 | 0.47 | 3.56 | 0.019 |
| 16.000 | 0.000 | 5.36 | 0.74 | 4.85 | 0.031 |
| 16.140 | 0.000 | 17.25 | 2.65 | 7.91 | 0.139 |
| 16.279 | 0.000 | 2.99 | 1.50 | 9.12 | 0.068 |
| 16.419 | 0.000 | 1.90 | 0.49 | 6.13 | 0.019 |
| 16.559 | 0.000 | 1.73 | 0.22 | 3.20 | 0.009 |
| 16.698 | 0.000 | 1.42 | 0.18 | 1.78 | 0.007 |
| 16.838 | 0.000 | 1.21 | 0.15 | 1.49 | 0.006 |
| 16.978 | 0.000 | 1.05 | 0.13 | 1.28 | 0.005 |
| 17.117 | 0.000 | 0.92 | 0.12 | 1.12 | 0.005 |
| 17.257 | 0.000 | 0.82 | 0.10 | 0.99 | 0.004 |
| 17.397 | 0.000 | 0.74 | 0.09 | 0.89 | 0.004 |
| 17.536 | 0.000 | 0.67 | 0.08 | 0.80 | 0.003 |
| 17.676 | 0.000 | 0.61 | 0.08 | 0.73 | 0.003 |
| 17.816 | 0.000 | 0.56 | 0.07 | 0.67 | 0.003 |
| 17.955 | 0.000 | 0.52 | 0.06 | 0.61 | 0.003 |
| 18.095 | 0.000 | 0.47 | 0.06 | 0.56 | 0.002 |
| 18.235 | 0.000 | 0.24 | 0.03 | 0.40 | 0.001 |
| 18.374 | 0.000 | 0.21 | 0.03 | 0.25 | 0.001 |
| 18.514 | 0.000 | 0.18 | 0.02 | 0.22 | 0.001 |
| 18.654 | 0.000 | 0.15 | 0.02 | 0.19 | 0.001 |
| 18.793 | 0.000 | 0.13 | 0.02 | 0.16 | 0.001 |
| 18.933 | 0.000 | 0.11 | 0.01 | 0.14 | 0.001 |
| 19.073 | 0.000 | 0.09 | 0.01 | 0.11 | 0.000 |
| 19.212 | 0.000 | 0.08 | 0.01 | 0.10 | 0.000 |
| 19.352 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 19.492 | 0.000 | 0.08 | 0.01 | 0.09 | 0.000 |
| 19.631 | 0.000 | 0.07 | 0.01 | 0.09 | 0.000 |
| 19.771 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 19.911 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 20.050 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 20.190 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 20.330 | 0.000 | 0.07 | 0.01 | 0.08 | 0.000 |
| 20.469 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 20.609 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 20.749 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 20.888 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 21.028 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 21.168 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 21.307 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 21.447 | 0.000 | 0.06 | 0.01 | 0.07 | 0.000 |
| 21.587 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 21.726 | 0.000 | 0.06 | 0.01 | 0.06 | 0.000 |
| 21.866 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 22.006 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 22.145 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 22.285 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 22.425 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 22.564 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 22.704 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 22.844 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 22.983 | 0.000 | 0.05 | 0.01 | 0.06 | 0.000 |
| 23.123 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 23.263 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 23.402 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 23.542 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 23.682 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 23.821 | 0.000 | 0.05 | 0.01 | 0.05 | 0.000 |
| 23.961 | 0.000 | 0.04 | 0.01 | 0.05 | 0.000 |
| 24.101 | 0.000 | 0.04 | 0.01 | 0.05 | 0.000 |
| 24.240 | 0.000 | 0.00 | 0.00 | 0.03 | 0.000 |
| 24.380 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

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*****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
=============================================================================
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1334

                              Analysis prepared by:

SWAP
BASIN 2 - AREAS C + D
PROPOSED CONDITION - 25 YEAR STORM

*****************************************************************************
-----------------------------------------------------------------------------

 Problem Descriptions:



-----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    6.05
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.140
    LOW LOSS FRACTION = 0.999
    TIME OF CONCENTRATION(MIN.) =  8.55
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  25
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.87
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.15
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.94
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.71
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  4.49

-----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.85
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.41

*****************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
-----------------------------------------------------------------------------
  0.04      0.0000      0.00  Q         .         .         .         .
  0.18      0.0000      0.00  Q         .         .         .         .
  0.32      0.0000      0.00  Q         .         .         .         .
  0.47      0.0000      0.00  Q         .         .         .         .
  0.61      0.0000      0.00  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.75 | 0.0000 | 0.00 | Q | . | . | . | . |
| 0.89 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.04 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.18 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.32 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.46 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.61 | 0.0000 | 0.00 | Q | . | . | . | . |
| 1.75 | 0.0001 | 0.00 | Q | . | . | . | . |
| 1.89 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.03 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.18 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.32 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.46 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.60 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.75 | 0.0001 | 0.00 | Q | . | . | . | . |
| 2.89 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.03 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.17 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.32 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.46 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.60 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.74 | 0.0001 | 0.00 | Q | . | . | . | . |
| 3.89 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.03 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.17 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.32 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.46 | 0.0001 | 0.00 | Q | . | . | . | . |
| 4.60 | 0.0002 | 0.00 | Q | . | . | . | . |
| 4.74 | 0.0002 | 0.00 | Q | . | . | . | . |
| 4.88 | 0.0002 | 0.00 | Q | . | . | . | . |
| 5.03 | 0.0002 | 0.00 | Q | . | . | . | . |
| 5.17 | 0.0002 | 0.00 | Q | . | . | . | . |
| 5.31 | 0.0002 | 0.00 | Q | . | . | . | . |
| 5.45 | 0.0002 | 0.00 | Q | . | . | . | . |
| 5.60 | 0.0002 | 0.00 | Q | . | . | . | . |
| 5.74 | 0.0002 | 0.00 | Q | . | . | . | . |
| 5.88 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.03 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.17 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.31 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.45 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.59 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.74 | 0.0002 | 0.00 | Q | . | . | . | . |
| 6.88 | 0.0002 | 0.00 | Q | . | . | . | . |
| 7.02 | 0.0003 | 0.00 | Q | . | . | . | . |
| 7.16 | 0.0003 | 0.00 | Q | . | . | . | . |
| 7.31 | 0.0003 | 0.00 | Q | . | . | . | . |
| 7.45 | 0.0003 | 0.00 | Q | . | . | . | . |
| 7.59 | 0.0003 | 0.00 | Q | . | . | . | . |
| 7.73 | 0.0003 | 0.00 | Q | . | . | . | . |
| 7.88 | 0.0003 | 0.00 | Q | . | . | . | . |
| 8.02 | 0.0003 | 0.00 | Q | . | . | . | . |

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 8.16      0.0003      0.00  Q         .         .         .         .
 8.30      0.0003      0.00  Q         .         .         .         .
 8.45      0.0003      0.00  Q         .         .         .         .
 8.59      0.0003      0.00  Q         .         .         .         .
 8.73      0.0003      0.00  Q         .         .         .         .
 8.88      0.0003      0.00  Q         .         .         .         .
 9.02      0.0003      0.00  Q         .         .         .         .
 9.16      0.0004      0.00  Q         .         .         .         .
 9.30      0.0004      0.00  Q         .         .         .         .
 9.45      0.0004      0.00  Q         .         .         .         .
 9.59      0.0004      0.00  Q         .         .         .         .
 9.73      0.0004      0.00  Q         .         .         .         .
 9.87      0.0004      0.00  Q         .         .         .         .
10.01      0.0004      0.00  Q         .         .         .         .
10.16      0.0004      0.00  Q         .         .         .         .
10.30      0.0004      0.00  Q         .         .         .         .
10.44      0.0004      0.00  Q         .         .         .         .
10.59      0.0004      0.00  Q         .         .         .         .
10.73      0.0004      0.00  Q         .         .         .         .
10.87      0.0004      0.00  Q         .         .         .         .
11.01      0.0005      0.01  Q         .         .         .         .
11.15      0.0006      0.02  Q         .         .         .         .
11.30      0.0009      0.04  Q         .         .         .         .
11.44      0.0014      0.05  Q         .         .         .         .
11.58      0.0021      0.07  Q         .         .         .         .
11.73      0.0029      0.08  Q         .         .         .         .
11.87      0.0040      0.10  Q         .         .         .         .
12.01      0.0053      0.12  Q         .         .         .         .
12.15      0.0085      0.43  Q         .         .         .         .
12.30      0.0137      0.45  Q         .         .         .         .
12.44      0.0192      0.48  Q         .         .         .         .
12.58      0.0249      0.50  Q         .         .         .         .
12.72      0.0310      0.53  .Q        .         .         .         .
12.87      0.0374      0.55  .Q        .         .         .         .
13.01      0.0441      0.59  .Q        .         .         .         .
13.15      0.0512      0.62  .Q        .         .         .         .
13.29      0.0588      0.66  .Q        .         .         .         .
13.43      0.0668      0.69  .Q        .         .         .         .
13.58      0.0752      0.75  .Q        .         .         .         .
13.72      0.0841      0.78  .Q        .         .         .         .
13.86      0.0937      0.84  .Q        .         .         .         .
14.01      0.1038      0.88  .Q        .         .         .         .
14.15      0.1145      0.94  .Q        .         .         .         .
14.29      0.1258      0.98  .Q        .         .         .         .
14.43      0.1380      1.08  . Q       .         .         .         .
14.57      0.1511      1.14  . Q       .         .         .         .
14.72      0.1653      1.28  . Q       .         .         .         .
14.86      0.1808      1.35  . Q       .         .         .         .
15.00      0.1978      1.54  .  Q      .         .         .         .
15.15      0.2166      1.65  .  Q      .         .         .         .
15.29      0.2377      1.93  .  Q      .         .         .         .
15.43      0.2616      2.11  .   Q     .         .         .         .
```

| | | | |
|---|---|---|---|
| 15.57 | 0.2867 | 2.16 | . Q . . . . |
| 15.72 | 0.3143 | 2.53 | . Q . . . . |
| 15.86 | 0.3542 | 4.25 | . Q . . . . |
| 16.00 | 0.4145 | 6.00 | . . Q . . . |
| 16.14 | 0.5590 | 18.53 | . . . . Q . |
| 16.28 | 0.6870 | 3.22 | . Q . . . . |
| 16.43 | 0.7170 | 1.88 | . Q . . . . |
| 16.57 | 0.7386 | 1.78 | . Q . . . . |
| 16.71 | 0.7576 | 1.44 | . Q . . . . |
| 16.85 | 0.7732 | 1.21 | . Q . . . . |
| 17.00 | 0.7863 | 1.03 | . Q . . . . |
| 17.14 | 0.7978 | 0.92 | .Q . . . . |
| 17.28 | 0.8080 | 0.81 | .Q . . . . |
| 17.42 | 0.8169 | 0.72 | .Q . . . . |
| 17.57 | 0.8249 | 0.64 | .Q . . . . |
| 17.71 | 0.8320 | 0.57 | .Q . . . . |
| 17.85 | 0.8384 | 0.51 | .Q . . . . |
| 17.99 | 0.8442 | 0.46 | Q . . . . |
| 18.14 | 0.8479 | 0.16 | Q . . . . |
| 18.28 | 0.8493 | 0.09 | Q . . . . |
| 18.42 | 0.8502 | 0.06 | Q . . . . |
| 18.57 | 0.8507 | 0.03 | Q . . . . |
| 18.71 | 0.8508 | 0.00 | Q . . . . |
| 18.85 | 0.8509 | 0.00 | Q . . . . |
| 18.99 | 0.8509 | 0.00 | Q . . . . |
| 19.14 | 0.8509 | 0.00 | Q . . . . |
| 19.28 | 0.8509 | 0.00 | Q . . . . |
| 19.42 | 0.8509 | 0.00 | Q . . . . |
| 19.56 | 0.8509 | 0.00 | Q . . . . |
| 19.70 | 0.8509 | 0.00 | Q . . . . |
| 19.85 | 0.8509 | 0.00 | Q . . . . |
| 19.99 | 0.8509 | 0.00 | Q . . . . |
| 20.13 | 0.8509 | 0.00 | Q . . . . |
| 20.27 | 0.8509 | 0.00 | Q . . . . |
| 20.42 | 0.8509 | 0.00 | Q . . . . |
| 20.56 | 0.8509 | 0.00 | Q . . . . |
| 20.70 | 0.8509 | 0.00 | Q . . . . |
| 20.84 | 0.8510 | 0.00 | Q . . . . |
| 20.99 | 0.8510 | 0.00 | Q . . . . |
| 21.13 | 0.8510 | 0.00 | Q . . . . |
| 21.27 | 0.8510 | 0.00 | Q . . . . |
| 21.42 | 0.8510 | 0.00 | Q . . . . |
| 21.56 | 0.8510 | 0.00 | Q . . . . |
| 21.70 | 0.8510 | 0.00 | Q . . . . |
| 21.84 | 0.8510 | 0.00 | Q . . . . |
| 21.98 | 0.8510 | 0.00 | Q . . . . |
| 22.13 | 0.8510 | 0.00 | Q . . . . |
| 22.27 | 0.8510 | 0.00 | Q . . . . |
| 22.41 | 0.8510 | 0.00 | Q . . . . |
| 22.56 | 0.8510 | 0.00 | Q . . . . |
| 22.70 | 0.8510 | 0.00 | Q . . . . |
| 22.84 | 0.8510 | 0.00 | Q . . . . |

```
  22.98      0.8510      0.00  Q         .         .         .         .
  23.12      0.8510      0.00  Q         .         .         .         .
  23.27      0.8510      0.00  Q         .         .         .         .
  23.41      0.8511      0.00  Q         .         .         .         .
  23.55      0.8511      0.00  Q         .         .         .         .
  23.69      0.8511      0.00  Q         .         .         .         .
  23.84      0.8511      0.00  Q         .         .         .         .
  23.98      0.8511      0.00  Q         .         .         .         .
  24.12      0.8511      0.00  Q         .         .         .         .
  24.27      0.8511      0.00  Q         .         .         .         .
 ---------------------------------------------------------------------------
-------------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    =======================                 =========
               0%                            1445.0
              10%                              77.0
              20%                              25.7
              30%                              17.1
              40%                               8.6
              50%                               8.6
              60%                               8.6
              70%                               8.6
              80%                               8.6
              90%                               8.6

  Problem Descriptions:




===========================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =    8.550
     DEAD STORAGE(AF) =       0.73
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                     INFLOW
                       |
                       |
                       |
```

```
                V                __effective depth
            -------------        |   (and volume)
            |           |    |    |
            | detention |    |....V.............
            |   basin   |<-->|          outflow
            |           |    |.........________
            -------------    |         |   \
                  |          | storage |     basin outlet
                  V          -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

| *BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) ** | **BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) * |
|---|---|---|---|---|---|
| * 0.000 | 0.000 | 0.000** | 0.100 | 0.030 | 0.100* |
| * 0.600 | 0.186 | 10.220** | 1.100 | 0.350 | 17.190* |
| * 2.000 | 0.988 | 17.240** | 2.500 | 1.259 | 18.440* |
| * 3.000 | 1.541 | 19.550** | 3.500 | 1.834 | 20.610* |
| * 4.000 | 2.139 | 21.620** | | | |

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BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

| INTERVAL NUMBER | DEPTH (FEET) | {S-O*DT/2} (ACRE-FEET) | {S+O*DT/2} (ACRE-FEET) |
|---|---|---|---|
| 1 | 0.00 | 0.00000 | 0.00000 |
| 2 | 0.10 | 0.02951 | 0.03069 |
| 3 | 0.60 | 0.12542 | 0.24578 |
| 4 | 1.10 | 0.24828 | 0.45072 |
| 5 | 2.00 | 0.88608 | 1.08912 |
| 6 | 2.50 | 1.15002 | 1.36718 |
| 7 | 3.00 | 1.42558 | 1.65582 |
| 8 | 3.50 | 1.71274 | 1.95546 |
| 9 | 4.00 | 2.01159 | 2.26621 |

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

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DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

| TIME (HRS) | DEAD-STORAGE FILLED(AF) | INFLOW (CFS) | EFFECTIVE DEPTH(FT) | OUTFLOW (CFS) | EFFECTIVE VOLUME(AF) |
|---|---|---|---|---|---|
| 0.040 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.182 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.325 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.467 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.610 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.752 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.895 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.037 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 1.180 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.322 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.465 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.607 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.750 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.892 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.035 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.177 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.320 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.462 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.605 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.747 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.890 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.032 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.175 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.317 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.460 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.602 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.745 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.887 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.030 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.172 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.315 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.457 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.600 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.742 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.885 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.027 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.170 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.312 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.455 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.597 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.740 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 5.882 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.025 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.168 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.310 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.452 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.595 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.738 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 6.880 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.022 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.165 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.307 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.450 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.592 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.735 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 7.878 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.020 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.163 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.305 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.447 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 8.590 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.733 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 8.875 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.017 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.160 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.302 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.445 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.587 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.730 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 9.872 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.015 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.158 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.300 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.443 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.585 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.727 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 10.870 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 11.012 | 0.001 | 0.01 | 0.00 | 0.00 | 0.000 |
| 11.155 | 0.001 | 0.02 | 0.00 | 0.00 | 0.000 |
| 11.297 | 0.001 | 0.04 | 0.00 | 0.00 | 0.000 |
| 11.440 | 0.002 | 0.05 | 0.00 | 0.00 | 0.000 |
| 11.583 | 0.002 | 0.07 | 0.00 | 0.00 | 0.000 |
| 11.725 | 0.003 | 0.08 | 0.00 | 0.00 | 0.000 |
| 11.867 | 0.005 | 0.10 | 0.00 | 0.00 | 0.000 |
| 12.010 | 0.006 | 0.12 | 0.00 | 0.00 | 0.000 |
| 12.153 | 0.011 | 0.43 | 0.00 | 0.00 | 0.000 |
| 12.295 | 0.016 | 0.45 | 0.00 | 0.00 | 0.000 |
| 12.438 | 0.022 | 0.48 | 0.00 | 0.00 | 0.000 |
| 12.580 | 0.028 | 0.50 | 0.00 | 0.00 | 0.000 |
| 12.722 | 0.034 | 0.53 | 0.00 | 0.00 | 0.000 |
| 12.865 | 0.041 | 0.55 | 0.00 | 0.00 | 0.000 |
| 13.008 | 0.048 | 0.59 | 0.00 | 0.00 | 0.000 |
| 13.150 | 0.055 | 0.62 | 0.00 | 0.00 | 0.000 |
| 13.292 | 0.063 | 0.66 | 0.00 | 0.00 | 0.000 |
| 13.435 | 0.071 | 0.69 | 0.00 | 0.00 | 0.000 |
| 13.578 | 0.080 | 0.75 | 0.00 | 0.00 | 0.000 |
| 13.720 | 0.089 | 0.78 | 0.00 | 0.00 | 0.000 |
| 13.863 | 0.099 | 0.84 | 0.00 | 0.00 | 0.000 |
| 14.005 | 0.109 | 0.88 | 0.00 | 0.00 | 0.000 |
| 14.148 | 0.120 | 0.94 | 0.00 | 0.00 | 0.000 |
| 14.290 | 0.132 | 0.98 | 0.00 | 0.00 | 0.000 |
| 14.432 | 0.144 | 1.08 | 0.00 | 0.00 | 0.000 |
| 14.575 | 0.158 | 1.14 | 0.00 | 0.00 | 0.000 |
| 14.717 | 0.173 | 1.28 | 0.00 | 0.00 | 0.000 |
| 14.860 | 0.189 | 1.35 | 0.00 | 0.00 | 0.000 |
| 15.003 | 0.207 | 1.54 | 0.00 | 0.00 | 0.000 |
| 15.145 | 0.226 | 1.65 | 0.00 | 0.00 | 0.000 |
| 15.288 | 0.249 | 1.93 | 0.00 | 0.00 | 0.000 |
| 15.430 | 0.274 | 2.11 | 0.00 | 0.00 | 0.000 |
| 15.572 | 0.299 | 2.16 | 0.00 | 0.00 | 0.000 |
| 15.715 | 0.329 | 2.53 | 0.00 | 0.00 | 0.000 |
| 15.858 | 0.379 | 4.25 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 16.000 | 0.450 | 6.00 | 0.00 | 0.00 | 0.000 |
| 16.142 | 0.668 | 18.53 | 0.00 | 0.00 | 0.000 |
| 16.285 | 0.706 | 3.22 | 0.00 | 0.00 | 0.000 |
| 16.427 | 0.728 | 1.88 | 0.00 | 0.00 | 0.000 |

DEAD STORAGE FILLED WITH UNIT INFLOW(CFS) = 0.47
REMAINING UNIT FLOW IS 1.31 CFS.

| | | | | | |
|---|---|---|---|---|---|
| 16.570 | 0.734 | 1.31 | 0.05 | 0.03 | 0.015 |
| 16.712 | 0.734 | 1.44 | 0.10 | 0.10 | 0.031 |
| 16.855 | 0.734 | 1.21 | 0.13 | 0.44 | 0.040 |
| 16.997 | 0.734 | 1.03 | 0.14 | 0.82 | 0.042 |
| 17.140 | 0.734 | 0.92 | 0.14 | 0.90 | 0.043 |
| 17.282 | 0.734 | 0.81 | 0.14 | 0.88 | 0.042 |
| 17.425 | 0.734 | 0.72 | 0.13 | 0.81 | 0.041 |
| 17.568 | 0.734 | 0.64 | 0.13 | 0.74 | 0.039 |
| 17.710 | 0.734 | 0.57 | 0.13 | 0.67 | 0.038 |
| 17.853 | 0.734 | 0.51 | 0.12 | 0.60 | 0.037 |
| 17.995 | 0.734 | 0.46 | 0.12 | 0.54 | 0.036 |
| 18.138 | 0.734 | 0.16 | 0.11 | 0.41 | 0.033 |
| 18.280 | 0.734 | 0.09 | 0.10 | 0.25 | 0.031 |
| 18.422 | 0.734 | 0.06 | 0.10 | 0.15 | 0.030 |
| 18.565 | 0.734 | 0.03 | 0.10 | 0.11 | 0.029 |
| 18.707 | 0.734 | 0.00 | 0.09 | 0.10 | 0.028 |
| 18.850 | 0.734 | 0.00 | 0.09 | 0.09 | 0.027 |
| 18.993 | 0.734 | 0.00 | 0.09 | 0.09 | 0.026 |
| 19.135 | 0.734 | 0.00 | 0.08 | 0.09 | 0.025 |
| 19.278 | 0.734 | 0.00 | 0.08 | 0.08 | 0.024 |
| 19.420 | 0.734 | 0.00 | 0.08 | 0.08 | 0.023 |
| 19.562 | 0.734 | 0.00 | 0.07 | 0.08 | 0.022 |
| 19.705 | 0.734 | 0.00 | 0.07 | 0.07 | 0.022 |
| 19.847 | 0.734 | 0.00 | 0.07 | 0.07 | 0.021 |
| 19.990 | 0.734 | 0.00 | 0.07 | 0.07 | 0.020 |
| 20.132 | 0.734 | 0.00 | 0.06 | 0.06 | 0.019 |
| 20.275 | 0.734 | 0.00 | 0.06 | 0.06 | 0.018 |
| 20.418 | 0.734 | 0.00 | 0.06 | 0.06 | 0.018 |
| 20.560 | 0.734 | 0.00 | 0.06 | 0.06 | 0.017 |
| 20.703 | 0.734 | 0.00 | 0.05 | 0.06 | 0.016 |
| 20.845 | 0.734 | 0.00 | 0.05 | 0.05 | 0.016 |
| 20.987 | 0.734 | 0.00 | 0.05 | 0.05 | 0.015 |
| 21.130 | 0.734 | 0.00 | 0.05 | 0.05 | 0.015 |
| 21.272 | 0.734 | 0.00 | 0.05 | 0.05 | 0.014 |
| 21.415 | 0.734 | 0.00 | 0.04 | 0.05 | 0.014 |
| 21.557 | 0.734 | 0.00 | 0.04 | 0.04 | 0.013 |
| 21.700 | 0.734 | 0.00 | 0.04 | 0.04 | 0.013 |
| 21.843 | 0.734 | 0.00 | 0.04 | 0.04 | 0.012 |
| 21.985 | 0.734 | 0.00 | 0.04 | 0.04 | 0.012 |
| 22.128 | 0.734 | 0.00 | 0.04 | 0.04 | 0.011 |
| 22.270 | 0.734 | 0.00 | 0.04 | 0.04 | 0.011 |
| 22.413 | 0.734 | 0.00 | 0.03 | 0.03 | 0.010 |
| 22.555 | 0.734 | 0.00 | 0.03 | 0.03 | 0.010 |
| 22.698 | 0.734 | 0.00 | 0.03 | 0.03 | 0.010 |
| 22.840 | 0.734 | 0.00 | 0.03 | 0.03 | 0.009 |
| 22.983 | 0.734 | 0.00 | 0.03 | 0.03 | 0.009 |

| | | | | | |
|---|---|---|---|---|---|
| 23.125 | 0.734 | 0.00 | 0.03 | 0.03 | 0.009 |
| 23.267 | 0.734 | 0.00 | 0.03 | 0.03 | 0.008 |
| 23.410 | 0.734 | 0.00 | 0.03 | 0.03 | 0.008 |
| 23.552 | 0.734 | 0.00 | 0.03 | 0.03 | 0.008 |
| 23.695 | 0.734 | 0.00 | 0.02 | 0.02 | 0.007 |
| 23.837 | 0.734 | 0.00 | 0.02 | 0.02 | 0.007 |
| 23.980 | 0.734 | 0.00 | 0.02 | 0.02 | 0.007 |
| 24.122 | 0.734 | 0.00 | 0.02 | 0.02 | 0.006 |
| 24.265 | 0.734 | 0.00 | 0.02 | 0.02 | 0.006 |
| 24.408 | 0.734 | 0.00 | 0.02 | 0.02 | 0.006 |
| 24.550 | 0.734 | 0.00 | 0.02 | 0.02 | 0.006 |
| 24.693 | 0.734 | 0.00 | 0.02 | 0.02 | 0.006 |
| 24.835 | 0.734 | 0.00 | 0.02 | 0.02 | 0.005 |
| 24.978 | 0.734 | 0.00 | 0.02 | 0.02 | 0.005 |
| 25.120 | 0.734 | 0.00 | 0.02 | 0.02 | 0.005 |
| 25.263 | 0.734 | 0.00 | 0.02 | 0.02 | 0.005 |
| 25.405 | 0.734 | 0.00 | 0.02 | 0.02 | 0.005 |
| 25.548 | 0.734 | 0.00 | 0.01 | 0.01 | 0.004 |
| 25.690 | 0.734 | 0.00 | 0.01 | 0.01 | 0.004 |
| 25.833 | 0.734 | 0.00 | 0.01 | 0.01 | 0.004 |
| 25.975 | 0.734 | 0.00 | 0.01 | 0.01 | 0.004 |
| 26.118 | 0.734 | 0.00 | 0.01 | 0.01 | 0.004 |
| 26.260 | 0.734 | 0.00 | 0.01 | 0.01 | 0.004 |
| 26.403 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 26.545 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 26.688 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 26.830 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 26.972 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 27.115 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 27.257 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 27.400 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 27.542 | 0.734 | 0.00 | 0.01 | 0.01 | 0.003 |
| 27.685 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 27.827 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 27.970 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 28.112 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 28.255 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 28.397 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 28.540 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 28.682 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 28.825 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 28.967 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 29.110 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 29.252 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 29.395 | 0.734 | 0.00 | 0.01 | 0.01 | 0.002 |
| 29.537 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 29.680 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 29.822 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 29.965 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 30.107 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 30.250 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 30.392 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |

| | | | | | |
|---|---|---|---|---|---|
| 30.535 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 30.677 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 30.820 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |
| 30.962 | 0.734 | 0.00 | 0.00 | 0.00 | 0.001 |

```
*****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
=============================================================================
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                              Analysis prepared by:

SWAP
BASIN 2 - AREAS C + D
PROPOSED CONDITION - 100 YEAR STORM

*****************************************************************************
-----------------------------------------------------------------------------

 Problem Descriptions:



-----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    6.05
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.140
    LOW LOSS FRACTION = 0.869
    TIME OF CONCENTRATION(MIN.) =  8.42
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.09
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.45
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.43
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.36
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.63

-----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.29
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.54

*****************************************************************************
  TIME     VOLUME       Q    0.        7.5      15.0      22.5      30.0
 (HOURS)    (AF)      (CFS)
-----------------------------------------------------------------------------
  0.00      0.0000      0.00  Q         .         .         .         .
  0.14      0.0004      0.06  Q         .         .         .         .
  0.28      0.0011      0.06  Q         .         .         .         .
  0.42      0.0018      0.06  Q         .         .         .         .
  0.56      0.0026      0.06  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.70 | 0.0033 | 0.06 | Q | . | . | . | . |
| 0.84 | 0.0040 | 0.06 | Q | . | . | . | . |
| 0.98 | 0.0048 | 0.06 | Q | . | . | . | . |
| 1.12 | 0.0055 | 0.06 | Q | . | . | . | . |
| 1.26 | 0.0063 | 0.07 | Q | . | . | . | . |
| 1.41 | 0.0070 | 0.07 | Q | . | . | . | . |
| 1.55 | 0.0078 | 0.07 | Q | . | . | . | . |
| 1.69 | 0.0086 | 0.07 | Q | . | . | . | . |
| 1.83 | 0.0093 | 0.07 | Q | . | . | . | . |
| 1.97 | 0.0101 | 0.07 | Q | . | . | . | . |
| 2.11 | 0.0109 | 0.07 | Q | . | . | . | . |
| 2.25 | 0.0117 | 0.07 | Q | . | . | . | . |
| 2.39 | 0.0125 | 0.07 | Q | . | . | . | . |
| 2.53 | 0.0133 | 0.07 | Q | . | . | . | . |
| 2.67 | 0.0141 | 0.07 | Q | . | . | . | . |
| 2.81 | 0.0149 | 0.07 | Q | . | . | . | . |
| 2.95 | 0.0157 | 0.07 | Q | . | . | . | . |
| 3.09 | 0.0165 | 0.07 | Q | . | . | . | . |
| 3.23 | 0.0174 | 0.07 | Q | . | . | . | . |
| 3.37 | 0.0182 | 0.07 | Q | . | . | . | . |
| 3.51 | 0.0190 | 0.07 | Q | . | . | . | . |
| 3.65 | 0.0199 | 0.07 | Q | . | . | . | . |
| 3.79 | 0.0207 | 0.07 | Q | . | . | . | . |
| 3.93 | 0.0216 | 0.07 | Q | . | . | . | . |
| 4.07 | 0.0224 | 0.07 | Q | . | . | . | . |
| 4.21 | 0.0233 | 0.07 | Q | . | . | . | . |
| 4.35 | 0.0242 | 0.08 | Q | . | . | . | . |
| 4.49 | 0.0250 | 0.08 | Q | . | . | . | . |
| 4.63 | 0.0259 | 0.08 | Q | . | . | . | . |
| 4.77 | 0.0268 | 0.08 | Q | . | . | . | . |
| 4.91 | 0.0277 | 0.08 | Q | . | . | . | . |
| 5.05 | 0.0286 | 0.08 | Q | . | . | . | . |
| 5.19 | 0.0295 | 0.08 | Q | . | . | . | . |
| 5.33 | 0.0305 | 0.08 | Q | . | . | . | . |
| 5.47 | 0.0314 | 0.08 | Q | . | . | . | . |
| 5.62 | 0.0323 | 0.08 | Q | . | . | . | . |
| 5.76 | 0.0333 | 0.08 | Q | . | . | . | . |
| 5.90 | 0.0342 | 0.08 | Q | . | . | . | . |
| 6.04 | 0.0352 | 0.08 | Q | . | . | . | . |
| 6.18 | 0.0362 | 0.08 | Q | . | . | . | . |
| 6.32 | 0.0371 | 0.08 | Q | . | . | . | . |
| 6.46 | 0.0381 | 0.09 | Q | . | . | . | . |
| 6.60 | 0.0391 | 0.09 | Q | . | . | . | . |
| 6.74 | 0.0401 | 0.09 | Q | . | . | . | . |
| 6.88 | 0.0412 | 0.09 | Q | . | . | . | . |
| 7.02 | 0.0422 | 0.09 | Q | . | . | . | . |
| 7.16 | 0.0432 | 0.09 | Q | . | . | . | . |
| 7.30 | 0.0443 | 0.09 | Q | . | . | . | . |
| 7.44 | 0.0453 | 0.09 | Q | . | . | . | . |
| 7.58 | 0.0464 | 0.09 | Q | . | . | . | . |
| 7.72 | 0.0475 | 0.09 | Q | . | . | . | . |
| 7.86 | 0.0485 | 0.09 | Q | . | . | . | . |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8.00 | 0.0496 | 0.10 | Q | . | . | . | . |
| 8.14 | 0.0508 | 0.10 | Q | . | . | . | . |
| 8.28 | 0.0519 | 0.10 | Q | . | . | . | . |
| 8.42 | 0.0530 | 0.10 | Q | . | . | . | . |
| 8.56 | 0.0542 | 0.10 | Q | . | . | . | . |
| 8.70 | 0.0553 | 0.10 | Q | . | . | . | . |
| 8.84 | 0.0565 | 0.10 | Q | . | . | . | . |
| 8.98 | 0.0577 | 0.10 | Q | . | . | . | . |
| 9.12 | 0.0589 | 0.10 | Q | . | . | . | . |
| 9.26 | 0.0601 | 0.11 | Q | . | . | . | . |
| 9.40 | 0.0614 | 0.11 | Q | . | . | . | . |
| 9.54 | 0.0626 | 0.11 | Q | . | . | . | . |
| 9.68 | 0.0639 | 0.11 | Q | . | . | . | . |
| 9.83 | 0.0652 | 0.11 | Q | . | . | . | . |
| 9.97 | 0.0665 | 0.11 | Q | . | . | . | . |
| 10.11 | 0.0678 | 0.11 | Q | . | . | . | . |
| 10.25 | 0.0693 | 0.13 | Q | . | . | . | . |
| 10.39 | 0.0708 | 0.14 | Q | . | . | . | . |
| 10.53 | 0.0726 | 0.16 | Q | . | . | . | . |
| 10.67 | 0.0745 | 0.17 | Q | . | . | . | . |
| 10.81 | 0.0766 | 0.19 | Q | . | . | . | . |
| 10.95 | 0.0789 | 0.20 | Q | . | . | . | . |
| 11.09 | 0.0813 | 0.22 | Q | . | . | . | . |
| 11.23 | 0.0840 | 0.24 | Q | . | . | . | . |
| 11.37 | 0.0869 | 0.26 | Q | . | . | . | . |
| 11.51 | 0.0900 | 0.27 | Q | . | . | . | . |
| 11.65 | 0.0933 | 0.30 | Q | . | . | . | . |
| 11.79 | 0.0969 | 0.31 | Q | . | . | . | . |
| 11.93 | 0.1007 | 0.34 | Q | . | . | . | . |
| 12.07 | 0.1048 | 0.36 | Q | . | . | . | . |
| 12.21 | 0.1109 | 0.69 | Q | . | . | . | . |
| 12.35 | 0.1189 | 0.70 | Q | . | . | . | . |
| 12.49 | 0.1273 | 0.75 | Q | . | . | . | . |
| 12.63 | 0.1361 | 0.77 | .Q | . | . | . | . |
| 12.77 | 0.1453 | 0.81 | .Q | . | . | . | . |
| 12.91 | 0.1548 | 0.84 | .Q | . | . | . | . |
| 13.05 | 0.1648 | 0.89 | .Q | . | . | . | . |
| 13.19 | 0.1753 | 0.92 | .Q | . | . | . | . |
| 13.33 | 0.1862 | 0.97 | .Q | . | . | . | . |
| 13.47 | 0.1977 | 1.01 | .Q | . | . | . | . |
| 13.61 | 0.2098 | 1.08 | .Q | . | . | . | . |
| 13.75 | 0.2225 | 1.11 | .Q | . | . | . | . |
| 13.90 | 0.2359 | 1.20 | .Q | . | . | . | . |
| 14.04 | 0.2501 | 1.24 | .Q | . | . | . | . |
| 14.18 | 0.2652 | 1.36 | .Q | . | . | . | . |
| 14.32 | 0.2812 | 1.41 | .Q | . | . | . | . |
| 14.46 | 0.2984 | 1.54 | . Q | . | . | . | . |
| 14.60 | 0.3167 | 1.62 | . Q | . | . | . | . |
| 14.74 | 0.3364 | 1.78 | . Q | . | . | . | . |
| 14.88 | 0.3577 | 1.88 | . Q | . | . | . | . |
| 15.02 | 0.3809 | 2.12 | . Q | . | . | . | . |
| 15.16 | 0.4063 | 2.26 | .  Q | . | . | . | . |

| | | | |
|---|---|---|---|
| 15.30 | 0.4346 | 2.62 | . Q . . . . |
| 15.44 | 0.4659 | 2.79 | . Q . . . . |
| 15.58 | 0.4997 | 3.03 | . Q . . . . |
| 15.72 | 0.5376 | 3.51 | . Q . . . . |
| 15.86 | 0.5887 | 5.31 | . Q . . . . |
| 16.00 | 0.6632 | 7.53 | . Q . . . |
| 16.14 | 0.8476 | 24.26 | . . . . Q . |
| 16.28 | 1.0126 | 4.20 | . Q . . . . |
| 16.42 | 1.0525 | 2.67 | . Q . . . . |
| 16.56 | 1.0821 | 2.42 | . Q . . . . |
| 16.70 | 1.1077 | 1.99 | . Q . . . . |
| 16.84 | 1.1291 | 1.70 | . Q . . . . |
| 16.98 | 1.1475 | 1.48 | .Q . . . . |
| 17.12 | 1.1635 | 1.30 | .Q . . . . |
| 17.26 | 1.1778 | 1.16 | .Q . . . . |
| 17.40 | 1.1905 | 1.04 | .Q . . . . |
| 17.54 | 1.2020 | 0.94 | .Q . . . . |
| 17.68 | 1.2125 | 0.86 | .Q . . . . |
| 17.82 | 1.2220 | 0.79 | .Q . . . . |
| 17.96 | 1.2308 | 0.72 | Q . . . . |
| 18.11 | 1.2385 | 0.60 | Q . . . . |
| 18.25 | 1.2439 | 0.33 | Q . . . . |
| 18.39 | 1.2474 | 0.29 | Q . . . . |
| 18.53 | 1.2505 | 0.25 | Q . . . . |
| 18.67 | 1.2532 | 0.21 | Q . . . . |
| 18.81 | 1.2555 | 0.18 | Q . . . . |
| 18.95 | 1.2574 | 0.15 | Q . . . . |
| 19.09 | 1.2590 | 0.12 | Q . . . . |
| 19.23 | 1.2604 | 0.11 | Q . . . . |
| 19.37 | 1.2616 | 0.11 | Q . . . . |
| 19.51 | 1.2629 | 0.11 | Q . . . . |
| 19.65 | 1.2641 | 0.10 | Q . . . . |
| 19.79 | 1.2653 | 0.10 | Q . . . . |
| 19.93 | 1.2665 | 0.10 | Q . . . . |
| 20.07 | 1.2676 | 0.10 | Q . . . . |
| 20.21 | 1.2687 | 0.09 | Q . . . . |
| 20.35 | 1.2698 | 0.09 | Q . . . . |
| 20.49 | 1.2709 | 0.09 | Q . . . . |
| 20.63 | 1.2719 | 0.09 | Q . . . . |
| 20.77 | 1.2730 | 0.09 | Q . . . . |
| 20.91 | 1.2740 | 0.09 | Q . . . . |
| 21.05 | 1.2749 | 0.08 | Q . . . . |
| 21.19 | 1.2759 | 0.08 | Q . . . . |
| 21.33 | 1.2769 | 0.08 | Q . . . . |
| 21.47 | 1.2778 | 0.08 | Q . . . . |
| 21.61 | 1.2787 | 0.08 | Q . . . . |
| 21.75 | 1.2796 | 0.08 | Q . . . . |
| 21.89 | 1.2805 | 0.08 | Q . . . . |
| 22.03 | 1.2814 | 0.08 | Q . . . . |
| 22.17 | 1.2823 | 0.07 | Q . . . . |
| 22.32 | 1.2831 | 0.07 | Q . . . . |
| 22.46 | 1.2840 | 0.07 | Q . . . . |

```
  22.60      1.2848      0.07  Q         .         .         .         .
  22.74      1.2856      0.07  Q         .         .         .         .
  22.88      1.2864      0.07  Q         .         .         .         .
  23.02      1.2872      0.07  Q         .         .         .         .
  23.16      1.2880      0.07  Q         .         .         .         .
  23.30      1.2888      0.07  Q         .         .         .         .
  23.44      1.2896      0.07  Q         .         .         .         .
  23.58      1.2903      0.07  Q         .         .         .         .
  23.72      1.2911      0.06  Q         .         .         .         .
  23.86      1.2918      0.06  Q         .         .         .         .
  24.00      1.2926      0.06  Q         .         .         .         .
  24.14      1.2933      0.06  Q         .         .         .         .
  24.28      1.2936      0.00  Q         .         .         .         .
 ---------------------------------------------------------------------------
-----------------------------------------------------------------------------
-
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    =======================                 =========
               0%                            1448.2
              10%                              75.8
              20%                              25.3
              30%                              16.8
              40%                               8.4
              50%                               8.4
              60%                               8.4
              70%                               8.4
              80%                               8.4
              90%                               8.4

  Problem Descriptions:




==========================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =    8.420
     DEAD STORAGE(AF) =       0.73
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00


                       INFLOW
```

```
                 |
                 |
                 |
                 V                __effective depth
            -------------         |   (and volume)
            |           |    |    |
            | detention |    |....V.............
            |   basin   |<-->|          outflow
            |           |    |.........________
            -------------    |         |   \
                  |          | storage |     basin outlet
                  V          -----------
               OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 9

| *BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) | **BASIN-DEPTH (FEET) | STORAGE (ACRE-FEET) | OUTFLOW (CFS) |
|---|---|---|---|---|---|
| * 0.000 | 0.000 | 0.000** | 0.100 | 0.030 | 0.700* |
| * 0.600 | 0.186 | 10.220** | 1.100 | 0.350 | 17.190* |
| * 2.000 | 0.988 | 17.240** | 2.500 | 1.259 | 18.440* |
| * 3.000 | 1.505 | 19.550** | 3.500 | 1.834 | 20.610* |
| * 4.000 | 2.139 | 21.620** | | | |

---

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

| INTERVAL NUMBER | DEPTH (FEET) | {S-O*DT/2} (ACRE-FEET) | {S+O*DT/2} (ACRE-FEET) |
|---|---|---|---|
| 1 | 0.00 | 0.00000 | 0.00000 |
| 2 | 0.10 | 0.02604 | 0.03416 |
| 3 | 0.60 | 0.12634 | 0.24486 |
| 4 | 1.10 | 0.24982 | 0.44918 |
| 5 | 2.00 | 0.88763 | 1.08757 |
| 6 | 2.50 | 1.15167 | 1.36553 |
| 7 | 3.00 | 1.39133 | 1.61807 |
| 8 | 3.50 | 1.71458 | 1.95362 |
| 9 | 4.00 | 2.01353 | 2.26427 |

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

---

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

| TIME (HRS) | DEAD-STORAGE FILLED(AF) | INFLOW (CFS) | EFFECTIVE DEPTH(FT) | OUTFLOW (CFS) | EFFECTIVE VOLUME(AF) |
|---|---|---|---|---|---|
| 0.002 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.142 | 0.001 | 0.06 | 0.00 | 0.00 | 0.000 |
| 0.283 | 0.001 | 0.06 | 0.00 | 0.00 | 0.000 |
| 0.423 | 0.002 | 0.06 | 0.00 | 0.00 | 0.000 |
| 0.563 | 0.003 | 0.06 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 0.704 | 0.004 | 0.06 | 0.00 | 0.00 | 0.000 |
| 0.844 | 0.004 | 0.06 | 0.00 | 0.00 | 0.000 |
| 0.984 | 0.005 | 0.06 | 0.00 | 0.00 | 0.000 |
| 1.125 | 0.006 | 0.06 | 0.00 | 0.00 | 0.000 |
| 1.265 | 0.007 | 0.07 | 0.00 | 0.00 | 0.000 |
| 1.405 | 0.007 | 0.07 | 0.00 | 0.00 | 0.000 |
| 1.546 | 0.008 | 0.07 | 0.00 | 0.00 | 0.000 |
| 1.686 | 0.009 | 0.07 | 0.00 | 0.00 | 0.000 |
| 1.826 | 0.010 | 0.07 | 0.00 | 0.00 | 0.000 |
| 1.967 | 0.011 | 0.07 | 0.00 | 0.00 | 0.000 |
| 2.107 | 0.011 | 0.07 | 0.00 | 0.00 | 0.000 |
| 2.247 | 0.012 | 0.07 | 0.00 | 0.00 | 0.000 |
| 2.388 | 0.013 | 0.07 | 0.00 | 0.00 | 0.000 |
| 2.528 | 0.014 | 0.07 | 0.00 | 0.00 | 0.000 |
| 2.668 | 0.014 | 0.07 | 0.00 | 0.00 | 0.000 |
| 2.809 | 0.015 | 0.07 | 0.00 | 0.00 | 0.000 |
| 2.949 | 0.016 | 0.07 | 0.00 | 0.00 | 0.000 |
| 3.089 | 0.017 | 0.07 | 0.00 | 0.00 | 0.000 |
| 3.230 | 0.018 | 0.07 | 0.00 | 0.00 | 0.000 |
| 3.370 | 0.019 | 0.07 | 0.00 | 0.00 | 0.000 |
| 3.510 | 0.019 | 0.07 | 0.00 | 0.00 | 0.000 |
| 3.651 | 0.020 | 0.07 | 0.00 | 0.00 | 0.000 |
| 3.791 | 0.021 | 0.07 | 0.00 | 0.00 | 0.000 |
| 3.931 | 0.022 | 0.07 | 0.00 | 0.00 | 0.000 |
| 4.072 | 0.023 | 0.07 | 0.00 | 0.00 | 0.000 |
| 4.212 | 0.024 | 0.07 | 0.00 | 0.00 | 0.000 |
| 4.352 | 0.025 | 0.08 | 0.00 | 0.00 | 0.000 |
| 4.493 | 0.025 | 0.08 | 0.00 | 0.00 | 0.000 |
| 4.633 | 0.026 | 0.08 | 0.00 | 0.00 | 0.000 |
| 4.773 | 0.027 | 0.08 | 0.00 | 0.00 | 0.000 |
| 4.914 | 0.028 | 0.08 | 0.00 | 0.00 | 0.000 |
| 5.054 | 0.029 | 0.08 | 0.00 | 0.00 | 0.000 |
| 5.194 | 0.030 | 0.08 | 0.00 | 0.00 | 0.000 |
| 5.335 | 0.031 | 0.08 | 0.00 | 0.00 | 0.000 |
| 5.475 | 0.032 | 0.08 | 0.00 | 0.00 | 0.000 |
| 5.615 | 0.033 | 0.08 | 0.00 | 0.00 | 0.000 |
| 5.756 | 0.034 | 0.08 | 0.00 | 0.00 | 0.000 |
| 5.896 | 0.035 | 0.08 | 0.00 | 0.00 | 0.000 |
| 6.036 | 0.036 | 0.08 | 0.00 | 0.00 | 0.000 |
| 6.177 | 0.037 | 0.08 | 0.00 | 0.00 | 0.000 |
| 6.317 | 0.038 | 0.08 | 0.00 | 0.00 | 0.000 |
| 6.457 | 0.039 | 0.09 | 0.00 | 0.00 | 0.000 |
| 6.598 | 0.040 | 0.09 | 0.00 | 0.00 | 0.000 |
| 6.738 | 0.041 | 0.09 | 0.00 | 0.00 | 0.000 |
| 6.878 | 0.042 | 0.09 | 0.00 | 0.00 | 0.000 |
| 7.019 | 0.043 | 0.09 | 0.00 | 0.00 | 0.000 |
| 7.159 | 0.044 | 0.09 | 0.00 | 0.00 | 0.000 |
| 7.299 | 0.045 | 0.09 | 0.00 | 0.00 | 0.000 |
| 7.440 | 0.046 | 0.09 | 0.00 | 0.00 | 0.000 |
| 7.580 | 0.047 | 0.09 | 0.00 | 0.00 | 0.000 |
| 7.720 | 0.048 | 0.09 | 0.00 | 0.00 | 0.000 |
| 7.861 | 0.049 | 0.09 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 8.001 | 0.050 | 0.10 | 0.00 | 0.00 | 0.000 |
| 8.141 | 0.051 | 0.10 | 0.00 | 0.00 | 0.000 |
| 8.282 | 0.052 | 0.10 | 0.00 | 0.00 | 0.000 |
| 8.422 | 0.054 | 0.10 | 0.00 | 0.00 | 0.000 |
| 8.562 | 0.055 | 0.10 | 0.00 | 0.00 | 0.000 |
| 8.703 | 0.056 | 0.10 | 0.00 | 0.00 | 0.000 |
| 8.843 | 0.057 | 0.10 | 0.00 | 0.00 | 0.000 |
| 8.983 | 0.058 | 0.10 | 0.00 | 0.00 | 0.000 |
| 9.124 | 0.060 | 0.10 | 0.00 | 0.00 | 0.000 |
| 9.264 | 0.061 | 0.11 | 0.00 | 0.00 | 0.000 |
| 9.404 | 0.062 | 0.11 | 0.00 | 0.00 | 0.000 |
| 9.545 | 0.063 | 0.11 | 0.00 | 0.00 | 0.000 |
| 9.685 | 0.065 | 0.11 | 0.00 | 0.00 | 0.000 |
| 9.825 | 0.066 | 0.11 | 0.00 | 0.00 | 0.000 |
| 9.966 | 0.067 | 0.11 | 0.00 | 0.00 | 0.000 |
| 10.106 | 0.068 | 0.11 | 0.00 | 0.00 | 0.000 |
| 10.246 | 0.070 | 0.13 | 0.00 | 0.00 | 0.000 |
| 10.387 | 0.072 | 0.14 | 0.00 | 0.00 | 0.000 |
| 10.527 | 0.074 | 0.16 | 0.00 | 0.00 | 0.000 |
| 10.667 | 0.075 | 0.17 | 0.00 | 0.00 | 0.000 |
| 10.808 | 0.078 | 0.19 | 0.00 | 0.00 | 0.000 |
| 10.948 | 0.080 | 0.20 | 0.00 | 0.00 | 0.000 |
| 11.088 | 0.083 | 0.22 | 0.00 | 0.00 | 0.000 |
| 11.229 | 0.085 | 0.24 | 0.00 | 0.00 | 0.000 |
| 11.369 | 0.088 | 0.26 | 0.00 | 0.00 | 0.000 |
| 11.509 | 0.092 | 0.27 | 0.00 | 0.00 | 0.000 |
| 11.650 | 0.095 | 0.30 | 0.00 | 0.00 | 0.000 |
| 11.790 | 0.099 | 0.31 | 0.00 | 0.00 | 0.000 |
| 11.930 | 0.103 | 0.34 | 0.00 | 0.00 | 0.000 |
| 12.071 | 0.107 | 0.36 | 0.00 | 0.00 | 0.000 |
| 12.211 | 0.115 | 0.69 | 0.00 | 0.00 | 0.000 |
| 12.351 | 0.123 | 0.70 | 0.00 | 0.00 | 0.000 |
| 12.492 | 0.132 | 0.75 | 0.00 | 0.00 | 0.000 |
| 12.632 | 0.141 | 0.77 | 0.00 | 0.00 | 0.000 |
| 12.772 | 0.150 | 0.81 | 0.00 | 0.00 | 0.000 |
| 12.913 | 0.160 | 0.84 | 0.00 | 0.00 | 0.000 |
| 13.053 | 0.170 | 0.89 | 0.00 | 0.00 | 0.000 |
| 13.193 | 0.181 | 0.92 | 0.00 | 0.00 | 0.000 |
| 13.334 | 0.192 | 0.97 | 0.00 | 0.00 | 0.000 |
| 13.474 | 0.204 | 1.01 | 0.00 | 0.00 | 0.000 |
| 13.614 | 0.216 | 1.08 | 0.00 | 0.00 | 0.000 |
| 13.755 | 0.229 | 1.11 | 0.00 | 0.00 | 0.000 |
| 13.895 | 0.243 | 1.20 | 0.00 | 0.00 | 0.000 |
| 14.035 | 0.257 | 1.24 | 0.00 | 0.00 | 0.000 |
| 14.176 | 0.273 | 1.36 | 0.00 | 0.00 | 0.000 |
| 14.316 | 0.289 | 1.41 | 0.00 | 0.00 | 0.000 |
| 14.456 | 0.307 | 1.54 | 0.00 | 0.00 | 0.000 |
| 14.597 | 0.326 | 1.62 | 0.00 | 0.00 | 0.000 |
| 14.737 | 0.347 | 1.78 | 0.00 | 0.00 | 0.000 |
| 14.877 | 0.369 | 1.88 | 0.00 | 0.00 | 0.000 |
| 15.018 | 0.393 | 2.12 | 0.00 | 0.00 | 0.000 |
| 15.158 | 0.419 | 2.26 | 0.00 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 15.298 | 0.450 | 2.62 | 0.00 | 0.00 | 0.000 |
| 15.439 | 0.482 | 2.79 | 0.00 | 0.00 | 0.000 |
| 15.579 | 0.517 | 3.03 | 0.00 | 0.00 | 0.000 |
| 15.719 | 0.558 | 3.51 | 0.00 | 0.00 | 0.000 |
| 15.860 | 0.620 | 5.31 | 0.00 | 0.00 | 0.000 |
| 16.000 | 0.707 | 7.53 | 0.00 | 0.00 | 0.000 |

DEAD STORAGE FILLED WITH UNIT INFLOW(CFS) = 2.31
REMAINING UNIT FLOW IS 21.95 CFS.

| | | | | | |
|---|---|---|---|---|---|
| 16.140 | 0.734 | 21.95 | 0.62 | 5.28 | 0.193 |
| 16.281 | 0.734 | 4.20 | 0.45 | 8.94 | 0.138 |
| 16.421 | 0.734 | 2.67 | 0.32 | 6.11 | 0.099 |
| 16.561 | 0.734 | 2.42 | 0.25 | 4.24 | 0.077 |
| 16.702 | 0.734 | 1.99 | 0.21 | 3.18 | 0.064 |
| 16.842 | 0.734 | 1.70 | 0.18 | 2.48 | 0.055 |
| 16.982 | 0.734 | 1.48 | 0.16 | 2.01 | 0.048 |
| 17.123 | 0.734 | 1.30 | 0.14 | 1.68 | 0.044 |
| 17.263 | 0.734 | 1.16 | 0.13 | 1.44 | 0.041 |
| 17.403 | 0.734 | 1.04 | 0.13 | 1.26 | 0.038 |
| 17.544 | 0.734 | 0.94 | 0.12 | 1.12 | 0.036 |
| 17.684 | 0.734 | 0.86 | 0.11 | 1.01 | 0.034 |
| 17.824 | 0.734 | 0.79 | 0.11 | 0.91 | 0.033 |
| 17.965 | 0.734 | 0.72 | 0.10 | 0.83 | 0.032 |
| 18.105 | 0.734 | 0.60 | 0.10 | 0.74 | 0.030 |
| 18.245 | 0.734 | 0.33 | 0.09 | 0.65 | 0.026 |
| 18.386 | 0.734 | 0.29 | 0.08 | 0.57 | 0.023 |
| 18.526 | 0.734 | 0.25 | 0.07 | 0.50 | 0.020 |
| 18.666 | 0.734 | 0.21 | 0.06 | 0.43 | 0.017 |
| 18.807 | 0.734 | 0.18 | 0.05 | 0.38 | 0.015 |
| 18.947 | 0.734 | 0.15 | 0.04 | 0.33 | 0.013 |
| 19.087 | 0.734 | 0.12 | 0.04 | 0.28 | 0.011 |
| 19.228 | 0.734 | 0.11 | 0.03 | 0.24 | 0.010 |
| 19.368 | 0.734 | 0.11 | 0.03 | 0.21 | 0.009 |
| 19.508 | 0.734 | 0.11 | 0.03 | 0.19 | 0.008 |
| 19.649 | 0.734 | 0.10 | 0.02 | 0.17 | 0.007 |
| 19.789 | 0.734 | 0.10 | 0.02 | 0.15 | 0.006 |
| 19.929 | 0.734 | 0.10 | 0.02 | 0.14 | 0.006 |
| 20.070 | 0.734 | 0.10 | 0.02 | 0.13 | 0.005 |
| 20.210 | 0.734 | 0.09 | 0.02 | 0.12 | 0.005 |
| 20.350 | 0.734 | 0.09 | 0.02 | 0.12 | 0.005 |
| 20.491 | 0.734 | 0.09 | 0.02 | 0.11 | 0.005 |
| 20.631 | 0.734 | 0.09 | 0.01 | 0.11 | 0.004 |
| 20.771 | 0.734 | 0.09 | 0.01 | 0.10 | 0.004 |
| 20.912 | 0.734 | 0.09 | 0.01 | 0.10 | 0.004 |
| 21.052 | 0.734 | 0.08 | 0.01 | 0.09 | 0.004 |
| 21.192 | 0.734 | 0.08 | 0.01 | 0.09 | 0.004 |
| 21.333 | 0.734 | 0.08 | 0.01 | 0.09 | 0.004 |
| 21.473 | 0.734 | 0.08 | 0.01 | 0.09 | 0.004 |
| 21.613 | 0.734 | 0.08 | 0.01 | 0.09 | 0.004 |
| 21.754 | 0.734 | 0.08 | 0.01 | 0.08 | 0.004 |
| 21.894 | 0.734 | 0.08 | 0.01 | 0.08 | 0.004 |
| 22.034 | 0.734 | 0.08 | 0.01 | 0.08 | 0.003 |
| 22.175 | 0.734 | 0.07 | 0.01 | 0.08 | 0.003 |

| | | | | | |
|---|---|---|---|---|---|
| 22.315 | 0.734 | 0.07 | 0.01 | 0.08 | 0.003 |
| 22.455 | 0.734 | 0.07 | 0.01 | 0.08 | 0.003 |
| 22.596 | 0.734 | 0.07 | 0.01 | 0.08 | 0.003 |
| 22.736 | 0.734 | 0.07 | 0.01 | 0.07 | 0.003 |
| 22.876 | 0.734 | 0.07 | 0.01 | 0.07 | 0.003 |
| 23.017 | 0.734 | 0.07 | 0.01 | 0.07 | 0.003 |
| 23.157 | 0.734 | 0.07 | 0.01 | 0.07 | 0.003 |
| 23.297 | 0.734 | 0.07 | 0.01 | 0.07 | 0.003 |
| 23.438 | 0.734 | 0.07 | 0.01 | 0.07 | 0.003 |
| 23.578 | 0.734 | 0.07 | 0.01 | 0.07 | 0.003 |
| 23.718 | 0.734 | 0.06 | 0.01 | 0.07 | 0.003 |
| 23.859 | 0.734 | 0.06 | 0.01 | 0.07 | 0.003 |
| 23.999 | 0.734 | 0.06 | 0.01 | 0.07 | 0.003 |
| 24.139 | 0.734 | 0.06 | 0.01 | 0.07 | 0.003 |
| 24.280 | 0.734 | 0.00 | 0.01 | 0.06 | 0.002 |
| 24.420 | 0.734 | 0.00 | 0.01 | 0.04 | 0.002 |
| 24.560 | 0.734 | 0.00 | 0.00 | 0.03 | 0.001 |
| 24.701 | 0.734 | 0.00 | 0.00 | 0.03 | 0.001 |

# Appendix D – Contribution Exhibits and Calculations to the downstream 30-inch Storm Drain

See Attached Exhibit

# ORANGE COUNTY

## PUBLIC WORKS

SANTA ANA, CALIFORNIA

BRYAN SPEEGLE, DIRECTOR

PLANS FOR CONSTRUCTION OF

# ALTON PARKWAY

FROM IRVINE BOULEVARD TO COMMERCENTRE DRIVE
STA. 150+52.93 TO STA. 206+67.89
TOTAL LENGTH = 5,615 FT

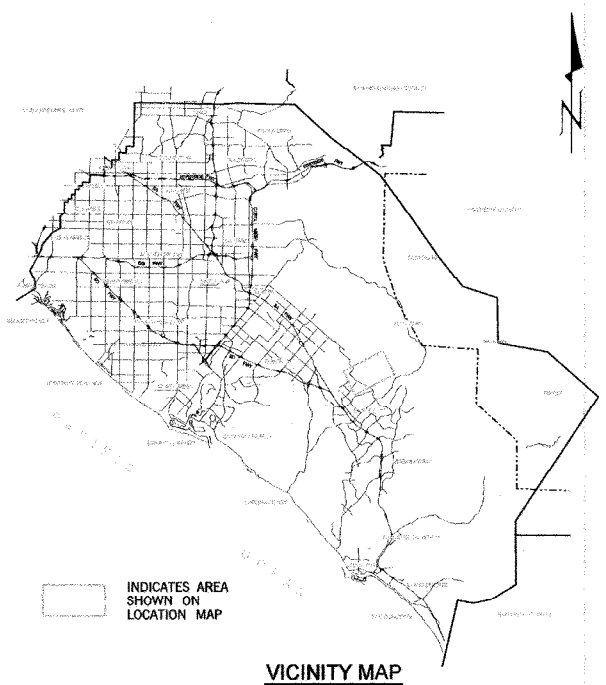
## APRIL 2009

FUNDED BY:

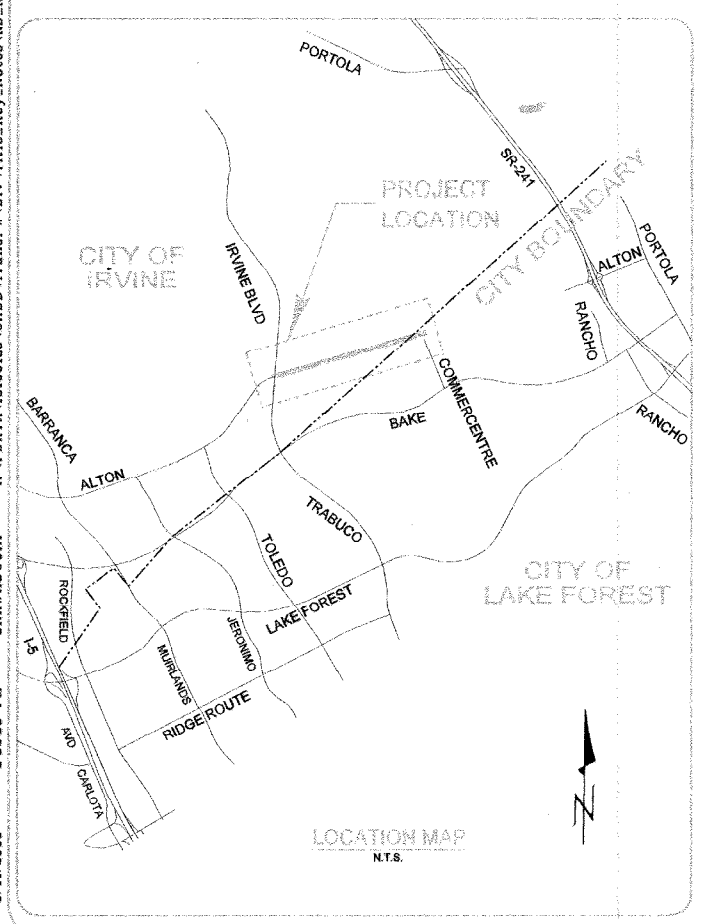
FOOTHILL CIRCULATION PHASING PLAN

MAINTAINED BY:

CITY OF IRVINE
CITY OF LAKE FOREST
OC PUBLIC WORKS




VICINITY MAP




LOCATION MAP
N.T.S.

| AGENCY - UTILITY | CONTACT | PHONE NO. |
|---|---|---|
| AT & T DISTRIBUTION | VIC PEREZ | (714)666-5696 |
| COX COMMUNICATIONS | REY CASTRO | (949)546-2466 |
| CITY OF IRVINE | STEVE SHERWOOD | (949)724-7327 |
| CITY OF LAKE FOREST | TED SIMON | (949)461-3488 |
| METROPOLITAN WATER DISTRICT | TIM HATCH | (714)271-2225 |
| THE IRVINE COMPANY | DOMINIC ETCHEBERRIA | (949)936-8080 |
| SOUTHERN CALIFORNIA EDISON | JUDY WONG | (949)587-5402 |
| COUNTY OF ORANGE | MARY VALLEAU | (714)834-6659 |
| CLEAR CHANNEL COMMUNICATIONS (ELLER MEDIA COMPANY) | KEVIN KOCIC | (310)755-7299 |
| IRVINE RANCH WATER DISTRICT (IRWD) | PATTY UEMATSU | (949)453-5626 |
| THE GAS COMPANY | DAVE BALDWIN | (714)634-3267 |
| TIME WARNER | GERRY ISSASI | (949)675-0403 |

Underground Service Alert
Call 811
TWO WORKING DAYS BEFORE YOU DIG

811
Know what's below.
Call before you dig.

### OC PUBLIC WORKS

SUBMITTED: JAMES VOLZ, PE, SENIOR CIVIL ENGINEER — 3/12/09 DATE

RECOMMENDED: VINCENT GIN, PE, INTERIM DIVISION MANAGER — 3/12/09 DATE

APPROVED: IGNACIO OCHOA, PE, CHIEF ENGINEER — 3/12/09 DATE

### BENCH MARK:

ELEVATIONS AS SHOWN HEREON ARE IN TERMS OF THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29) BASED LOCALLY UPON THE FOLLOWING COUNTY OF ORANGE BENCHMARK(S):

| NAME | | NGVD29 ELEV. (FT) | YEAR LEVELED |
|---|---|---|---|
| 1290 | OCS BM 3E-112-90 | 454.17 | 1990 |
| 1390 | OCS 1492 (OCS BM 3E-113-90) | 410.86 | 1990 |
| OEOC | OCS OEOC | 1288.94 | |
| TRAK | OCS TRAK | 492.92 | |
| WHYT | OCS WHYT | 982.04 | |

### BASIS OF COORDINATES:

BEARINGS AND COORDINATES AS SHOWN HEREON ARE IN TERMS OF THE CALIFORNIA COORDINATE SYSTEM OF 1983 (CCS83, EPOCH 1991.35), ZONE 6; BASED LOCALLY UPON THE FOLLOWING CONTROL STATIONS AS PUBLISHED BY THE COUNTY OF ORANGE:

| NAME | | NORTHING (FT)-GRID | EASTING (FT)-GRID | ELEVATION (FT) |
|---|---|---|---|---|
| 1390 | OCS 1492 (OCS BM 3E-113-90) | 2191968.88 | 6117316.14 | 410.86 |
| 8661 | OCS 8661 | 2189781.55 | 6118595.05 | |
| 6733 | OCS 6733 | 2192338.64 | 6133530.85 | |
| OEOC | OCS OEOC | 2225548.33 | 6107585.97 | |
| TRAK | OCS TRAK | 2171989.94 | 6088763.43 | |
| WHYT | OCS WHYT | 2191879.59 | 6137737.00 | |

ALL COORDINATES AND DISTANCES ARE IN TERMS OF THE U.S. SURVEY FOOT, 1 METER = 39.37/12 FEET

### RECORD DRAWINGS

| | |
|---|---|
| CONTRACTOR | SUKUT CONSTRUCTION |
| RESIDENT ENGINEER | TIM NGUYEN |
| INSPECTOR | MICHAEL ROMERO |
| START DATE | SEPTEMBER 2010 |
| COMPLETION DATE | JUNE 2012 |

### RECORD DRAWING

THIS RECORD DRAWING HAS BEEN PREPARED, IN PART, BASED ON INFORMATION FURNISHED BY OTHERS WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, THE ENGINEER CANNOT ASSURE ITS ACCURACY AND THE ENGINEER IS NOT RESPONSIBLE FOR THE ACCURACY OF THIS RECORD DRAWING OR FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO IT AS A RESULT. THOSE RELYING ON THIS RECORD DRAWING ARE ADVISED TO OBTAIN INDEPENDENT VERIFICATION OF ITS ACCURACY BEFORE APPLYING IT FOR ANY PURPOSE.

RBF CONSULTING — DATE JUNE 2011

### CITY OF IRVINE

APPROVED:

MARK CARROLL, PE
CITY OF IRVINE, CITY ENGINEER
RCE 51515 EXP. 12-31-09 — 3-17-09 DATE

### CITY OF LAKE FOREST

APPROVED:

ROBERT L. WOODINGS, PE
CITY OF LAKE FOREST, CITY ENGINEER — 4-30-09 DATE

### PREPARED BY

RBF CONSULTING
PLANNING ■ DESIGN ■ CONSTRUCTION
14725 ALTON PARKWAY
IRVINE, CALIFORNIA 92618-2027
949.472.3505 • FAX 949.472.8373 • www.RBF.com

PREPARED UNDER RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER — GARY L. MILLER — No. 36897 — Exp. 6/30/10 — CIVIL — STATE OF CALIFORNIA

GARY L. MILLER, PE
PUBLIC WORKS — 3/12/09 DATE

## INDEX OF SHEETS


ALTON PARKWAY PLANS
- GENERAL
  - TITLE SHEET (C-100)
  - GENERAL NOTES, ABBREVIATIONS, & SYMBOLS (C-101 - C-102)
  - CONSTRUTION NOTES & INDEX MAP (C-103 - C-104)
  - TYPICAL SECTIONS (ALTON PKWY.) (C105)
  - TYPICAL SECTIONS & DETAILS (WILDLIFE CORRIDOR & MAGAZINE RD) (C-106)
  - LOCAL DEPRESSION DETAILS (C-107 - C-110)
  - CONSTRUCTION DETAILS (C-111)
- ALTON PKWY: GRADING, REMOVAL, EROSION CONTROL & FENCING
  - GRADING & REMOVAL PLANS (C-200 - C-209)
  - GRADING DETAILS (C-210 - C-211)
  - EROSION CONTROL PLANS (C-212 - C-220)
  - EROSION CONTROL DETAILS (C-221 - C-222)
  - FENCING PLANS (C-223 - C-225)
- UTILITIES
  - UTILITY DISPOSITION PLANS (ALTON PKWY: C-300 - C-303)
  - UTILITY DISPOSITION PLANS (WILDLIFE CORRIDOR: C-304 - C-306)
  - UTILITY DISPOSITION PLAN (IRVINE BLVD: C-307)
- ROADWAY: ALTON PKWY & IRVINE BLVD
  - PLAN & PROFILE SHEETS. ALTON PKWY (C-400 - C-407)
  - PLAN & PROFILE SHEETS: IRVINE BLVD (C-408 - C-409)
  - IRVINE BLVD INTERSECTION DETAIL (C-410)
  - MUSICK INTERSECTION DETAIL (C-411)
  - COMMERCENTRE DR INTERSECTION DETAIL (C-412)
  - ALLRED CENTRE INTERSECTION DETAIL (C-413)
- WILDLIFE CORRIDOR & MAGAZINE ROAD
  - PLAN SHEETS: WILDLIFE CORRIDOR & MAGAZINE RD (C-500 - C-502)
  - PROFILE SHEETS: WILDLIFE CORRIDOR (C-503 - C-504)
  - PROFILE SHEETS: MAGAZINE RD (C-505 - C-506)
- WILDLIFE CORRIDOR : GRADING, REMOVAL & EROSION CONTROL
  - GRADING & REMOVAL PLANS (C-507 - C-509)
  - EROSION CONTROL PLANS (C-510 - C-512)
- DRAINAGE
  - PLAN & PROFILE SHEETS: STORM DRAIN (C-600 - C-611)
  - STORM DRAIN DETAILS (C612-C616)
  - PLAN & PROFILE SHEETS: IRVINE BLVD STORM DRAIN (C-617)
- TRAFFIC & ELECTRICAL
  - TRAFFIC SIGNAL & INTERSECTION LIGHTING (C-700 - C-705)
  - TRAFFIC SIGNAL COMMUNICATION PLANS (C-800 - C-804)
  - ROADWAY LIGHTING PLAN (C-900 - C-903)
  - SIGNING & STRIPING PLAN (C-1000 - C-1006)
- STRUCTURAL
  - BORREGO CANYON WASH CHANNEL STRUCTURAL DETAILS (C-1100 - C-1105)
- IRRIGATION & PLANTING
  - LANDSCAPE IRRIGATION (C-1200 - C-1202)
  - LANDSCAPE PLANTING (C-1203 - C-1207)
  - LANDSCAPE IRRIGATION LEGEND & NOTES (C-1208)
  - LANDSCAPE IRRIGATION DETAILS (C-1209)
  - LANDSCAPE PLANTING DETAILS & LEGEND (C-1210)
  - LANDSCAPE IRRIGATION & PLANTING: IRVINE BLVD (C-1211)
- DESIGN CROSS SECTIONS
  - ALTON PARKWAY DESIGN CROSS SECTIONS (X-1 - X-22)

COMMERCENTRE DRIVE PLANS
- "COMMERCENTRE DRIVE
  FROM ALTON PARKWAY TO EXISTING COMMERCENTRE DRIVE
  STA. 11+19.65 TO STA. 15+53.42"

IRWD PLANS
- "UTILITY RELOCATIONS
  ALTON PARKWAY ROAD EXTENSION
  IRVINE RANCH WATER DISTRICT
  PROJECT NUMBER 10799, 11374, 24175, 30222"


| NO. | DESCRIPTION | SHT. | APPROVED | DATE |
|---|---|---|---|---|
| 1 | REVISED WILDLIFE CORRIDOR | | | 3-1-11 |
| 2 | SEE IRWD PROJECT PLANS | | | 3-1-11 |
| 3 | REVISED ISLAND CURB AT IRVINE: LINE E, STRUCTURAL JOINTS | | | 3-1-11 |
| 4 | RECORD DRAWING 03/22/13 | | | |

REVISIONS

| NO. | DESCRIPTION | SHT. | APPROVED | DATE |
|---|---|---|---|---|
| 1 | ADDED HABITAT RESERVE SIGN, REVISED FENCING DETAIL, INTERSECTION GRADES, AND IRRIGATION PLANS 10/6/10 | | | 10-18-10 |
| 2 | ADDED RETAINING WALL AND REVISED GRADING AND DRAINAGE TO AVOID NCCP BOUNDARY 10/6/10 | | | 10-18-10 |
| 3 | SEE IRWD PROJECT PLANS | | | |
| 4 | SEE IRWD PROJECT PLANS | | | |
| 5 | MUSICK FENCE DETAILS | | JRV | 1/25/11 |
| 6 | LOCAL DEPRESSION ELEVATION CORRECTIONS | | | |
| 7 | SEE IRWD PROJECT PLANS | | | |

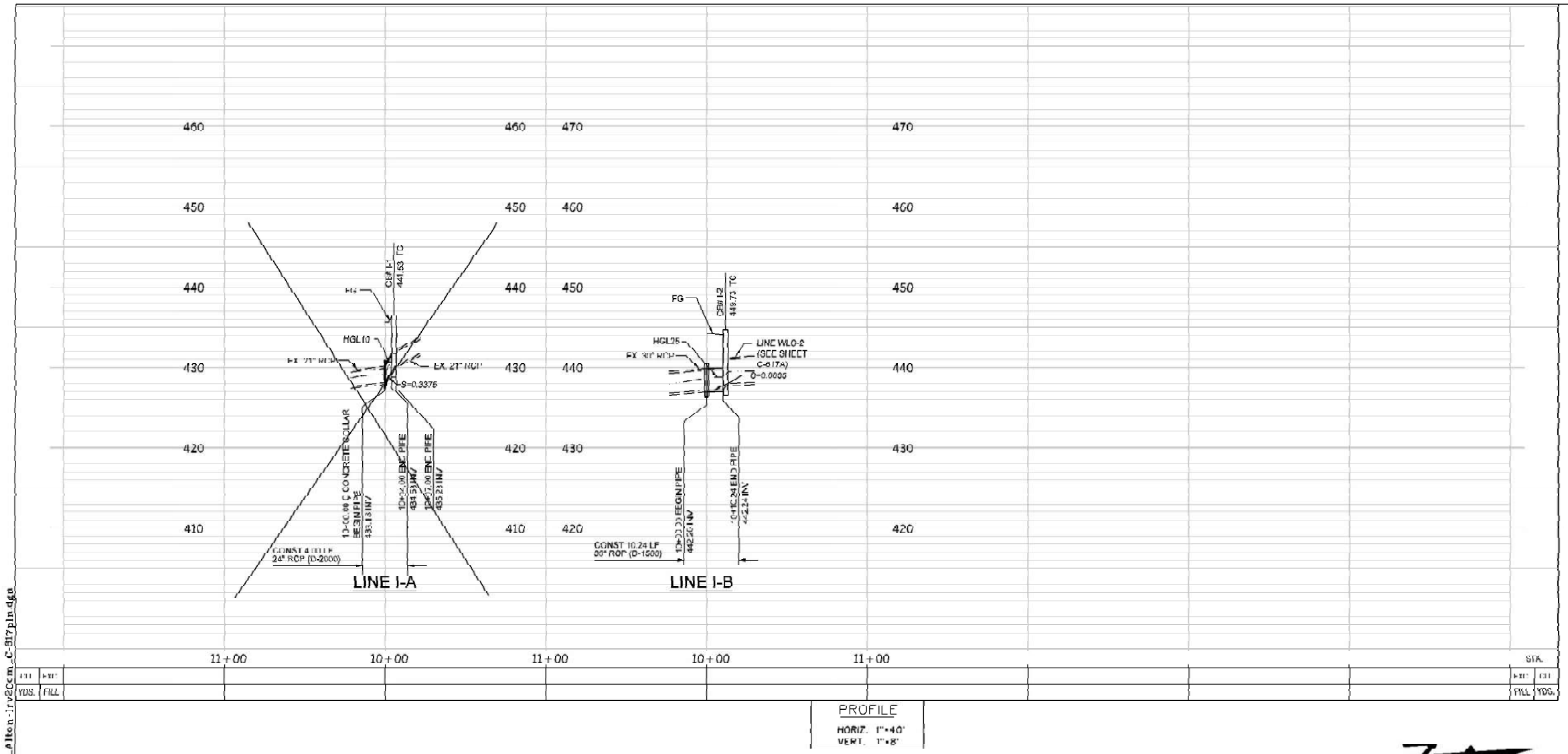
REVISIONS

W. O. NO. ETD2000
DWG. NO.

SHEET 1 OF 130

CITY OF IRVINE PLAN CHECK # 00469862 EMC
CITY OF IRVINE PERMIT # 470207-MCE
CITY OF LAKE FOREST PLAN CHECK # 1588B-1152

3/11/2009 3:52:53 PM SKAWAGUCHI H:\PDATA\10106189\CADD\TransPW\Div\Title_Key_Notes\RD_Alton-irv2Com_C-100title.dgn




## CONSTRUCTION NOTES

### STORM DRAIN

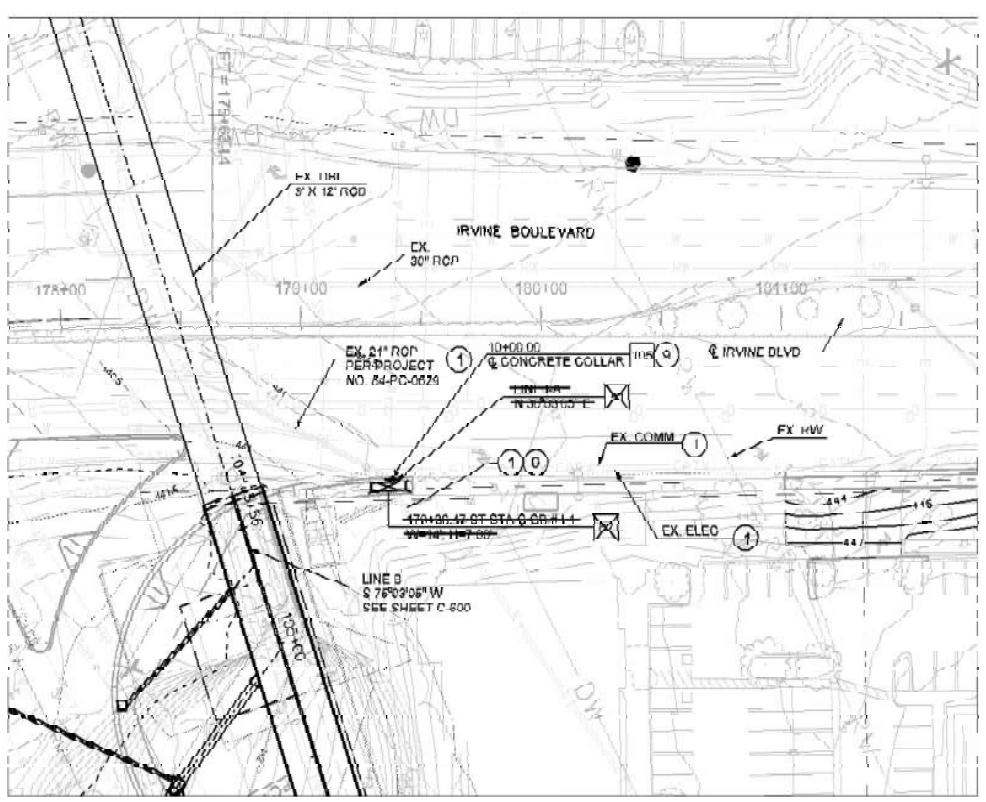
51 CONSTRUCT 24" RCP (D-LOAD PER PROFILE)

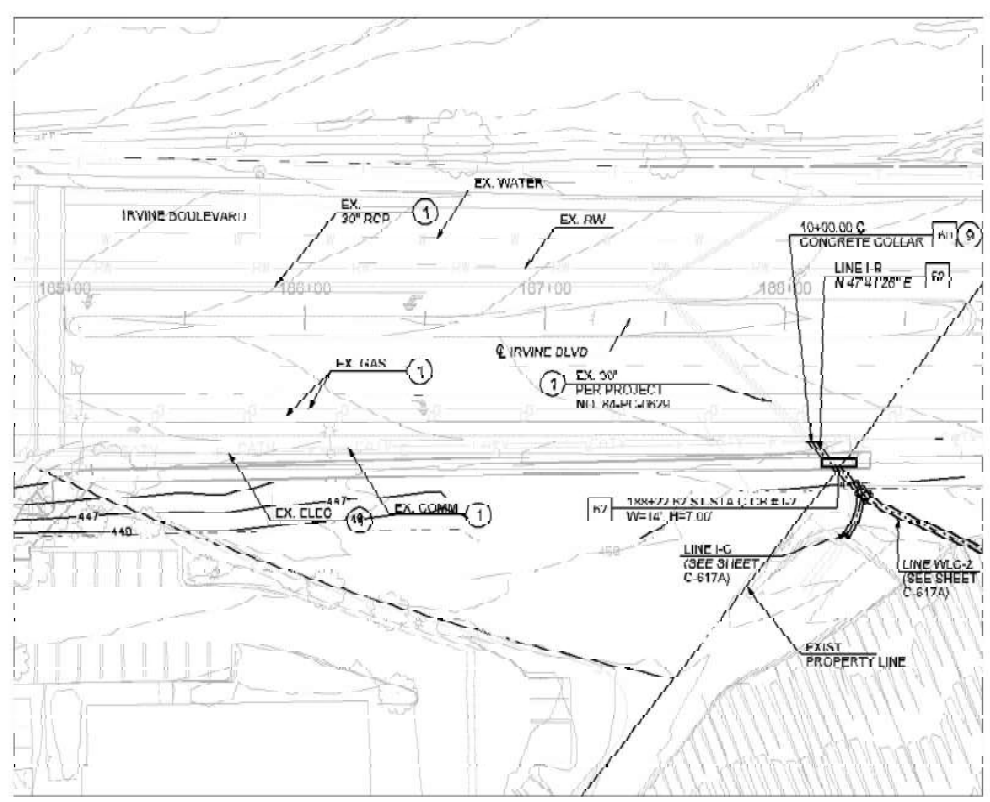
52 CONSTRUCT 30" RCP (D-LOAD PER PROFILE)

00 CONSTRUCT CONCRETE COLLAR PER CITY OF IRVINE STD. PLAN NO. 310

52 CONSTRUCT CATCH BASIN TYPE II PER CITY OF IRVINE STD. PLAN NO. 301

105 CONSTRUCT MODIFIED CONCRETE COLLAR TYPE II PER DETAIL ON SHEET C-616




### LEGEND

(1) PROTECT IN PLACE

(9) REMOVE INTERFERRING PORTIONS OF DRAINAGE PIPE

HYDRAULIC DATA

| LINE | STATION | Diam | $Q_{10}$ | N | So | dn | dc | Vn | Vc | Sf | Fn |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LINE I-A | 10+00.00 TO 10+04.00 | 24" | 17.0 | .013 | .3376 | 0.5 | 1.5 | 28.3 | 6.8 | .0096 | 8.7 |
| LINE I-B | 10+00.00 TO 10+10.24 | 30" | 19.7* | .013 | .0035 | 1.7 | 1.5 | 5.5 | 6.6 | .00231 | 0.8 |

* Q25

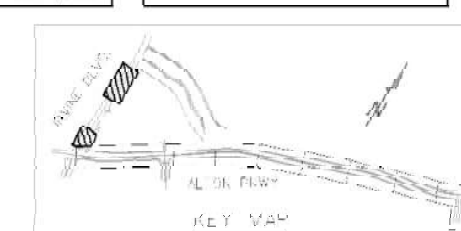
RECORD DRAWING

THIS RECORD DRAWING HAS BEEN PREPARED, IN PART, BASED UPON INFORMATION FURNISHED BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, THE ENGINEER CANNOT ASSUME ITS ACCURACY, AND THUS IS NOT RESPONSIBLE FOR THE ACCURACY OF THIS RECORD DRAWING OR FOR ANY LIABILITY OR OBLIGATIONS WHICH MAY HAVE BEEN INCORPORATED INTO IT AS A RESULT. THOSE RELYING ON THIS RECORD DRAWING ARE ADVISED TO OBTAIN INDEPENDENT VERIFICATION OF ITS ACCURACY BEFORE EXERCISING ANY RIGHTS OR OBLIGATIONS.

JOE CORDER RWO DATE: JUNE 2012

RECORD DRAWINGS

| | |
|---|---|
| CONTRACTOR: | DUROY CONSTRUCTION |
| PROJECT ENGINEER: | TIM HOUTEN |
| INSPECTOR: | MICHAEL ROMERO |
| START DATE: | SEPTEMBER 2010 |
| COMPLETION DATE: | JUNE 2012 |




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| A | 15% PROJECT DRAWING FOR BID | 07/14/11 | |
| B | RECORD DRAWINGS | 03/22/13 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: STEVEN K. STEFFEN, No. 66423, Exp. 3/31/13, CIVIL, STATE OF CALIFORNIA, PROFESSIONAL ENGINEER — DATE

DESIGNED BY: TM | CHECKED BY: JCS | DRAWN BY: LC | DRAWING CODE: | FILE NAME: 33_Storm1-3Corr_C-617plan.dgn | PLOT DATE: MARCH 2013 | SCALE: 1"=40'

COUNTY OF ORANGE PUBLIC WORKS

PREPARED BY: RBF CONSULTING

CITY OF IRVINE PLAN CHECK # 304B9842-EMC

CITY OF IRVINE PERMIT #1-2720-MUE

CITY OF LAKE FOREST PLAN CHECK # 10486-110

ALTON PARKWAY IRVINE BLVD TO COMMERCENTER DR.

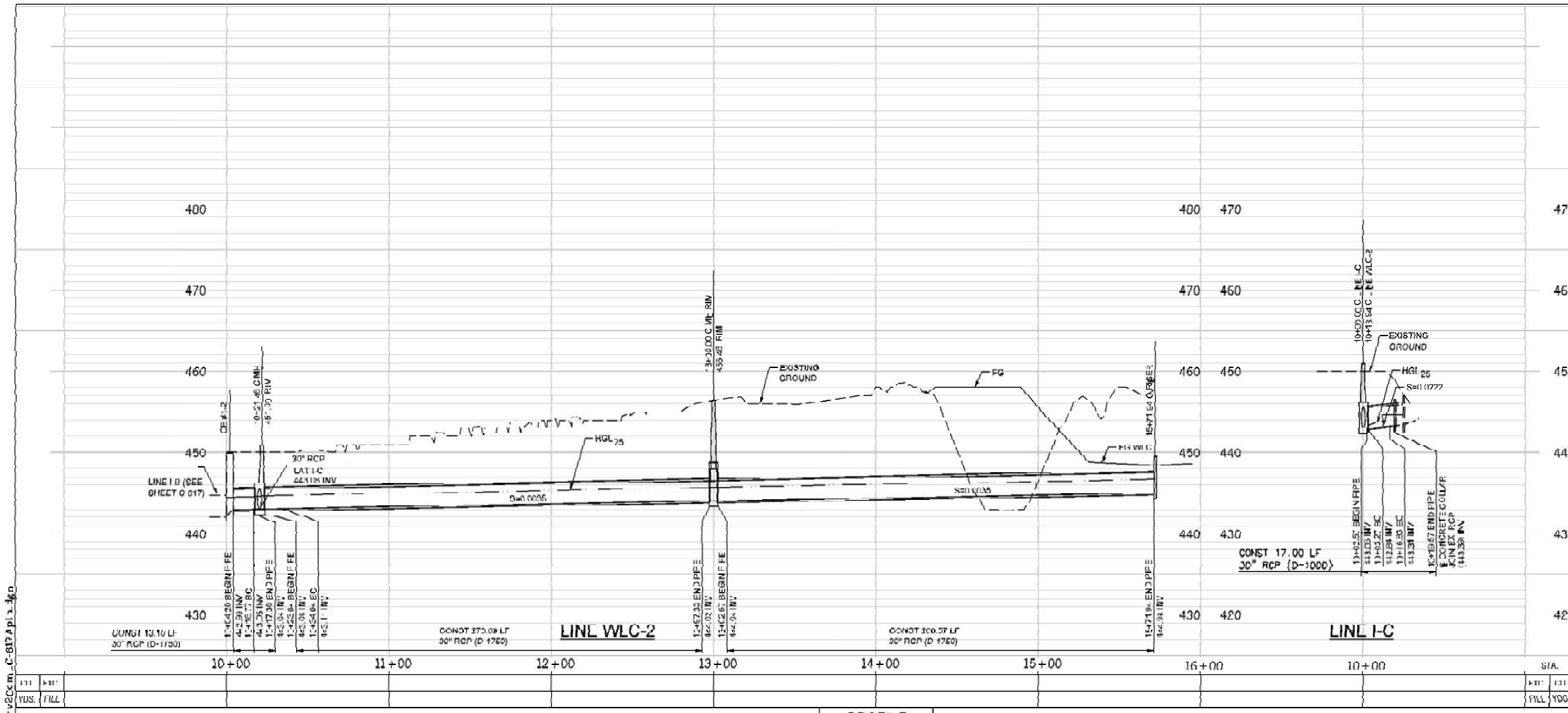
STORM DRAINAGE III

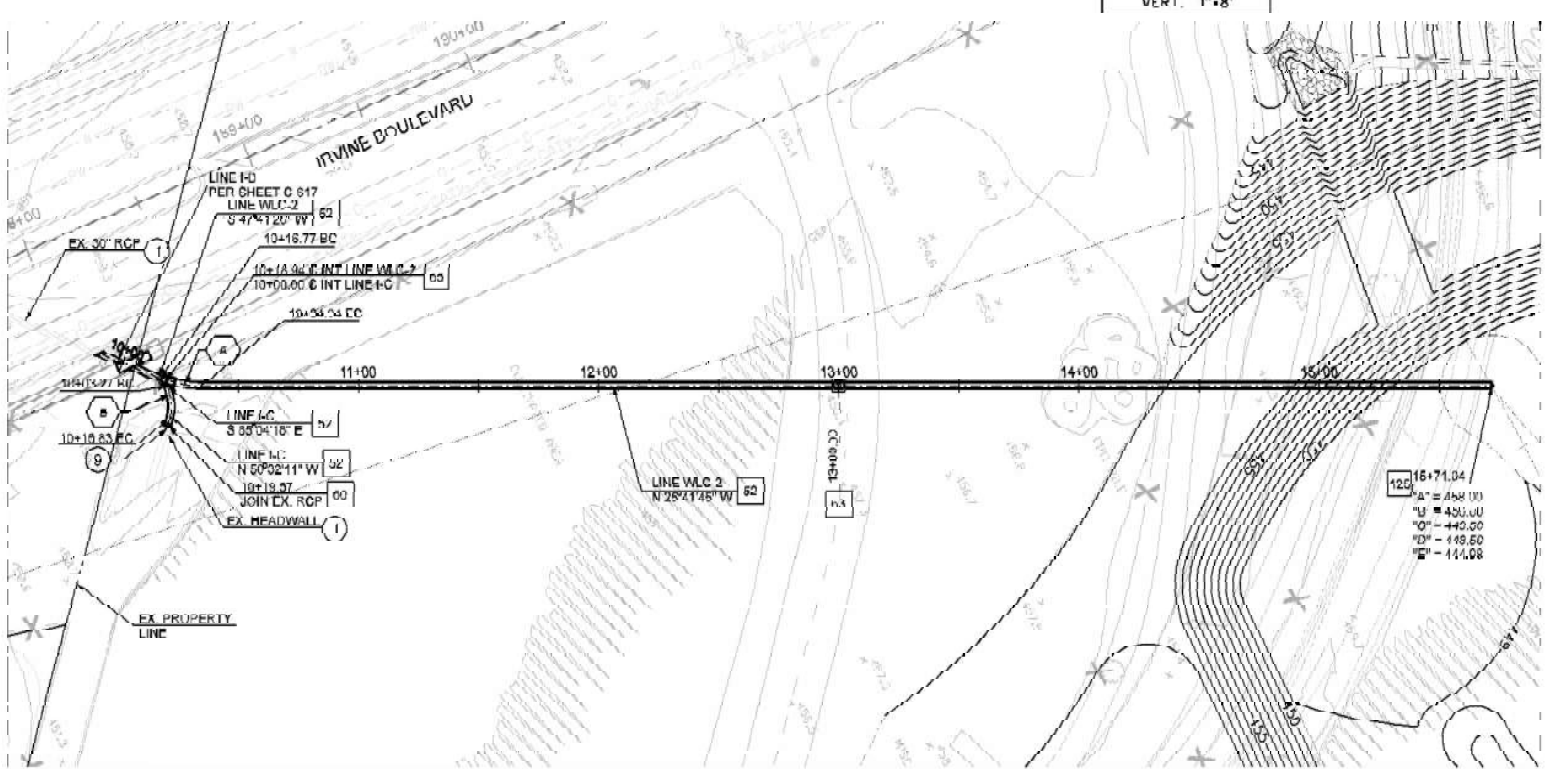
Sheet Reference Number

C-617

Sheet 90 of 130

3/22/2013 11:28:21 AM jcorder




*NOTE: CONTRACTOR TO VERIFY HORIZONTAL AND VERTICAL LOCATION AT CONNECTION POINT

## CONSTRUCTION NOTES

### STORM DRAIN

- 52 CONSTRUCT 30" RCP (D-LOAD PER PROFILE)
- 60 CONSTRUCT CONCRETE COLLAR PER CITY OF IRVINE STD. PLAN NO. 310
- 63 CONSTRUCT JUNCTION STRUCTURE NO. I PER CITY OF IRVINE STD. PLAN NO. 300
- 66 CONSTRUCT JUNCTION STRUCTURE NO. III PER CITY OF IRVINE STD. PLAN NO. 300
- 126 INSTALL DESILTING BASIN PER DETAIL ON SHEET C-622 AND VALVES HEREON

### LEGEND

- (1) PROTECT IN PLACE
- (9) REMOVE INTERFERRING PORTIONS OF DRAINAGE PIPE

**CURVE DATA**

| NO. | Δ | R | L | T | REFERENCE |
|---|---|---|---|---|---|
| A | 21°59'11" | 40.00 | 17.27 | 8.74 | CL WLC 2 |
| B | 34°32'07" | 22.50 | 13.56 | 6.99 | CL I-C |

**HYDRAULIC DATA**

| LINE | STATION | Diam | $Q_{25}$ | N | So | dn | dc | Vn | Vc | Sf | Fn |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LINE WLC-2 | 10+00.00 TO 15+71.94 | 30" | 19.7 | .013 | .0035 | 1.7 | 2.3 | 5.5 | 6.6 | .00251 | 0.8 |
| LINE I-C | 10+00.00 TO 10+10.24 | 30" | 0.5 | .013 | .0160 | 0.6 | 0.8 | 7.5 | 8.9 | .0003 | 2.1 |

**RECORD DRAWING**

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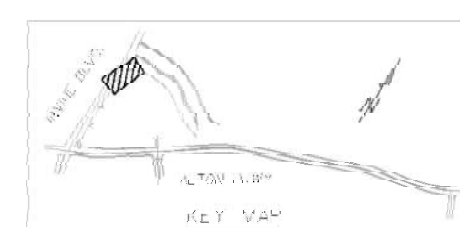
RBF CONSULTING DATE: JUNE 2012

**RECORD DRAWINGS**

CONTRACTOR: MOJO CONSTRUCTION
RESIDENT ENGINEER: TIM HOUVEN
WO#/SO#/PO#: WO#WEL 20W2PO
START DATE: SEPTEMBER 2010
COMPLETION DATE: JUNE 2012




COUNTY OF ORANGE CALIFORNIA

| MARK | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| A | REFER TO REC. DRAWING DATED LAKE FOREST RECORD DRAWINGS | 03/22/13 | |

PREPARED UNDER THE RESPONSIBLE CHARGE OF: STEVEN K. SITTER, No. C042-54, Exp. 3/31/13, CIVIL, REGISTERED PROFESSIONAL ENGINEER — DATE

DESIGNED BY: TMM; DRAWN BY: EG; CHECKED BY: SKS

ORANGE COUNTY PUBLIC WORKS

DRAWING CODE:

PREPARED BY: RBF CONSULTING

FILE NAME: RL_Alton-Irv2Ccm_C-617ph-fin

PLOT DATE: MARCH 2013

SCALE: 1"=40'

CITY OF IRVINE PLAN CHECK # 2013-0882-EMC

CITY OF IRVINE PERMIT #-07-OP-MJE

CITY OF LAKE FOREST PLAN CHECK # 13-06-1102

ALTON PARKWAY (IRVINE BLVD. TO COMMERCENTRE DR.)

# STORM DRAINAGE

Sheet Reference Number

C-617A

| NO. | DATE | REVISIONS CONTINUED | APP. | DATE |
|---|---|---|---|---|
| 13 | 8/4/86 | REVISED PHASE 3 DETOUR STRIPING FOR IRVINE BLVD. BETWEEN BAKE PARKWAY & FAIRBANKS ON SHEETS 65, 66, 71, 72, 73, & 76 | [signature] | 8-20-86 |
| 12 | 7/15/86 | REVISED QUANTITIES ON SHT. 2; ADDED CONSTRUCTION NOTES 120 & 121 ON SHT. 3; RELOCATED EXIST. F.H. ALONG PARKER FROM STA. 27+25 TO STA. 27+65.43 AND ADDED INSTALLATION OF WATER SERVICES ON SHT. 15; REVISED REF. LOCATION OF F.H. ON SHT. 31. | [signature] | 7/ /86 |
| 11 | 6/20/86 | REVISED STRIPING TO REMOVE ONE LEFT TURN LANE ON TRABUCO AND BAKE ON SHTS 43, & 52; REVISED SIGNING & STRIPING ON SHT. 49. TO CORRESPOND TO SHT. 10 | [signature] | 7-9-86 |
| 10 | 6/17/86 | REVISED EST. QTY. FOR ITEM 65 ON SHT. 2; ADDED CONST. NOTES 84 & EST. QTY. ON SHT. 3; CHANGED CONST. NOTE 65 TO 84 ON SHT. 28; REVISED CURB INLET STATIONS ON SHTS. 22, 25, 27, 29, 30, 31, 32 & 33. | | |
| 9 | 5/27/86 | REVISED TOTAL NUMBER OF SHEETS FROM 70 TO 78; SUBSTITUTED SHEETS 62 THRU 78 FOR SHEETS 62 THRU 70 | | |
| 7 | 6/6/86 | REVISED QTYS ON SHT. 2; ADDED ITEMS 115, 116, 117, 118 & 119 ON SHT. 3; ADDED CONST. NOTES 113, 115, 116 & 118 ON SHT. 6; ADDED CONST. NOTES 31, 37, 117 & 119 ON SHT. 10; ADDED CONST. NOTES 31, 32, 35 & 43 ON SHT. 12; ADDED WATER CHANGES AND ADDITIONS TO SHTS 15, 23, 26, 30 & 60 FOR REFERENCE PURPOSES; ADDED CONST. NOTE 90 TO SHT. 57 AND UPDATED UTILITY REFERENCES, ADDED CONST. NOTES 93, 90 & 119 ON SHT. 4 | RMM | 6/12/86 |
| 8 | 5/19/86 | REVISED LATERAL A-3 AND STATIONS FOR C.B. #3 AND C.B. #4. ON SHT. NO. 23, ADD STATIONS ON LATERAL A-5 & S.D. CURVE DATA, SHT. 22 | [signature] | 5-22-86 |
| 6 | 4/30/86 | ADDED WATER NOTES ON 40 & 42 ON SHT. 10, ADD WATER LINE CROSSINGS IN SEWER LATERAL PROFILE ON SHT. 38; REVISED WATER SERVICES FOR IRVINE BLVD MEDIAN LANDSCAPING ON SHTS 4, 5, 6 & 7 | [signature] | 5/6/86 |

| NO. | DATE | REVISIONS CONTINUED | APP. | DATE |
|---|---|---|---|---|
| 16 | 10-13-86 | CHANGED QUANTITIES FOR CONSTRUCTION NOTE (11) ON SHEET 2 AND ADDED STREET NAME SIGNS ON SHEET 11, 16 & 18. CHANGED FAIRBANKS TO MUSICK, SHEETS 2 & 18 | [signature] | 11-3-86 |
| 15 | 9-12-86 | REVISED PHASE 3 DETOUR TO BECOME PHASE 3A DETOUR ON SHEET NOS. 66, 69, 70, 71, 72, & 73. | [signature] | 11-5-86 |
| 14 | 9/8/86 | ADDED CONST. NOTE 122 ON SHT. 3. REPLACED SEWER CLEANOUT WITH SEWER INSPECTION MANHOLE AT PARKER ST. STA. 23+45.68 ON SHT. 15 TO SERVE PRIVATE ONSITE SYSTEM IN PARCELS 1 & 2 | [signature] | 9/19/86 |

| NO. | DATE | REVISIONS CONTINUED | APP. | DATE |
|---|---|---|---|---|
| 21 | 8/11/89 | CONST. SEWER LATERAL TO LOT #7 & ADDED MANHOLE | [signature] | 8-4-89 |
| 18 | 11-25-86 | REVISED PHASE 3A DETOUR ON SHEET 72 TO PROVIDE A LEFT TURN POCKET TO PARKER NE'LY OF IRVINE BLVD. 12/19/86 BG. | [signature] | 12-11-86 |
| 17 | 11-5-86 | REVISED QTYS. OF ITEMS 60, 61 & 67 ON SHT. NO. 2; ADDED C.S.P. DROP INLET #30, ADDED 18" S.D. & CATCH BASIN W/ LOCAL DEPRESSION & ADDED S.D. ALT. ALIGN. DETAIL | | |

# CONSTRUCTION PLANS FOR THE IMPROVEMENT OF

# IRVINE INDUSTRIAL COMPLEX EAST PHASE IV

## (ALL OF TENTATIVE PARCEL MAP NO. 84-TP-0629)

**RECORD DRAWING**

THIS IS A RECORD DRAWING OF THE FACILITIES IDENTIFIED IN THE TITLE BLOCK ONLY AND HAS BEEN PREPARED IN PART ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY OTHERS. THE ENGINEER/ARCHITECT AND OWNER(S) WILL NOT BE RESPONSIBLE FOR ANY ERROR(S) OR OMISSION(S) WHICH HAVE BEEN INCORPORATED INTO THIS DRAWING. ACTUAL CONDITIONS WILL VARY SOMEWHAT FROM THE CONDITIONS SHOWN HEREON AND AT SOME LOCATIONS THE VARIANCE MAY BE LARGE. IF THE PRECISE LOCATION OF ANY FACILITY IS REQUIRED, THE FACILITY SHOULD BE FIELD LOCATED IN THE PRESENCE OF AN EMPLOYEE OF THE DISTRICT OR THE OWNER(S) OF THE UTILITIES INVOLVED.

NOTICE:

Pursuant to Assembly Bill 3019, no excavation permit is valid unless the following is performed:

1. UNDERGROUND SERVICE ALERT has been contacted and has provided inquiry I.D. Number ____________.
2. The undersigned agrees to contact and obtain an inquiry I.D. Number from UNDERGROUND SERVICE ALERT (1-800-422-4133) at least 2 working days prior to commencing excavation.

SIGNED: ____________ DATE: ____________

## general notes:

1. ALL WORK SHALL CONFORM TO THE STANDARD SPECIFICATIONS (STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION), CITY OF IRVINE STANDARD DRAWINGS, CITY OF IRVINE STANDARD SPECIFICATIONS, AND THE CURRENT ORANGE COUNTY MANUAL OF WARNING SIGNS, LIGHTS, AND DEVICES FOR USE IN WORK UPON HIGHWAYS, EACH OF THE MOST RECENT DATE.
2. THE CONTRACTOR SHALL TELEPHONE THE CITY OF IRVINE AT LEAST TWO WORKING DAYS (48 HOURS) PRIOR TO STARTING CONSTRUCTION, (714-754-3676).
3. ALL UNDERGROUND FACILITIES SHALL BE INSTALLED PRIOR TO SURFACING OF STREETS. THE INSTALLATION OF ALL UNDERGROUND FACILITIES CROSSING EXISTING ARTERIAL HIGHWAYS REQUIRES BORING OR JACKING, UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
4. ANY EXISTING PAVEMENT DISTURBED BY THE CONSTRUCTION OF UNDERGROUND INSTALLATIONS SHALL BE COVERED BY A PERMIT ISSUED BY THE CITY OF IRVINE.
5. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ARRANGE FOR AND COORDINATE THE RELOCATION OF ANY EXISTING UTILITIES DEEMED NECESSARY BY THE PROPOSED IMPROVEMENT.
6. WHENEVER IT BECOMES NECESSARY TO TUNNEL UNDER EXISTING IMPROVEMENTS, THE CONTRACTOR SHALL SUPPORT THOSE IMPROVEMENTS IN A MANNER APPROVED BY THE CITY ENGINEER OR THE CONTRACTOR SHALL SAWCUT, REMOVE AND REPLACE THOSE IMPROVEMENTS IN ACCORDANCE WITH THE CITY OF IRVINE STANDARD DRAWINGS.
7. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE NEW SEWER LATERALS CONSTRUCTED AND TO STAMP THE CURB WITH AN "S" ABOVE THE NEW LATERAL. INDIVIDUAL SEWER AND WATER SERVICES SHALL NOT BE LOCATED UNDER A DRIVEWAY.
8. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND STAMP THE CURB ON EACH SIDE OF THE STREET WITH THE APPROPRIATE LETTER: "E" FOR EDISON, "T" FOR TELEPHONE, ETC., WHEREVER UNDERGROUND FACILITIES CROSS A STREET.
9. PRIOR TO PLACING OF UNDERGROUND UTILITIES THE LOCATION OF ALL UNDERGROUND FACILITIES (ELECTRICAL, TELEPHONE, CABLE TV, GAS, ETC.) SHALL BE ADDED TO IMPROVEMENT PLANS.
10. ALL CONCRETE WORK AS SHOWN ON PLANS (CURB & GUTTER, STORM DRAIN PIPE MANHOLES, SIDEWALK, ETC.) SHALL BE EXTRA STRENGTH CONCRETE WITH 7 SACK TYPE I CEMENT OR 6 SACK TYPE V CEMENT. UNLESS DEEMED UNNECESSARY BY SULPHATE-CONTENT TESTS AS APPROVED BY THE CITY OF IRVINE.
11. CONTRACTOR SHALL OBTAIN ANY REQUIRED O.S.H.A. PERMITS PRIOR TO CONSTRUCTION OF UNDERGROUND FACILITIES.
12. THE FOLLOWING SIGN SHALL BE POSTED AT ALL STREET INTERSECTIONS AND TRACT ENTRANCES:

    "MAINTENANCE OF THIS STREET AND RIGHT-OF-WAY ARE DEVELOPER RESPONSIBILITY.

    DEVELOPER: *THE IRVINE CO.* PHONE: *(714) 720-2919*

    THE SIGNS SHALL HAVE 3" HIGH (MINIMUM) LETTERING AND MUST BE INSTALLED PRIOR TO ANY OCCUPANCY. DEVELOPER SHALL REMOVE SIGNS AT THE TIME OF CITY ACCEPTANCE OF STREET IMPROVEMENTS.
13. STREET CONSTRUCTION AND IMPROVEMENTS SHALL NOT BE OPENED FOR PUBLIC USE UNTIL ACCEPTED BY THE CITY COUNCIL, UNLESS A PROPERLY EXECUTED AGREEMENT AND INDEMNIFICATION IS APPROVED BY THE CITY ATTORNEY AND MANAGER OF INSPECTION SERVICES.
14. PRIOR TO FINAL ACCEPTANCE OF STREET IMPROVEMENTS, ALL STREET STRIPING AND STENCILING WITHIN THE PERIMETER OF THE CONSTRUCTION PROJECT WILL BE RESTORED TO A "LIKE NEW" CONDITION, IN A MANNER MEETING THE APPROVAL OF THE DIRECTOR E.M.A./PUBLIC WORKS.

* ALL NEW STRIPING AND STENCILING SHALL HAVE TWO (2) COATS OF PAINT. THE SECOND COAT SHALL BE APPLIED SEVEN (7) DAYS AFTER THE INITIAL COAT.

**PRIVATE ENGINEER'S NOTICE TO CONTRACTOR**

The existence and location of any underground utilities or structures shown on these plans are obtained by a search of available records. To the best of our knowledge there are no existing utilities except those shown on this plan. The Contractor is required to take all precautionary measures to protect the utilities shown, and any other lines or structures not shown on these plans, and is responsible for the protection of, and any damage to these lines or structures.

**NOTICE**

CONTRACTOR SHALL VERIFY ALL CONDITIONS AND DIMENSIONS AND SHALL REPORT ALL DISCREPANCIES TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF WORK.

Construction contractor agrees that in accordance with generally accepted construction practices, construction contractor will be required to assume sole and complete responsibility for job site conditions during the course of construction of the project, including safety of all persons and property; that this requirement shall be made to apply continuously and not be limited to normal working hours, and construction contractor further agrees to defend, indemnify and hold design professional harmless from any and all liability, real or alleged, in connection with the performance of work on this project, excepting liability arising from the sole negligence of design professional.

California Council of Civil Engineers & Land Surveyors

## storm drain notes:

1. STATIONS SHOWN THUS (0 + 00) ARE STORM DRAIN STATIONS AND ARE INDEPENDENT OF ALL CENTERLINE STATIONS.
2. ALL WORK SHALL CONFORM TO THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, CITY OF IRVINE STANDARD DRAWINGS, CITY OF IRVINE STANDARD SPECIFICATIONS, ALL APPLICABLE GENERAL NOTES AND THE STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA.
3. ALL TRENCH EXCAVATIONS SHALL CONFORM TO STATE OF CALIFORNIA CONSTRUCTION SAFETY ORDERS.
4. ALL PIPE SHALL BE BEDDED IN ACCORDANCE WITH CITY OF IRVINE STANDARD PLAN NO. 318.
5. THE CITY OF IRVINE INSPECTION DEPARTMENT SHALL BE NOTIFIED AT LEAST TWO WORKING DAYS (48 HOURS) PRIOR TO START OF WORK AT 754-3676. A PRE-CONSTRUCTION CONFERENCE IS REQUIRED PRIOR TO START OF CONSTRUCTION.
6. R.C.P. SHALL CONFORM TO APPLICABLE A.S.T.M. STANDARDS.
7. SUBSTITUTION OF A.C.P. FOR R.C.P. MUST HAVE PRIOR APPROVAL BY CITY ENGINEER.
8. ALL FILL MATERIAL SHALL BE COMPACTED TO 90% RELATIVE COMPACTION AS DETERMINED BY CALIFORNIA TEST METHOD 216 F.
9. ALL MATERIALS TESTING FOR THE DRAINAGE FACILITIES SHALL BE PROVIDED BY THE CONTRACTOR OR DEVELOPER IN ACCORDANCE WITH THE NUMBER, LOCATION, AND FREQUENCY REQUESTED BY THE CITY INSPECTOR.
10. (△2) C.I.P.P. SHALL CONFORM TO THE PROVISIONS OF A.C.I. STD 346-70.
11. (△3) SEE SHEET 21 FOR TYPICAL SECTION OF C.I.P.P. WITH WALL THICKNESS DIMENSIONS FOR 24"-120" DIAMETERS.

## WATER NOTES:

1. THE WATER SYSTEM IS TO BE INSTALLED BY THE DEVELOPER. ALL WATER SYSTEM WORK SHALL CONFORM TO THE DISTRICT'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION OF WATER, SEWER, & RECLAIMED WATER FACILITIES," AS LAST REVISED.
2. THE DISTRICT ENGINEERING OFFICE SHALL BE CALLED FOR INSPECTION TWO WORKING DAYS BEFORE START OF WORK AT (714)833-1223.
3. A PRECONSTRUCTION CONFERENCE OF REPRESENTATIVES FROM AFFECTED AGENCIES & THE CONTRACTOR SHALL BE HELD ON THE JOBSITE 24 HOURS PRIOR TO START OF WORK.
4. THE WATER SYSTEM IS TO BE STAKED BY THE DEVELOPER'S ENGINEER WITH MINIMUM 50-FOOT STATIONS IF THERE ARE NOT ANY EXISTING CURBS.
5. ANY WATER SERVICE FOUND TO BE WITHIN A DRIVEWAY OR SIDEWALK SHALL BE REMOVED COMPLETELY AND REINSTALLED AT THE PROPER LOCATION, AT NO COST TO THE DISTRICT.
6. ALL MAIN LINE VALVES SHALL BE MAINTAINED SO AS TO BE ACCESSIBLE DURING TRACT DEVELOPMENT, & ALL VALVE STEM TOPS HAVING OVER 48 INCHES OF COVER WILL REQUIRE AN EXTENSION AS PER DRAWINGS W-4.
7. IN DEDICATED STREETS, THE TOP OF THE PIPE 10 INCHES AND SMALLER SHALL BE A MINIMUM OF 42 INCHES BELOW THE FINISHED STREET SURFACE & 48 INCHES BELOW FINISHED STREET SURFACE ON ALL PRIMARY & SECONDARY STREETS UNLESS OTHERWISE SHOWN ON THE PLANS.
8. ALL FIRE HYDRANTS SHALL BE SET WITH THE BOTTOM FLANGE 4 INCHES ABOVE THE CONCRETE PAD OR SIDEWALK WITHOUT THE USE OF SPOOLS.
9. (△4) ALL WATER MAINS SHALL BE CLASS 150, ACP UNLESS OTHERWISE NOTED.
10. NO TAPS OR OTHER CONNECTIONS SHALL BE MADE TO EXISTING DISTRICTS WATER MAINS PRIOR TO CONDUCTING AN APPROVED PRESSURE TEST ON THE NEW WATER DISTRIBUTION SYSTEM. TAPPING SLEEVES SHALL BE PRESSURE TESTED IN AN APPROVED MANNER IN THE FIELD IN THE PRESENCE OF THE DISTRICT INSPECTOR. PRIOR TO TAPPING THE MAIN LINE, TAPPING OF THE MAIN LINE SHALL NOT PROCEED UNLESS A DISTRICT INSPECTOR IS PRESENT.
11. WHERE METERS & METER BOXES ARE LOCATED WITHIN SLOPES, THE ANGLE METER STOPS SHALL BE SO LOCATED THAT THE METERS & BOXES WILL BE PARALLEL & FLUSH, RESPECTIVELY, WITH THE FINISH SURFACE.
12. NO METER IS TO BE PLACED WITHIN ANY SIDEWALK OR DRIVEWAY AREA.
13. INDIVIDUAL PRESSURE REGULATORS MAY BE REQUIRED BY THE CITY OF IRVINE.
14. (△4) CONTRACTOR TO COORDINATE SHUTDOWN OF 18" & 20" DIAMETER WATER TRANSMISSION MAINS WITH IRWD OPERATIONS DEPARTMENT BEFORE COMMENCING RELOCATION WORK SHOWN ON THESE PLANS.

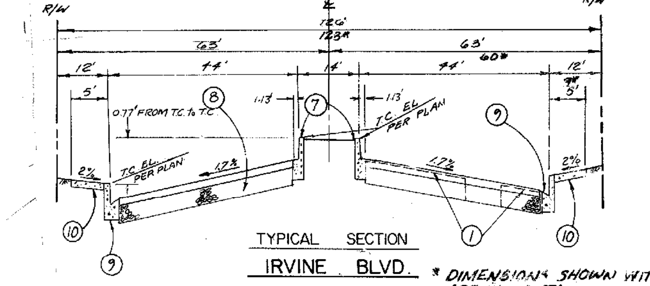
*THESE PLANS ARE APPROVED FOR SEWER & WATER ONLY*
[signature: Edward A. Slunka] 3/11/86 DATE

E.M.A. PERMIT NO. 86-13426-RE

*THESE PLANS ARE APPROVED FOR STORM DRAIN IMPROVEMENTS ONLY.*
[signature: Lowell Anderson] RCE 30190 2-11-86

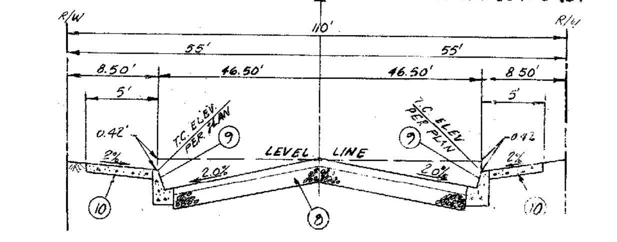
## SEWER NOTES:

1. THE SEWER SYSTEM IS TO BE INSTALLED BY THE DEVELOPER. ALL SEWER WORK SHALL CONFORM TO THE DISTRICT'S "STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF WATER, SEWER & RECLAIMED WATER FACILITIES," AS LAST REVISED.
2. THE DISTRICT ENGINEERING OFFICE SHALL BE CALLED FOR INSPECTION TWO WORKING DAYS BEFORE START OF WORK AT (714) 833-1223.
3. A PRECONSTRUCTION CONFERENCE SHALL BE HELD 24 HOURS BEFORE STARTING CONSTRUCTION WORK.
4. ALL LATERALS ARE TO BE STAKED BY A SURVEYOR BEFORE TRENCHING & A COMPLETE SET OF CUT SHEETS SUPPLIED TO THE DISTRICT INSPECTOR.
5. THE SEWER CONTRACTOR SHALL HAVE A COPY OF THE DISTRICT STANDARD SPECIFICATIONS ON THE JOB.
6. ALL SEWER MANHOLE LIDS ARE TO HAVE "IRWD" CAST THEREON AS SHOWN IN DRAWING S-4.
7. THE CONTRACTOR IS TO PROVIDE THE DISTRICT WITH AN AS-BUILT SET OF JOB PRINTS WITH TIEDOWN MEASUREMENTS FOR ALL LATERALS & MANHOLES.
8. THE CONTRACTOR SHALL OBTAIN A CITY OR COUNTY PERMIT FOR WORK DONE IN THE PUBLIC RIGHT-OF-WAY.
9. BEFORE FINAL ACCEPTANCE, THE DEVELOPER'S ENGINEER SIGNING THE PLANS SHALL FURNISH THE DISTRICT WITH A SET OF AS-BUILT MYLARS OF THE SEWER PLAN.
10. INFILTRATION & AIR TESTING OF SEWERLINES SHALL BE IN ACCORDANCE WITH THE DISTRICT'S "STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF WATER, SEWER, & RECLAIMED WATER FACILITIES."
11. THE CONTRACTOR SHALL EXPOSE ALL JOINT POINTS TO THE EXISTING SEWER SYSTEM FOR VERIFICATION OF LOCATION & ELEVATION BEFORE CONSTRUCTION.
12. STATIONS SHOWN AS [0+00.00] ARE SEWER STATIONS & ARE INDEPENDENT OF ALL OTHER STATIONS.
13. PIPELINE LEAKAGE TESTS SHALL BE MADE IN PRESENCE OF THE DISTRICT INSPECTOR, ONLY AFTER BACKFILL HAS BEEN COMPLETED, COMPACTION TESTS ON BACKFILL HAVE BEEN MADE, & THE BACKFILL HAS BEEN ACCEPTED BY THE DISTRICT INSPECTOR.
14. ALL SEWERLINES SHALL BE BALLED IN THE PRESENCE OF THE DISTRICT INSPECTOR, BEFORE COMPLETION OF ALL LEAKAGE TESTS.
15. THE DISTRICT WILL INSPECT & TEST THE SEWER COLLECTION SYSTEM & LATERAL SEWERS TO THE PROPERTY LINE CLEANOUT. PRIVATELY OWNED SEWER LATERALS FROM THE PROPERTY LINE CLEANOUT WILL BE INSPECTED & TESTED BY THE CITY OF IRVINE OR OTHER APPROPRIATE AGENCIES IF OUTSIDE THE CITY OF IRVINE.
16. TRENCH BACKFILL, ON ALL SEWER & WATER TO BE DEDICATED TO THE DISTRICT, SHALL BE COMPACTED TO 90% RELATIVE DENSITY AS DETERMINED BY THE FIVE-LAYER TEST METHOD (CALIFORNIA 216G). TESTS WILL BE REQUIRED EVERY 300 FEET OF TRENCH OR AS DETERMINED BY DISTRICT INSPECTOR. THE DEVELOPER SHALL SUBMIT WRITTEN RESULTS OF COMPACTION TEST TO THE DISTRICT BEFORE ACCEPTANCE. IF IN DEDICATED STREET OR FUTURE STREET, COMPACTION WILL BE AS REQUIRED BY GOVERNMENTAL AGENCY HAVING JURISDICTION, BUT NO LESS THAN 90% RELATIVE COMPACTION.
17. DISTRICT WILL INSPECT & TEST MAIN LINE SEWER ONLY. SEWER LATERALS FROM THE MAIN LINE OR PROPERTY LINE TO BUILDING THAT ARE PRIVATE WILL BE INSPECTED & TESTED BY THE CITY OF IRVINE COMMUNITY DEVELOPMENT DEPARTMENT OR OTHER APPROPRIATE AGENCIES IF OUTSIDE THE CITY OF IRVINE.
18. ALL SEWER MAIN LINES 6" & LARGER ARE TO BE INSPECTED BY THE DISTRICT USING A CLOSED CIRCUIT TELEVISION SYSTEM. A VIDEO RECORDING WILL BE MADE OF THE INSPECTION.




TYPICAL SECTION
IRVINE BLVD.

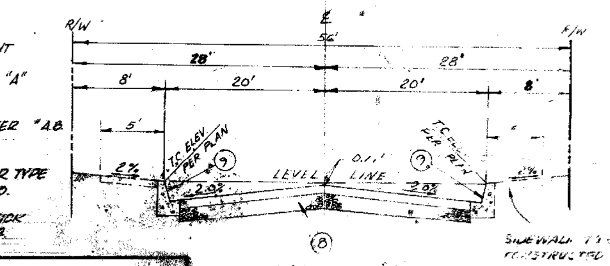
* DIMENSIONS SHOWN WITH * ARE FROM STA 202+30.16 TO STA. 209+34.34




TYPICAL SECTION
ALTON PARKWAY

## CONSTRUCTION NOTES:

1. REMOVE EXISTING A.C. PAVEMENT
7. CONSTRUCT CONC. CURB TYPE "A" PER STD. PLAN NO. 200.
8. CONST. "A.C. W/SEAL COAT OVER "A.B. WITH PRIME COAT
9. CONST. CONC. CURB AND GUTTER TYPE "A-2" PER STD. PLAN NO. 200.
10. CONST. CONC. SIDEWALK 4" THICK (W=4.5') PER STD. PLAN NO. 201 & 202.




TYPICAL SECTION
PARKER - FAIRBANKS
HAMMOND - ASTOR - MUSICK

COUNTY OF ORANGE
EMA/TRAFFIC ENGINEERING DIVISION

*THIS PLAN IS SIGNED BY E.M.A./T.E.D. FOR CONCEPT AND ADHERENCE TO COUNTY SIGNING, STRIPING, AND SIGNALIZATION STANDARDS AND REQUIREMENTS ONLY. E.M.A./T.E.D. IS NOT RESPONSIBLE FOR DESIGN ASSUMPTIONS OR ACCURACY. THIS APPROVAL COVERS IMPROVEMENTS IN UNINCORPORATED COUNTY TERRITORY ONLY AS SHOWN ON SHEET NOS. 1, 43, 45, 52, 62-73, & 76-78.*

[signature] 5/29/86
STEVEN M. HOGAN R.C.E. 29268 EXP 3/87 DATE
[signature] 6/25/86
KEN R. SMITH R.C.E. 22438 EXP 9/89 DATE
[signature] 6/25/86
by C.R. NELSON DATE

COUNTY OF ORANGE
E.M.A. REGULATION DIVISION
THIS PLAN IS SIGNED BY E.M.A. REGULATION FOR CONCEPT AND ADHERENCE TO COUNTY STANDARDS & REQUIREMENTS ONLY. E.M.A. REGULATION IS NOT RESPONSIBLE FOR DESIGN ASSUMPTIONS OR ACCURACY.
APPROVED BY
R.C.E. DATE

SIDEWALK TO BE CONSTRUCTED AND LEVEL ADJACENT TO PROPERTY (TYPICAL BOTH SIDES)

## LEGEND

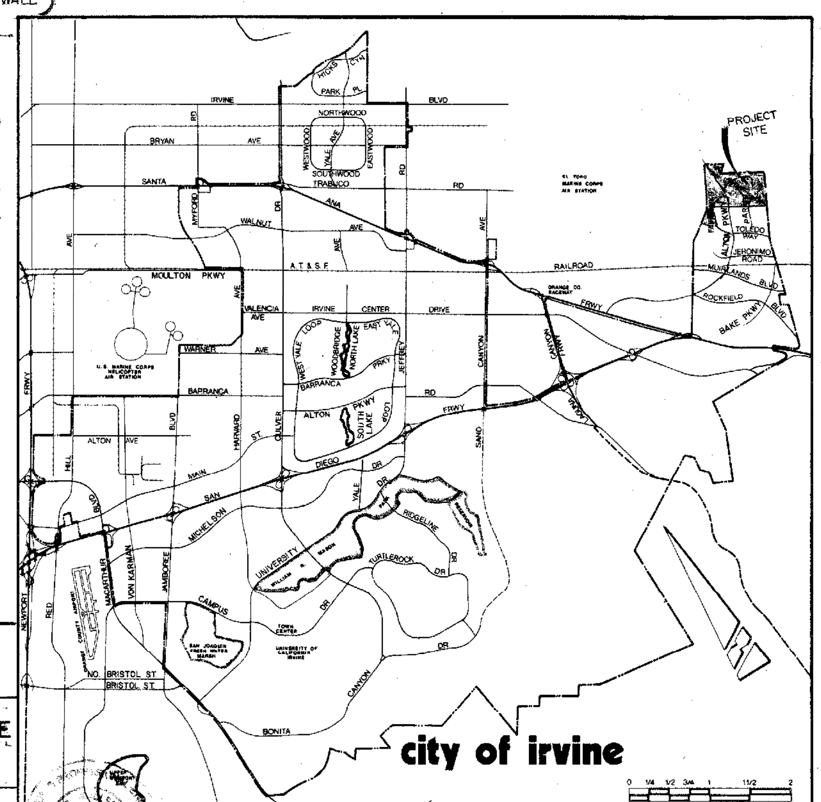
- SEWER MAIN & MANHOLE
- SEWER CLEANOUT
- SEWER LATERAL
- WATER MAIN
- WATER VALVE
- FIRE HYDRANT ASSEMBLY
- BOUNDARY LINE
- STREET LIGHT
- STREET NAME SIGN
- EDGE OF PAVEMENT
- TRAFFIC SIGN
- STOP SIGN
- B.O. BLOW-OFF
- (TYP) TYPICAL
- DENOTES STORM DRAIN & SIZE
- FLOW LINE
- DENOTES GRADE BREAK (ON PROFILES)
- PROPERTY LINE
- EASEMENT LINE

# BENCH MARK:

D-784
2.1 MILES S/E ALONG THE ATCHISON, TOPEKA & SANTA FE RAILWAY FROM THE STATION AT IRVINE, 105 FT. N/E OF & ACROSS THE TRACK FROM MILEPOLE 185, 8 RAILS S/E OF A WOODEN BRIDGE D 185, IN LINE WITH A ROW OF EUCALYPTUS TREES PARALLELING THE TRACK, 59.4 FT. N/E OF THE N/E RAIL, 42.7 FT. S/W OF THE BDRY. LINE FENCE FOR THE EL TORO MARINE CORPS BASE, 2.3 FT. N/E OF A WITNESS POST, ABOUT 2.5 FT. LOWER THAN THE TRACK & SET IN THE TOP OF A CONCRETE POST PROJECTING 0.1 FOOT ABOVE THE GROUND
ELEV. 270.243 1976 ADJ.

# BASIS OF BEARINGS:

"STATE OF CALIFORNIA LAMBERT COORDINATE SYSTEM - ZONE VI" BASED ON THE LINE BETWEEN ORANGE COUNTY SURVEYOR'S HORIZONTAL CONTROL STATIONS "3-2-175-IRV" AND "CANADA" (OCS 1-1-75 DATUM) BEING N 08°54'30.5" W.




**city of irvine**

# LOCATION MAP

| NO. | DATE | REVISIONS | APP | DATE |
|---|---|---|---|---|
| 5 | 4/15/86 | REVISED CURVE DATA & STATIONING ON SHT. 25; ADDED DROP INLET NO. 29 & CSP STORM DRAIN LATERAL A-5 ON SHT. 2, 4, & 23 | [signature] | 5-22-86 |
| 4 | 4/15/86 | ADDED WATER NOTE NO. 14 ON SHT. 1; REVISED WATER MAIN RELOCATIONS ON SHTS 8, 9, 11 & 12; ADDED SEWER MANHOLES & LATERAL; ADDED REVISED WATER & SEWER LINE REFERENCES ON SHTS 23, 24, 25 & 26 | RMM | 4-22-86 |
| 3 | 4/9/86 | ADDED STORM DRAIN NOTE NO. 11 ON SHT. 1; ADDED C.I.P.P. TYPICAL SECTION DETAIL ON SHT. 21 | [signature] | 4-9-86 |
| 2 | 3/26/86 | ADD CIPP STORM DRAIN ALTERNATE; REVISE QUANTITIES ON SHEET 2, CHANGED PIPE SIZES FOR LATERAL B-5 ON SHT 26 & LATERAL D-5 ON SHT 23 | [signature] | 4-8-86 |
| 1 | 3/25/86 | REVISED QUANTITIES ON SHT. 2; ADDED CONST. NOTES ON SHT. 2; ADDED SEWER LATERAL ON SHT 4. REVISED WATERLINE PROFILE SHT. 4; ADDED CONC. ENCASEMENT ON SHT. 4. | RMM | 3/25/86 |

PLANS PREPARED BY:
RBF
Robert Bein, William Frost & Associates
PROFESSIONAL ENVIRONMENTAL ENGINEERS & PLANNERS
P.O. BOX 2580 • 1401 QUAIL STREET, NEWPORT BEACH, CALIFORNIA 92663
(714) 833-0070
[signature: Robert Kallenberg] 27987 8-5-85
DESIGN ENGINEER R.C.E. NO. DATE

| | | DATE |
|---|---|---|
| DRAWN BY: | S.O. | 4-84 |
| DESIGNED BY: | S.M.T. | 4-84 |
| CHECKED BY: | | |
| RECOMMENDED BY | [signature: Carlos A. Pineda] 6/21/86 | 05-22-86 |

APPROVED BY
CITY ENGINEER
[signature: Edward A. Slunka] RCE 29705 5/22/86 DATE

APPROVED BY
ORANGE COUNTY FIRE MARSHAL
[signature] 9-4-85 DATE

IRVINE RANCH WATER DISTRICT
APPROVAL OF SEWER FACILITIES
APPROVED BY: [signature]
SUPERVISED BY: [signature]
REVIEWED BY: [signature]

IRVINE RANCH WATER DISTRICT
APPROVAL OF WATER FACILITIES
APPROVED BY: [signature]
SUPERVISED BY: [signature]
REVIEWED BY: [signature]

(ALL OF TENTATIVE PM 84-TP-0629)
IRVINE INDUSTRIAL COMPLEX EAST PHASE IV
STREET IMPROVEMENT PLANS
TITLE SHEET

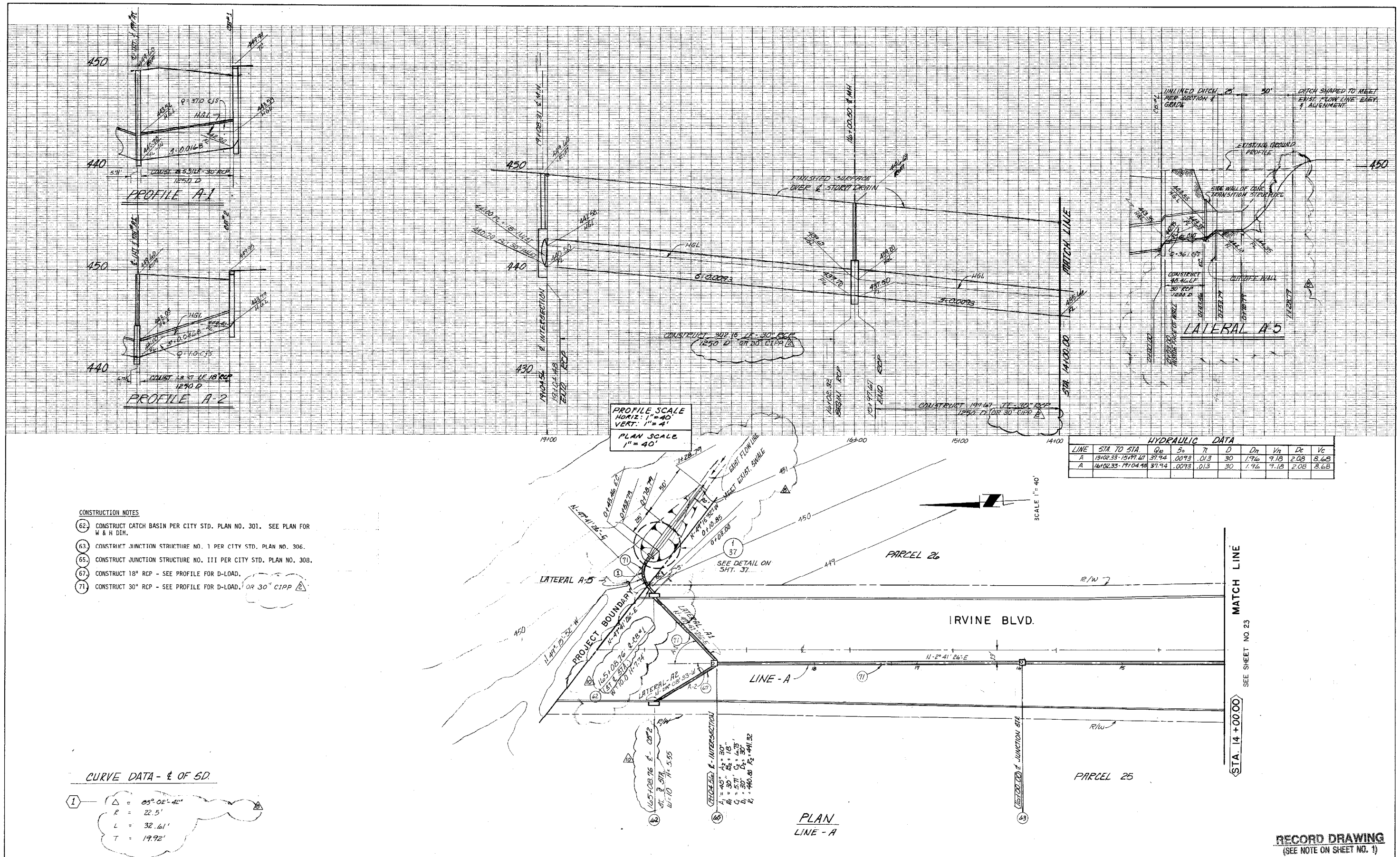
**CITY OF IRVINE**
COMMUNITY DEVELOPMENT DEPARTMENT

PROJECT NO.
84-PC-0629

SHEET 1 OF 78

MICROFILMED

EASI FILE CORP. IRVINE, CA EFH24 482




| HYDRAULIC DATA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| LINE | STA. TO STA. | $Q_{10}$ | $S_o$ | n | D | $D_n$ | $V_n$ | $D_c$ | $V_c$ |
| A | 13+02.33 - 15+97.67 | 37.94 | .0093 | .013 | 30 | 1.96 | 9.18 | 2.08 | 8.68 |
| A | 16+02.33 - 19+04.98 | 37.94 | .0093 | .013 | 30 | 1.96 | 9.18 | 2.08 | 8.68 |

CONSTRUCTION NOTES

62. CONSTRUCT CATCH BASIN PER CITY STD. PLAN NO. 301. SEE PLAN FOR W & H DIM.
63. CONSTRUCT JUNCTION STRUCTURE NO. 1 PER CITY STD. PLAN NO. 306.
65. CONSTRUCT JUNCTION STRUCTURE NO. III PER CITY STD. PLAN NO. 308.
67. CONSTRUCT 18" RCP - SEE PROFILE FOR D-LOAD.
71. CONSTRUCT 30" RCP - SEE PROFILE FOR D-LOAD. OR 30" CIPP

CURVE DATA - ℄ OF SD

1 — $\Delta$ = 85° 02' 42"
R = 22.5'
L = 32.61'
T = 19.92'

RECORD DRAWING
(SEE NOTE ON SHEET NO. 1)

| NO. | DATE | REVISIONS |
|---|---|---|
| 7 | | |
| 6 | | |
| 10 | 6-18-86 | REVISED C.B. STATIONING |
| 9 | 5-27-86 | REVISED TOTAL NUMBER OF SHEETS FROM 70 TO 78. |
| 8 | 5-20-86 | ADD STATIONS ON LATERAL A-5 PLAN PROFILE & REVISE CURVE DATA |
| 2 | 3-27-86 | ADD 30" CIPP ALTERNATE |
| 1 | | |

DRAWN BY: TE DATE
DESIGNED BY: U.B. DATE
CHECKED BY: DATE

Prepared by:
Robert Bein, William Frost & Associates
PROFESSIONAL ENVIRONMENTAL ENGINEERS & PLANNERS
P.O. BOX 2580 • 1401 QUAIL STREET, NEWPORT BEACH, CALIFORNIA 92663
(714) 833-0070

IRVINE INDUSTRIAL COMPLEX EAST - PHASE IV
STORM DRAIN LINE - A

CITY OF IRVINE
COMMUNITY DEVELOPMENT DEPARTMENT

PROJECT NO. 84-PC-0629
SHEET 22 OF ~~43~~ 78

EAS FILE COPY, IRVINE, CA
482

381 482 J.N. 22818

| NO. | DATE | REVISIONS |
|---|---|---|
| 5 | 5/27/86 | REVISED TOTAL NUMBER OF SHEETS FROM 72 TO 80 |
| 4 | 5/20/83 | REVISED LATERAL A-3 AND STATIONS OF C.B.'S #3 AND C.B. #4 |
| 3 | 4/25/82 | ADDED ROOF INLET & 18" CSP LATERAL A-5 TO M.S. NO. AT 20+ STA. 13+00; MODIFIED BASIN A-3 TO BASIN A-4 |
| 2 | 6/10/80 | MODIFIED IN WATER MAIN ALIGNMENT AND BLACKTOP AND ELECTRIC FOR ELECTRICAL PURPOSES. |
| 1 | | |
| 6 | 3-26-86 | ADD 30" CIPP ALTERNATE REVISE LINE A, LATERAL A3 LATERAL A4, & HYDRAULIC DATA RMM 6/12/86 |

| | |
|---|---|
| DRAWN BY: | JE |
| DESIGNED BY: | L.L.B. |
| CHECKED BY: | |

PLANS PREPARED BY:

**Robert Bein, William Frost & Associates**
PROFESSIONAL ENVIRONMENTAL ENGINEERS & PLANNERS
P.O. BOX 2860 • 1401 QUAIL STREET NEWPORT BEACH, CALIFORNIA 92663
(714) 833-0070

# CITY OF IRVINE
## COMMUNITY DEVELOPMENT DEPARTMENT

IRVINE INDUSTRIAL COMPLEX EAST - PHASE IV

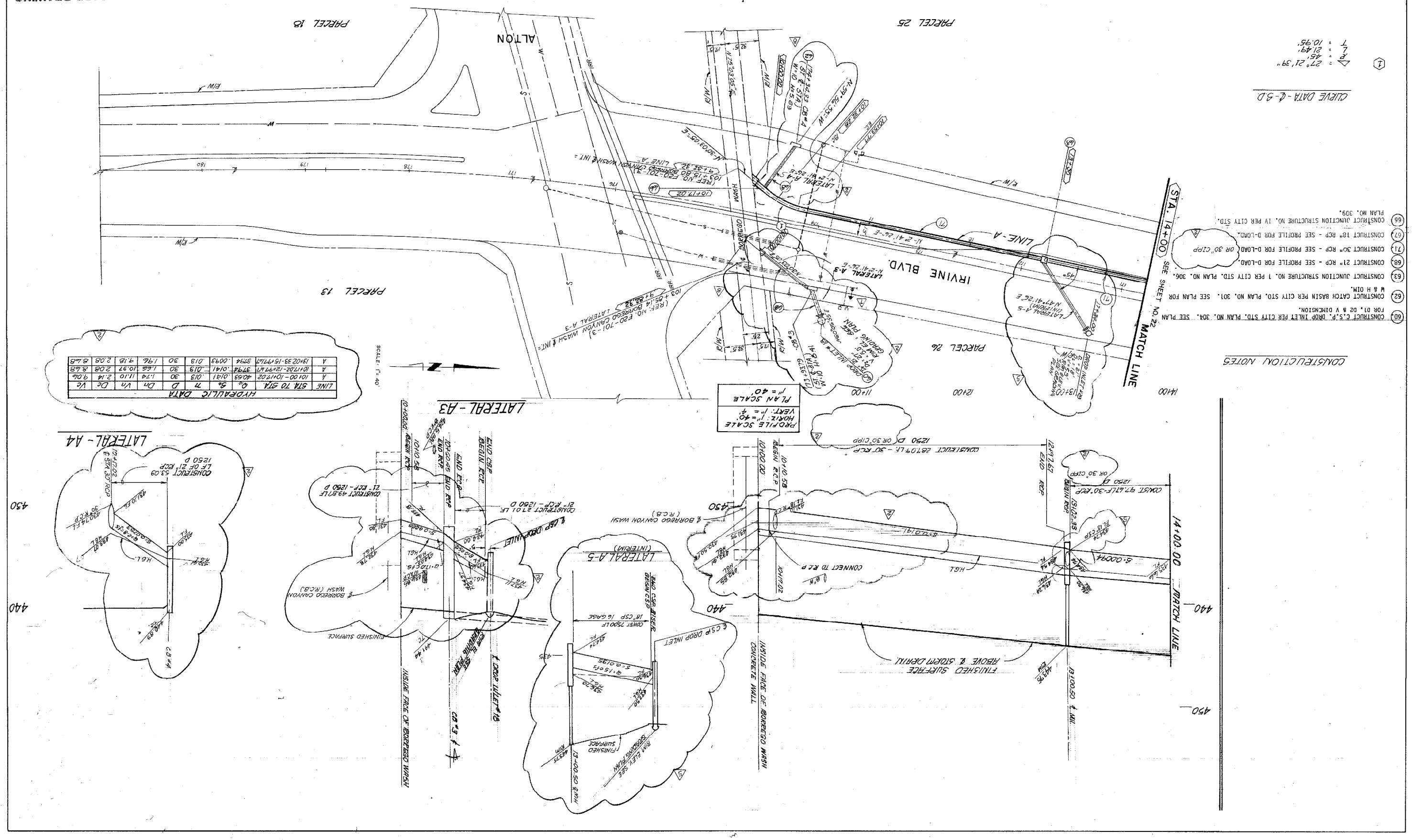
## STORM DRAIN LINE - A

PROJECT NO. 84-PC-0629

SHEET 23 OF ~~43~~ 76

482 / 38

RECORD DRAWING
(SEE NOTE ON SHEET NO. 1)




| LINE | STA TO STA | Q | S | n | D | Dh | Vn | Dc | Vc |
|---|---|---|---|---|---|---|---|---|---|
| A | 10+00 - 10+17.02 | 40.63 | .0141 | .013 | 30 | 1.74 | 11.10 | 2.14 | 9.06 |
| A | 10+17.02 - 12+91.40 | 37.94 | .0141 | .013 | 30 | 1.66 | 10.97 | 2.08 | 8.68 |
| A | 12+91.40 - 13+91.40 | 37.94 | .0093 | .013 | 30 | 1.96 | 9.18 | 2.08 | 8.68 |


EFN 24
482
BASE FILE CORP. IRVINE, CA

Rational Method Peak Flow Calculation for ST-1

0.81 Acre Portion of Irvine Boulevard

L = 522’  Δ Elevation = 4.5’

Q = C x I x A

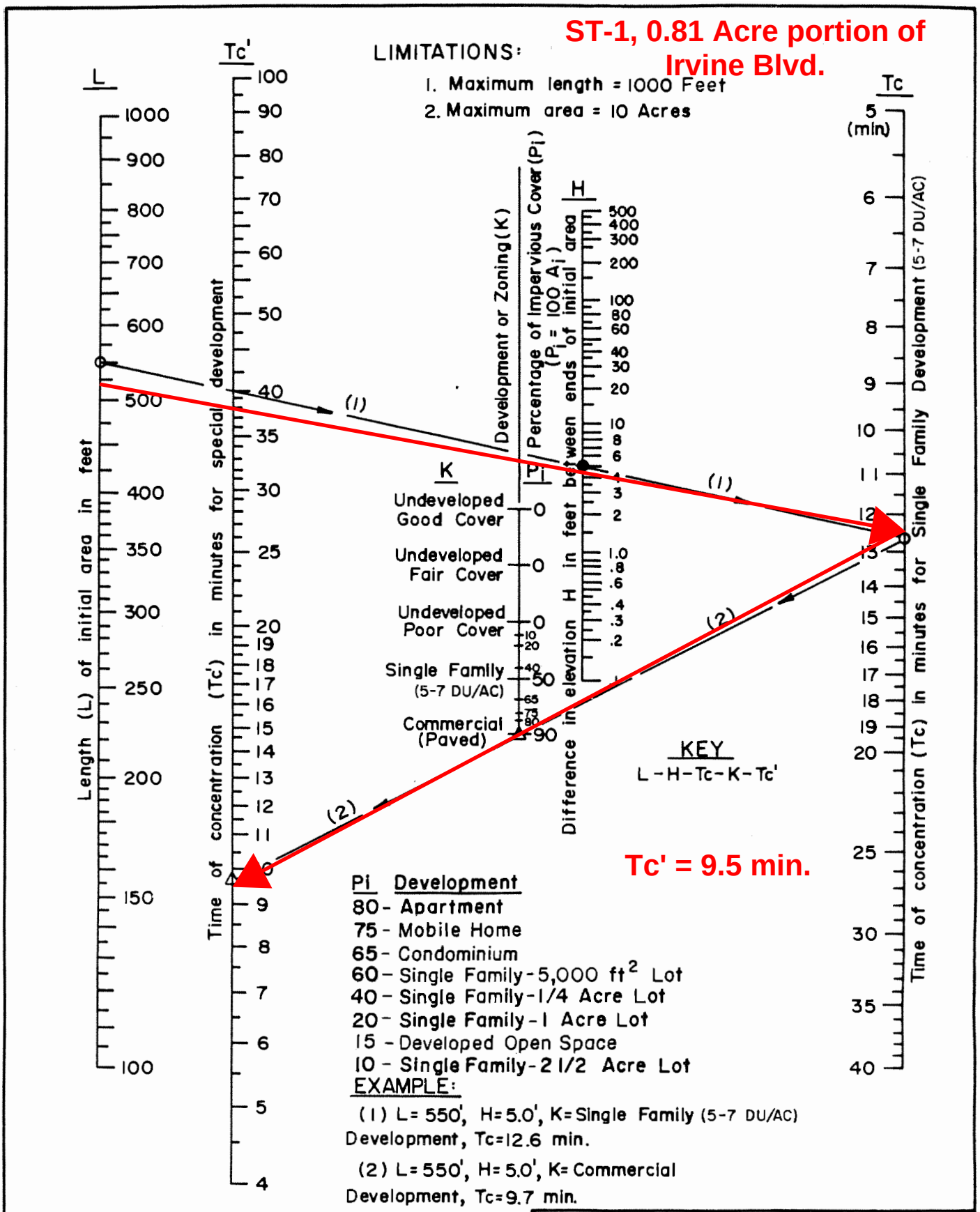
C = .9  (100% Impervious)

I = 3.35 in/hr  (O.C. Hydrology manual Fig. B-3)

A = 0.81 acres

Q = .9 x 3.35 x 0.81

Q = 2.44 cfs




**ORANGE COUNTY**

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA



Figure D-1

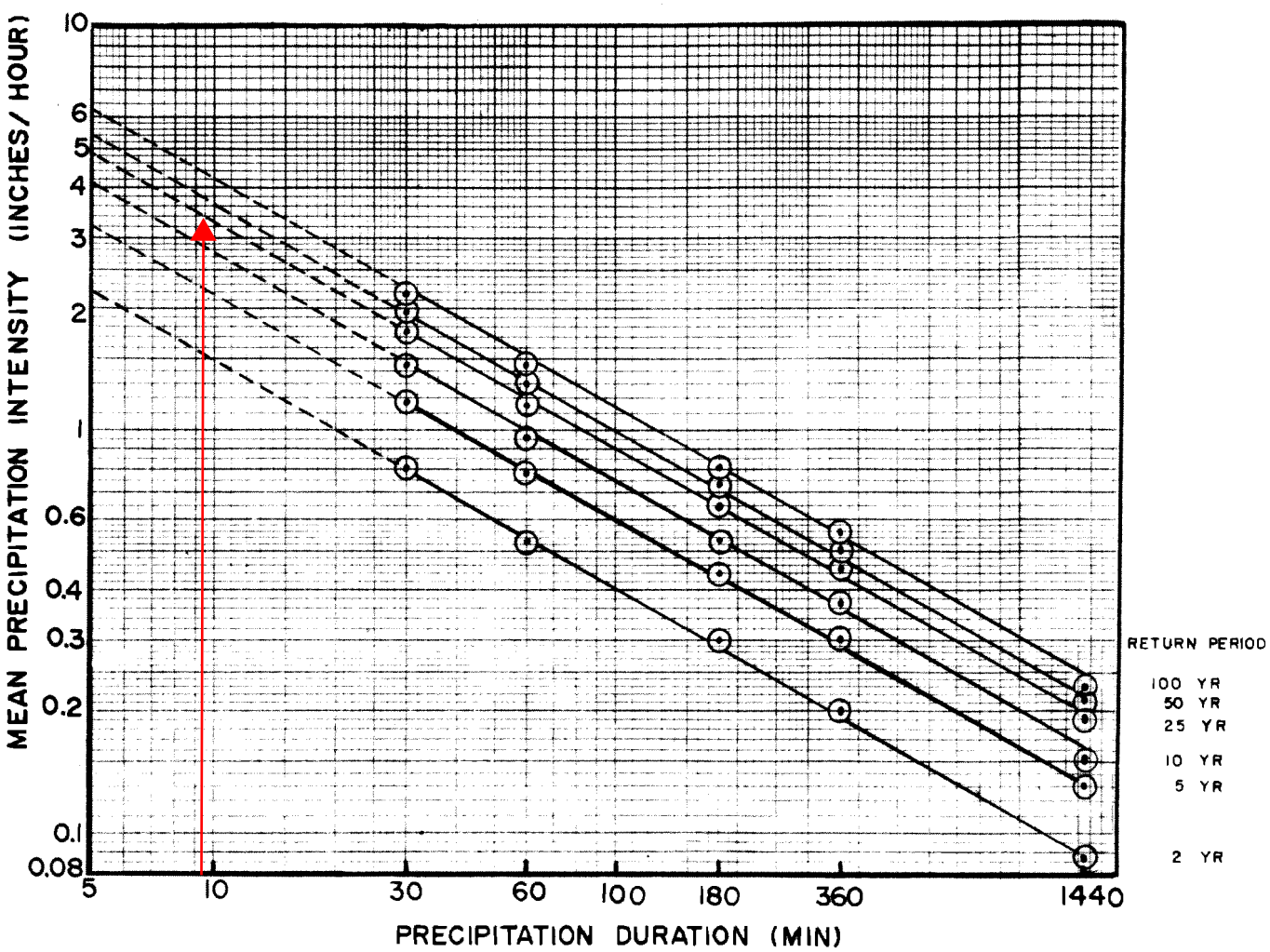
**ST-1, 0.81 Acre portion of Irvine Blvd.**

Regression Equations: $I(t) = at^b$

(I= Intensity in inches/hour, t= duration in minutes)

| Return Frequency (years) | a | b |
|---|---|---|
| 2 | 5.702 | -0.574 |
| 5 | 7.870 | -0.562 |
| 10 | 10.209 | -0.573 |
| 25 | 11.995 | -0.566 |
| 50 | 13.521 | -0.566 |
| 100 | 15.560 | -0.573 |

**I(t) = 11.995(9.5)^(-0.566)**
**I(t) = 3.35 in/hr**




**ORANGE COUNTY**
HYDROLOGY MANUAL

MEAN PRECIPITATION INTENSITIES FOR NONMOUNTAINOUS AREAS

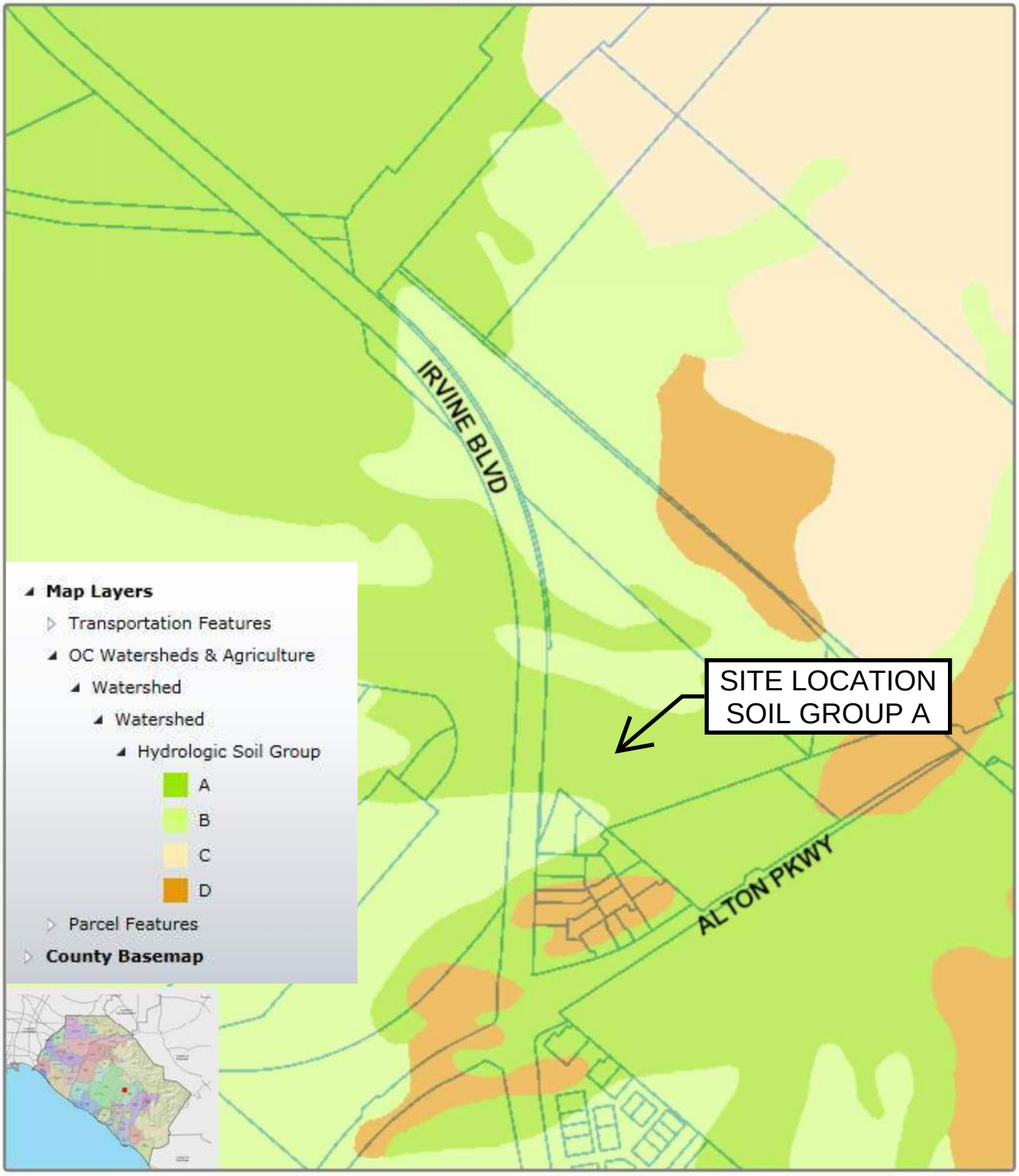
Figure B-3

# Appendix E – Hydrologic Soils Group Map

See Attached Exhibit

# Orange County Public Works - Hydrologic Soils Group Map

Orange County, CA




*Disclaimer: Map and parcel data are believed to be accurate, but accuracy is not guaranteed. This is not a legal document and should not be substituted for a title search,appraisal, survey, or for zoning verification.*

Map Scale
**1 inch = 660 feet**
11/26/2014

**WQ XX-XXXX**

# CONCEPTUAL
# County of Orange/Santa Ana Region Priority Project Water Quality Management Plan (WQMP)

**Project Name:**

**WESTERN ALTON PARCEL – NORTHERN PARCEL**

**IRVINE BOULEVARD**

**IRVINE, CA 92618**

**Prepared for:**

**Orange County Public Works**

**County Executive Office – Land Development**

**445 Civic Center Drive West, 2nd Floor**

**Santa Ana, CA**

**Prepared by:**

**Tait & Associates, Inc.**

**701 N. Parkcenter Drive**

**Santa Ana, CA 92705**

**714-560-8200**

**Prepared: August 11, 2015**

**Revised: February 3, 2016**

**County of Orange**
**Orange County Public Works - Grading Section**
**300 North Flower Street - P.O. Box 4048**
**Santa Ana, California 92702-4048** **(714) 667-8871**

# OC Great Park

**C-WQMP**

## Conceptual WQMP
## REVIEW SHEET

**Permits Numbers: TBD**

| ***Plan Date*** | ***Date Received*** | ***Date Reviewed*** | ***Plan Check Status*** |
|---|---|---|---|
| 02/03/2016 | 02/18/2016 | 03/08/2016 | Approval |

**By the Consulting Firm: Tait & Associates, Inc. (714) 560-8200**

**Project: Western Alton Parcel – Northern Parcel**
Site Address: OC Great Park, Irvine, CA 90242
APN: 591-133-16, 591-133-17, 591-133-18
**Civil Engineer: Todd Schmieder,** tschmieder@tait.com

---

Developer/Owner: OCPW, CEO - Land Development
Address: 445 Civic Center Drive West, 2nd Floor
**Contact: Eric Hull**, eric.hull@ocpw.ocgov.com
Tel: (714) 667-8833, Cell: (714) 415-8099

---

**The Conceptual WQMP was approved based on the conditions below:**

**I. Project Site Condition:**
Project Area: 21.98 acres – Planned Community of Multi-Family Residential Units.
Impervious Area: 14.29 acres (65%)
Pervious Area: 7.69 acres (35%)
Priority Project Category: New development greater than 10,000 square feet.

**II. Proposed BMPs:**

1. Bio-treatment & Hydromodification BMPs for Development Site:
   a) BIO-1: Bio-retention with underdrain (Cudo Water Storage System) for Hydromodification and LID/DCV.
   b) BlO-7: proprietary vegetated bio-treatment system (Modular Wetland System MWS Units).
   c) Infiltration/Detention Basin BMP (INF) for Hydromodification and LID/DCV.

The details of the proposed BMP is to be determined in future permit application.

**III. Approval:**
The locations, section details, and the treatment areas of the above BMPs as shown in the WQMP Exhibit were reasonable and adequate to meet the water quality and hydromodification requirements set forth in, Order No. R8-2009-0030 /NPDES No. CAS618030, of Santa Ana Regional Water Quality Control Board. The above referenced conceptual WQMP was approved.

**Report Reviewed by:** J T Yean **Date: 03-08-2016**
J.T. Yean, Civil Engineer

| Project Owner's Certification | | | |
|---|---|---|---|
| Planning Application No. (If applicable) | T.B.D. | Grading Permit No. | T.B.D. |
| Tract/Parcel Map and Lot(s) No. | Lot 300, 313 Block 175, M.B. 1/88 | Building Permit No. | T.B.D. |
| Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers) | | | Address: T.B.D.<br>APN: 591-133-16, 591-133-17, 591-133-18 |

This Water Quality Management Plan (WQMP) has been prepared for Orange County Public Works by Tait & Associates, Inc. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

| **Owner:** | | | |
|---|---|---|---|
| Title | County of Orange | | |
| Company | County Executive Office – Land Development | | |
| Address | 445 Civic Dr. West, 2nd Floor, Santa Ana, CA | | |
| Email | T.B.D. | | |
| Telephone # | 714-667-9673 | | |
| I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein. | | | |
| Owner Signature | | Date | |

| **Preparer (Engineer): Todd Schmieder** | | | |
|---|---|---|---|
| Title | Project Manager | PE Registration # | C37167 |
| Company | Tait & Associates | | |
| Address | 701 N. Parkcenter Drive, Santa Ana, CA 92705 | | |
| Email | tschmieder@tait.com | | |
| Telephone # | 714-560-8200 | | |
| I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board. | | | |
| Preparer Signature | | Date | |
| Place Stamp Here | | | |

# Contents

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## Attachments

**Attachment A** . ..... Educational Materials

**Attachment B**..... Hydrology Maps, HCOC Backup Calculations (2yr, 24hr AES files), Modular Wetlands Unit 48 Hour Draw Down Volumes

**Attachment C**..... Supporting Maps & Exhibits

**Attachment D**..... OC-Specific Design Criteria and Considerations & Proprietary BMP information and details

**Attachment E**..... Infiltration Feasibility worksheet/Summary of Harvested Water Demand and Feasibility Worksheet/Soils Report Information

**Attachment F**..... Operations and Maintenance (O&M) & Inspection Form

**Attachment G**..... Conditions of Approval

**Attachment H**..... California Department of Public Health Regulations

**Attachment I**..... 25-yr & 100-yr Hydrograph and Basin Stage-Storage Curve

# Section I Permit(s) and Water Quality Conditions of Approval or Issuance

| **Project Infomation** | | | |
|---|---|---|---|
| Permit/Application No. (If applicable) | T.B.D. | Grading or Building Permit No. (If applicable) | T.B.D. |
| Address of Project Site (or Tract Map and Lot Number if no address) and APN | Lot 300, 313 Block 175, M.B. 1/88<br>APN: 591-133-16, 591-133-17, 591-133-18 | | |
| | | | |
| **Water Quality Conditions of Approval or Issuance** | | | |
| Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.) | Conditions of Approval have not yet been applied. | | |
| | | | |
| **Conceptual WQMP** | | | |
| Was a Conceptual Water Quality Management Plan previously approved for this project? | No. | | |
| | | | |
| **Watershed-Based Plan Conditions** | | | |
| Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS. | Borrego Creek – No TMDLs<br>San Diego Creek/Newport Bay – Sediment, Nutrient, Toxics, Fecal Coliform | | |

# Section II Project Description

## II.1 Project Description

| Description of Proposed Project | | | | |
|---|---|---|---|---|
| Development Category (From Model WQMP, Table 7.11-2; or -3): | This project is considered a priority project under the following categories:<br>Category 1 – New development projects that create 10,000 square feet or more of impervious surface (collectively over the entire site). This category includes commercial, industrial, residential, mixed-use, and public projects on private, or public, property that falls under the planning and building authority or the Permittees. | | | |
| Project Area (ft²): 1,254,528 | Number of Dwelling Units: T.B.D. | | SIC Code: N.A. for Residential | |
| Project Area | Pervious | | Impervious | |
| | Area (acres or sq ft) | Percentage | Area (acres or sq ft) | Percentage |
| Pre-Project Conditions | 21.98 ac | 100% | 0 ac | 0% |
| Post-Project Conditions | 7.69 ac | 35% | 14.29 ac | 65% |
| Drainage Patterns/Connections | Storm water runoff discharges from the site in 2 separate directions. The majority of site runoff is conveyed west along Irvine Boulevard in an existing open channel trench to the Agua Chinon Channel. The remaining site runoff enters the Wildlife Corridor to the south via existing storm drains. Runoff within the Wildlife Corridor is conveyed to the Borrego Channel. The Borrego Canyon Channel eventually joins the Agua Chinon Channel before discharging to the Sand Diego Creek and ultimately the Upper Newport Bay.<br>The majority of proposed development will direct runoff westward through a storm drain system to an on-site detention basin. The detention basin will discharge site runoff to the existing open channel trench adjacent to Irvine Boulevard that is currently serving the site.<br>The portion of Irvine Boulevard adjacent to the project site will direct runoff westward through a storm drain system to an on-site detention basin. The detention basin will discharge site runoff to the existing open | | | |

| | |
|---|---|
| | channel trench adjacent to Irvine Boulevard that is currently serving the site.<br><br>The proposed development will maintain on-site and off-site runoff contributions to the Wildlife Corridor similar to the existing condition. |
| Narrative Project Description:<br><br>(Use as much space as necessary.) | The proposed construction involves the development of approximately 21.98 acres for a planned community of multi-family dwelling units. |

## II.2 Potential Stormwater Pollutants

Based on Table 2.1 "Anticipated and Potential Pollutants Generated by Land Use Type" in the Technical Guidance Document, under the category of Attached and Detached Residential Development, the pollutants of concerns are listed below.

| **Pollutants of Concern** | | | |
|---|---|---|---|
| Pollutant | Check One for each: E=Expected to be of concern N=Not Expected to be of concern | | Additional Information and Comments |
| Suspended-Solid/ Sediment | E ☒ | N ☐ | |
| Nutrients | E ☒ | N ☐ | |
| Heavy Metals | E ☐ | N ☒ | |
| Pathogens (Bacteria/Virus) | E ☒ | N ☐ | |
| Pesticides | E ☒ | N ☐ | |
| Oil and Grease | E ☒ | N ☐ | |
| Toxic Organic Compounds | E ☐ | N ☒ | |
| Trash and Debris | E ☒ | N ☐ | |

## II.3 Hydrologic Conditions of Concern

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below.

Per Section 2.2.3.1 in the TGD and the map provided in Appendix XVI, the project site is located in a potential area of erosion, habitat, & physical structure susceptibility due to the presence of an un-stabilized natural drainage channels downstream of the project area. See the HCOC map in Appendix C for project site and drainage channel locations.

The calculations shown on the following pages indicate that the post-development peak flow and runoff volume for the project will increase with the proposed improvements due to a decrease in the pervious area. Therefore the project has been determined to have HCOC's.

The results for the 2 year 24 hour storm event calculations for peak flows, time of concentrations and runoff volumes are as follows:

This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both pre and post development volume calculations. The resultant files are included in Attachment B. These files have been added together to generate a **total** pre- and post-project volume as shown in the table in this Section. **Pre = 0.76 ac-ft or 33,105.6 cu-ft** & **Post = 1.10 ac-ft or 47,916 cu-ft.** The total delta volume for HCOC is **14,810.4 cu-ft.** The calculations are shown in Section IV.3.5. For this project, the DCV exceeds the HCOC Volume.

| | **Total Area (acres)** | | **Peak Flow Rate (cfs)** | | **Time of Concentration (min.)** | | **Volume** | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Area A | **17.9** | | **9.91** | | **24.65** | | | |
| Area B | **2.9** | | **2.65** | | **17.37** | | | |
| Area C | **8.0** | | **7.80** | | **12.47** | | | |
| Area A | | **17.5** | | **20.54** | | **9.85** | | |
| Area B | | **3.2** | | **3.43** | | **14.32** | | |
| Area C | | **6.7** | | **8.98** | | **7.93** | | |
| Area D | | **1.5** | | **2.16** | | **8.52** | | |
| **Totals** | **28.8** | **28.9** | **20.36** | **35.11** | **24.65** | **7.93** | **0.76 ac-ft Or 33,105.6 ft²** | **1.10 ac-ft Or 47,916 ft²** |
| **Increase % or Amount** | | | **72%** | | **-16.72 min.** | | **45%** | |

See Appendix B for HCOC Flow Rate, Time of Concentration & Volume Calculations for each drainage area.

## II.4 Post Development Drainage Characteristics

The proposed drainage pattern will follow the existing drainage pattern as shown on the Conceptual Hydrology Map. See the following page. The majority of proposed development, Subarea A, will direct runoff westward through a storm drain system to an on-site detention basin. The detention basin will discharge site runoff to the existing open channel trench adjacent to Irvine Boulevard that is currently serving the site.

The portion of Irvine Boulevard adjacent to the project site will be improved to include a parkway, curb and gutter, and a lane expansion. Subarea B represents runoff from the proposed portion of Irvine Boulevard that flows west to the existing open channel trench downstream of the project site.

The proposed development will maintain on-site and off-site runoff contributions to the Wildlife Corridor similar to the existing condition, represented by Subareas C and D. Stormwater runoff in both Subareas will sheet flow to graded inlets and enter a stormdrain system. Subarea C will discharge to the existing WLC-3 storm drain and Subarea D will discharge to the existing WLC-1 storm drain.

## II.5 Property Ownership/Management

Orange County Public Works

County Executive Office – Land Development

445 Civic Center Drive West, 2nd Floor

Santa Ana, CA

# Section III Site Description

## III.1 Physical Setting

| | |
|---|---|
| Name of Planned Community/Planning Area (if applicable) | Western Alton Parcel – Northern Parcel |
| Location/Address | The project is located in the northeasterly quadrant of the former El Toro Marine Corps Air Station, northerly of the intersection of Alton Parkway and Irvine Blvd, within the City of Irvine, California. |
| | |
| General Plan Land Use Designation | T.B.D. |
| Zoning | T.B.D. |
| Acreage of Project Site | 21.98 |
| Predominant Soil Type | The project site location resides within the hydrology soil group B. |

## III.2 Site Characteristics

| Site Characteristics | |
|---|---|
| Precipitation Zone | The rainfall zone for the project has a design capture storm depth of 0.85" based on the Rainfall zones map on the TGD figure XVI. |
| Topography | The topography of the project site is relatively flat with a 2 to 3% slope downward to the west. On-site ground surface elevations range from +497 to +423 feet above mean sea level. Magazine road runs along the southern perimeter of the site adjacent to the Irvine Wildlife Corridor. Magazine road is paved with asphalt and provides access to the project site and adjacent land northeast of the site. |
| Drainage Patterns/Connections | The proposed drainage pattern will follow the existing drainage pattern as shown on the Conceptual Hydrology Map. See Attachment B. The majority of proposed development, Subarea A & B , will direct runoff westward through a storm drain system to an on-site detention basin. The detention basin will discharge site runoff to the existing open channel trench adjacent to Irvine Boulevard that is currently serving the site.<br><br>The proposed development will maintain on-site and off-site runoff contributions to the Wildlife Corridor similar to the existing condition, represented by Subareas C and D. Stormwater runoff in both Subareas will sheet flow to graded inlets and enter a stormdrain system. Subarea C will discharge to the existing WLC-3 storm drain and Subarea D will discharge to the existing WLC-1 storm drain. |
| Soil Type, Geology, and Infiltration Properties | The project site location resides within the hydrology soil group B. Group B soils are typically silt loams and loams. They have a moderate infiltration rate when thoroughly wetted and consist chiefly of moderately deep to deep and moderately well to well drained soils with moderately fine to moderately coarse texture. |
| Hydrogeologic (Groundwater) Conditions | The historic high groundwater was reported to be as shallow as 60 feet below the existing ground surface. |

| | |
|---|---|
| Geotechnical Conditions (relevant to infiltration) | Dense sand with isolated layers of stiff silt and clay. |
| Off-Site Drainage | No changes to the existing site drainage are anticipated. |
| Utility and Infrastructure Information | The proposed utilities will be located under asphaltic paving with surface drainage, infiltration impacting the subsurface utilities is not a concern for the proposed project. |

## III.3 Watershed Description

| | |
|---|---|
| Receiving Waters | Agua Chinon Channel<br>Borrego Canyon Wash<br>San Diego Creek Reach 2<br>San Diego Creek Reach 1<br>Newport Bay, Upper<br>Newport Bay, Lower |
| 303(d) Listed Impairments | Borrego Creek – Ammonia, Indicator Bacteria<br>San Diego Creek Reach 2 – Indicator Bacteria, Nutrients, Sedimentation/Siltation, Unknown Toxicity<br>San Diego Creek Reach 1 – Fecal Coliform, Nutrients, Pesticides, Sedimentation/Siltation, Selenium, Toxaphene<br>Newport Bay, Upper – Chlordane, Copper, DDT, Indicator Bacteria, Metals, Nutrients, PCBs, Pesticides, Sediment Toxicity, Sedimentation/Siltation<br>Newport Bay, Lower – Chlordane, Copper, DDT, Indicator Bacteria, Nutrients, PCBs, Pesticides, Sediment Toxicity |
| Applicable TMDLs | San Diego Creek/Newport Bay (Sediment, Nutrients, Toxics, Fecal Coliform |
| Pollutants of Concern for the Project | Suspended-Solid/ Sediment, Nutrients, Pathogens (Bacteria/Virus), Pesticides, Oil and Grease, Trash and Debris |
| Environmentally Sensitive and Special Biological Significant Areas | None |

# Section IV Best Management Practices (BMPs)

## IV. 1 Project Performance Criteria

| | | |
|---|---|---|
| (NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis? | YES ☐ | NO ☒ |
| If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities. | There are currently no applicable approved WHIMP's within the watershed for this project. | |

| Project Performance Criteria | |
|---|---|
| If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP) | Hydrologic Conditions of Concern are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts if either the post-development runoff volume or time of concentration for the 2-year, 24-hour storm exceeds the pre-development runoff volume or the time of concentration for the 2-year, 24-hour storm event by more than 5 percent.<br><br>This project is located within an area of hydrologic concern and will increase the peak flow and decrease the time of concentration for the storm event described above, therefore, this project is considered for Hydrologic Conditions of Concern. This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both pre and post development volume calculations. The resultant files are included in Attachment B.<br><br>HCOC will be mitigated through the use of underground detention basins to store the difference in runoff volumes with downstream Proprietary Bio-Treatment Units (Modular Wetlands). In addition, an Infiltration Basin will also detain runoff to serve as additional mitigation to address the project HCOC's. |
| List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP) | Where feasible, Infiltration BMP's will be utilized for the entire DCV. Harvest and Reuse BMP's are not an option for this project. This project does not consist of enough landscape for irrigation reuse. In addition, dual plumbed recycled water systems are not accepted by the California State Health Department (See section 60313.General Requirements, attachment H for a copy of the "Regulations Related to Recycled Water"). "No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility." This project is a multi-family development and Evapotranspiration and Evaporation BMP's are not feasible. In location where Infiltration BMP's are not feasible, Proprietary Biotreatment BMP's with upstream underground detention will be utilized for this project. |
| List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP) | Infiltration BMP's and Proprietary Biotreatment BMP's will be utilized for the entire DCV for this project. Treatment Control BMP's are not required. |

| | |
|---|---|
| Calculate LID design storm capture volume for Project. | <u>Project Information:</u><br>Imperviousness = 0.65%<br>d=0.85" ( See the "Rainfall Zones" Map in Attachment C)<br>See the following pages for calculations. The calculations have been broken down by Drainage Management Areas (DMA's). |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.77 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,520.5 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 678.8 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.52 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,026.9 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 458.4 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-3)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.38 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 750.4 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 335 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-4)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.11 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2191.9 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 978.5 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-5)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.73 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1441.5 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 643.5 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-6)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.80 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 3554.5 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1586.8 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-7)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.89 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 3732.2 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1666.2 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-8)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.61 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 3179.3 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1419.3 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-9)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.89 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1757.5 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 784.6 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-10)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.68 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1342.8 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 599.5 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-11)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.47 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2902.8 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1295.9 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-12)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.82 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1619.3 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 722.9 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-13)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.57 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1125.6 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 502.5 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-14)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.62 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1224.3 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 546.6 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-15)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.23 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 454.2 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 202.8 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-16)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.26 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2488.1 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1110.8 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-17)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.10 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2172.2 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 969.7 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-18)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.69 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1362.6 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 608.3 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-19)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.19 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 375.2 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 167.5 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-20)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.12 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 237.0 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 105.8 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA B-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.36 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 710.9 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 317.4 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA B-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.45 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 888.6 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 396.7 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA B-3)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.18 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2330.2 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1040.3 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA B-4)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.17 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2310.4 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 2.4 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.56 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 2.24 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1031.4 | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.91 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1797.0 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 3.53 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 6970.8 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-3)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.97 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1915.5 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-4)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.29 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 572.7 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-5)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.67 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1323.1 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-6)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.29 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 572.7 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA D-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.17 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 335.7 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA D-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.37 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2705.4 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

# DMA'S EXHIBIT & TABLE

## IV.2. Site Design and Drainage

The proposed drainage pattern will follow the existing drainage pattern as shown on the Conceptual Hydrology Map. See Attachment B. The portion of Irvine Boulevard adjacent to the project site will be improved to include a parkway, curb and gutter, and a lane expansion. Subarea B represents runoff from the proposed portion of Irvine Boulevard that flows west to proposed catch basins along the project site boundary. Subarea B will then join the on-site storm drain system for Subarea A. The majority of proposed development, Subarea A, will direct runoff westward through a storm drain system to an on-site infiltration/detention basin. The detention basin will discharge site runoff to the existing open channel trench adjacent to Irvine Boulevard that is currently serving the site.

The proposed development will maintain on-site and off-site runoff contributions to the Wildlife Corridor similar to the existing condition, represented by Subareas C and D. Stormwater runoff in both Subareas will sheet flow to graded inlets and enter a stormdrain system. Subarea C will discharge to the existing WLC-3 storm drain and Subarea D will discharge to the existing WLC-1 storm drain.

## IV.3 LID BMP Selection and Project Conformance Analysis

### IV.3.1 Hydrologic Source Controls (HSCs)

| Name | Included? |
|---|---|
| Localized on-lot infiltration | ☐ |
| Impervious area dispersion (e.g. roof top disconnection) | ☐ |
| Street trees (canopy interception) | ☒ |
| Residential rain barrels (not actively managed) | ☐ |
| Green roofs/Brown roofs | ☐ |
| Blue roofs | ☐ |
| Impervious area reduction (e.g. permeable pavers, site design) | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Future calculations will be provided for Street Trees (canopy interception) upon final WQMP and landscape plans have been incorporated into the design.

## IV.3.2 Infiltration BMPs

Infiltration is not feasible for the entire project due to site location and infiltration infeasiblility. For DMA's A-1 through A-20, and B-1 through B-4, and infiltration basin is proposed to treat/retain the DCV. In addition, see Attachment E "Infiltration Feasibility Worksheet".

For DMA's C-3 through C-6, and D-1 and D-2 this project will utilize Proprietary Bio-treatment BMP's with upstream underground detention for the DCV. In addition, these DMA's are located adjacent to the Right-of-Way and next to Environmental corridor which are concerns for the potential use of infiltration basins. Finally, infiltration rates have not been provided for Areas C-4, C-5, and C-6.

| Name | Included? |
|---|---|
| Bioretention without underdrains | ☐ |
| Rain gardens | ☐ |
| Porous landscaping | ☐ |
| Infiltration planters | ☐ |
| Retention swales | ☐ |
| Infiltration trenches | ☐ |
| Infiltration basins | ☒ |
| Drywells | ☐ |
| Subsurface infiltration galleries | ☐ |
| French drains | ☐ |
| Permeable asphalt | ☐ |
| Permeable concrete | ☐ |
| Permeable concrete pavers | ☐ |
| Other: Underground Infiltration | ☐ |
| Other: | ☐ |

For this project, the DCV exceeds the HCOC Volume. The total DCV for DMA's A-1 through A-20, and B-1 through B-4 is **40,699 cu-ft.** The minimum infiltration rate, from the Technical Guidance Document, is 0.3 in/hr. From Section IV.1 Worksheets B, the required minimum footprint(s) for an infiltration basin for these DMA's is **18,169 sq-ft** with a maximum depth of **2.24 ft** in order to maintain a drawdown time less than 48 hours. An infiltration basin is a possible option for these areas. Further percolation rate testing will be required in order to determine if an infiltration basin is a viable option for these areas.

# INFILTRATION BMP EXHIBIT & TABLE

## IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

| Name | Included? |
|---|---|
| All HSCs; *See Section IV.3.1* | ☐ |
| Surface-based infiltration BMPs | ☒ |
| Biotreatment BMPs | ☒ |
| Above-ground cisterns and basins | ☐ |
| Underground detention | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Evapotranspiration, Rainwater Harvesting BMPs are not proposed; however, the proposed Proprietary Biotreatment BMPs may result in subsequent evapotranspiration. See section IV3.4. This project is a multi-family development and Evapotranspiration and Evaporation BMP's are not feasible.

Dual plumbed recycled water systems are not accepted by the California State Health Department (See section 60313.General Requirements, attachment H for a copy of the "Regulations Related to Recycled Water"). "No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility."

Rainwater harvest for irrigation reuse is no feasible for this project due to the landscape area required. Per the TGD, the site requires 13.29 acres of landscape area for irrigation reuse, but only has an effective area of 7.69 Acres provided.

See Attachment E: Summary of Harvested Water Demand and Feasibility" for calculations.

### IV.3.4 Biotreatment BMPs

In locations that Infiltration BMP'are not feasible for the entire DCV, Proprietary Biotreatment BMP's will be utilized for the remaining DCV for this project.

| Name | Included? |
|---|---|
| Bioretention with underdrains | ☐ |
| Stormwater planter boxes with underdrains | ☐ |
| Rain gardens with underdrains | ☐ |
| Constructed wetlands | ☐ |
| Vegetated swales | ☐ |
| Vegetated filter strips | ☐ |
| Proprietary vegetated biotreatment systems | ☒ |
| Wet extended detention basin | ☐ |
| Dry extended detention basins | ☐ |
| Other: | ☐ |
| Other: | ☐ |

DMA's C-3 through C-6, D-1, and D-2 have been designed to capture the DCV. For DCV calculations, see Section IV.1. Modular Wetland Unit 48 hour Draw Down Volumes are shown in Attachment B. These DMA's will utilize a proprietary bioretention system (Modular Wetlands Linear System). The DCV will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

**DCV RESULTS:**

**DMA C-3 = 1915.5 cu-ft**
20′ wide by 52′ long by 2′ deep.
(20′ x 52′ x 2′) x 95% void space = 1976 cu-ft Volume Provided
A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

**DMA C-4 = 572.7 cu-ft**
10′ wide by 32′ long by 2′ deep.
(10′ x 32′ x 2′) x 95% void space = 608 cu-ft Volume Provided
A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

**DMA C-5 = 1323.1 cu-ft**
10′ wide by 70′ long by 2′ deep.
(10′ x 70′ x 2′) x 95% void space = 1330 cu-ft Volume Provided
A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

**DMA C-6 = 572.7 cu-ft**
10′ wide by 32′ long by 2′ deep.
(10′ x 32′ x 2′) x 95% void space = 608 cu-ft Volume Provided
A MWS-L-4-4 has a 2280 cu-ft Drain Down @ 48 hours.

**DMA D-1 & D-2 = 3041.1 cu-ft**
10′ wide by 162′ long by 2′ deep.
(10′ x 162′ x 2′) x 95% void space = 3078 cu-ft Volume Provided
A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

# BIO-TREATMENT BMP's EXHIBIT & TABLE

### IV.3.5 Hydromodification Control BMPs

Hydromodification BMPs are required for this site as the 2-year, 24-hour pre-developed site has a lower peak flow and higher time of concentration than the 2-year, 24-hour post-developed site. A combination of hydromodification control BMPs will be utilized for this project. This project will utilized Proprietary Bio-treatment BMP's (Modular Wetlands Linear System) with underground detention and an infiltration basin to match the pre and post development volumes and flowrates, thereby controlling hydromodification/hydrologic conditions of concern. A "Drainage Analysis" report has been prepared for this project, to demonstrate compliance with the requirements of the Orange County Drainage Area Management Plan.

| Hydromodification Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| Infiltration Basin | Infiltration BMP's are LID BMPs that capture, store and infiltrate stormwater runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. These types of BMPs may also lose some water to evapotranspiration, but are characterized by having their most dominant volume losses due to infiltration. |
| Biotreatment BMP's | Biotreatment BMPs are a broad class of LID BMPs that reduce stormwater volume to the maximum extent practicable, treat stormwater using a suite of treatment mechanisms characteristic of biologically active systems, and discharge water to the downstream storm drain system or directly to receiving waters. Treatment mechanisms include media filtration (through biologically-active media), vegetative filtration (straining, sedimentation, interception and stabilization of particles resulting from shallow flow through vegetation), general sorption processes, biologically-mediated transformations, and other processes to address both suspended and dissolved constituents. |
| Proprietary Biotreatment | Proprietary Biotreatment falls under the category of Biotreatment BMP's. See above. |
| Detention Basins | Volume based BMP. |

This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both pre and post development volume calculations. The resultant files are included in Attachment B. These files have been added together to generate a **total** pre- and post-project volume as shown in the table in Section II.3. **Pre = 0.76 ac-ft or 33,106 cu-ft** & **Post = 1.10 ac-ft or 47,916 cu-ft.** The pre- and post-project volumes have been broken down by percentage based on each individual DMA's. The volume of each DMA has been pro-rated based on the individual DMA's area divided by the total project area. The calculations are shown on the following pages.

## 2 YEAR 24 HOUR CALCULATIONS

Given: Total Acres for all DMA's – 28.81 acres
Pre-development Total Volume – 33,106 cu-ft (From AES Files)
Post-development Total Volume – 47,916 cu-ft (From AES Files)

Calculations:

DMA A-1
DMA A-1 = 0.77 ac
0.77 ac/28.81 ac = 0.0267
Pre = 0.0267 x 33,106 cu-ft = **883.9 cu-ft**
Post = 0.0267 x 47,916 cu-ft = **1,279.4 cu-ft**

DMA A-2
DMA A-2 = 0.52 ac
0.52 ac/28.81 ac = 0.0180
Pre = 0.0180 x 33,106 cu-ft = **595.9 cu-ft**
Post = 0.0180 x 47,916 cu-ft = **862.5 cu-ft**

DMA A-3
DMA A-3 = 0.38 ac
0.38 ac/28.81 ac = 0.0132
Pre = 0.0132 x 33,106 cu-ft = **437.0 cu-ft**
Post = 0.0132 x 47,916 cu-ft = **632.5 cu-ft**

DMA A-4
DMA A-4 = 1.11 ac
1.11 ac/28.81 ac = 0.0385
Pre = 0.0385 x 33,106 cu-ft = **1,274.6 cu-ft**
Post = 0.0385 x 47,916 cu-ft = **1,844.8 cu-ft**

DMA A-5
DMA A-5 = 0.73 ac
0.73 ac/28.81 ac = 0.0253
Pre = 0.0253 x 33,106 cu-ft = **837.6 cu-ft**
Post = 0.0253 x 47,916 cu-ft = **1,212.3 cu-ft**

DMA A-6
DMA A-6 = 1.80 ac
1.80 ac/28.81 ac = 0.0625
Pre = 0.0625 x 33,106 cu-ft = **2,069.1 cu-ft**
Post = 0.0625 x 47,916 cu-ft = **2,994.8 cu-ft**

DMA A-7
DMA A-7 = 1.89 ac
1.89 ac/28.81 ac = 0.0656
Pre = 0.0656 x 33,106 cu-ft = **2,171.8 cu-ft**
Post = 0.0656 x 47,916 cu-ft = **3,143.3 cu-ft**

DMA A-8
DMA A-8 = 1.61 ac
1.61 ac/28.81 ac = 0.0559
Pre = 0.0559 x 33,106 cu-ft = **1,850.6 cu-ft**
Post = 0.0559 x 47,916 cu-ft = **2,678.5 cu-ft**

DMA A-9
DMA A-9 = 0.89 ac
0.89 ac/28.81 ac = 0.0309
Pre = 0.0309 x 33,106 cu-ft = **1,023.0 cu-ft**
Post = 0.0309 x 47,916 cu-ft = **1,480.6 cu-ft**

DMA A-10
DMA A-10 = 0.68 ac
0.68 ac/28.81 ac = 0.0236
Pre = 0.0236 x 33,106 cu-ft = **781.3 cu-ft**
Post = 0.0236 x 47,916 cu-ft = **1,130.8 cu-ft**

DMA A-11
DMA A-11 = 1.47 ac
1.47 ac/28.81 ac = 0.0510
Pre = 0.0510 x 33,106 cu-ft = **1,688.4 cu-ft**
Post = 0.0510 x 47,916 cu-ft = **2,443.7 cu-ft**

DMA A-12
DMA A-12 = 0.82 ac
0.82 ac/28.81 ac = 0.0285
Pre = 0.0285 x 33,106 cu-ft = **943.5 cu-ft**
Post = 0.0285 x 47,916 cu-ft = **1,365.6 cu-ft**

DMA A-13
DMA A-13 = 0.57 ac
0.57 ac/28.81 ac = 0.0198
Pre = 0.0198 x 33,106 cu-ft = **655.5 cu-ft**
Post = 0.0198 x 47,916 cu-ft = **948.7 cu-ft**

DMA A-14
DMA A-14 = 0.62 ac
0.62 ac/28.81 ac = 0.0215
Pre = 0.0215 x 33,106 cu-ft = **711.8 cu-ft**
Post = 0.0215 x 47,916 cu-ft = **1,030.2 cu-ft**

DMA A-15
DMA A-15 = 0.23 ac
0.23 ac/28.81 ac = 0.0080
Pre = 0.0080 x 33,106 cu-ft = **264.8 cu-ft**
Post = 0.0080 x 47,916 cu-ft = **383.3 cu-ft**

DMA A-16
DMA A-16 = 1.26 ac
1.26 ac/28.81 ac = 0.0437
Pre = 0.0437 x 33,106 cu-ft = **1,446.7 cu-ft**
Post = 0.0437 x 47,916 cu-ft = **2,093.9 cu-ft**

DMA A-17
DMA A-17 = 1.10 ac
1.10 ac/28.81 ac = 0.0382
Pre = 0.0382 x 33,106 cu-ft = **1,264.6 cu-ft**
Post = 0.0382 x 47,916 cu-ft = **1,830.4 cu-ft**

DMA A-18
DMA A-18 = 0.69 ac
0.69 ac/28.81 ac = 0.0240
Pre = 0.0240 x 33,106 cu-ft = **794.5 cu-ft**
Post = 0.0240 x 47,916 cu-ft = **1,150.0 cu-ft**

DMA A-19
DMA A-19 = 0.19 ac
0.19 ac/28.81 ac = 0.0066
Pre = 0.0066 x 33,106 cu-ft = **218.5 cu-ft**
Post = 0.0066 x 47,916 cu-ft = **316.2 cu-ft**

DMA A-20
DMA A-20 = 0.12 ac
0.12 ac/28.81 ac = 0.0042
Pre = 0.0042 x 33,106 cu-ft = **139.0 cu-ft**
Post = 0.0042 x 47,916 cu-ft = **201.2 cu-ft**

DMA B-1
DMA B-1 = 0.36 ac
0.36 ac/28.81 ac = 0.0125
Pre = 0.0125 x 33,106 cu-ft = **413.8 cu-ft**
Post = 0.0125 x 47,916 cu-ft = **599.0 cu-ft**

DMA B-2
DMA B-2 = 0.45 ac
0.45 ac/28.81 ac = 0.0156
Pre = 0.0156 x 33,106 cu-ft = **516.5 cu-ft**
Post = 0.0156 x 47,916 cu-ft = **747.5 cu-ft**

DMA B-3
DMA B-3 = 1.18 ac
1.18 ac/28.81 ac = 0.0410
Pre = 0.0410 x 33,106 cu-ft = **1,357.3 cu-ft**
Post = 0.0410 x 47,916 cu-ft = **1,964.6 cu-ft**

DMA B-4
DMA B-4 = 1.17 ac
1.17 ac/28.81 ac = 0.0406
Pre = 0.0406 x 33,106 cu-ft = **1,344.1 cu-ft**
Post = 0.0406 x 47,916 cu-ft = **1,945.4 cu-ft**

DMA C-1
DMA C-1 = 0.91 ac
0.91 ac/28.81 ac = 0.0316
Pre = 0.0316 x 33,106 cu-ft = **1,046.1 cu-ft**
Post = 0.0316 x 47,916 cu-ft = **1,514.1 cu-ft**

DMA C-2
DMA C-2 = 3.53 ac
3.53 ac/28.81 ac = 0.1225
Pre = 0.1225 x 33,106 cu-ft = **4,055.5 cu-ft**
Post = 0.1225 x 47,916 cu-ft = **5,869.7 cu-ft**

DMA C-3
DMA C-3= 0.97 ac
0.97 ac/28.81 ac = 0.0337
Pre = 0.0337 x 33,106 cu-ft = **1,115.7 cu-ft**
Post = 0.0337 x 47,916 cu-ft = **1,614.8 cu-ft**

DMA C-4
DMA C-4= 0.29 ac
0.29 ac/28.81 ac = 0.0101
Pre = 0.0101 x 33,106 cu-ft = **334.4 cu-ft**
Post = 0.0101 x 47,916 cu-ft = **484.0 cu-ft**

DMA C-5
DMA C-5= 0.67 ac
0.67 ac/28.81 ac = 0.0233
Pre = 0.0233 x 33,106 cu-ft = **771.4 cu-ft**
Post = 0.0233 x 47,916 cu-ft = **1,116.4 cu-ft**

DMA C-6
DMA C-6= 0.29 ac
0.29 ac/28.81 ac = 0.0101
Pre = 0.0101 x 33,106 cu-ft = **334.4 cu-ft**
Post = 0.0101 x 47,916 cu-ft = **484.0 cu-ft**

DMA D-1
DMA D-1 = 0.17 ac
0.17 ac/28.81 ac = 0.0059
Pre = 0.0059 x 33,106 cu-ft = **195.3 cu-ft**
Post = 0.0059 x 47,916 cu-ft = **282.7 cu-ft**

DMA D-2
DMA D-2 = 1.37 ac
1.37 ac/28.81 ac = 0.0476
Pre = 0.0476 x 33,106 cu-ft = **1,575.8 cu-ft**
Post = 0.0476 x 47,916 cu-ft = **2,280.8 cu-ft**

# HYDROMODIFICATION BMP EXHIBIT & TABLE

### IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub Regional LID BMPs are not applicable for the project.

### IV.3.7 Treatment Control BMPs

Infiltration BMP's and Proprietary Biotreatment BMP's have been sized for the DCV for this project, and therefore Treatment Control BMP's are not required.

| Treatment Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## IV.3.8 Non-structural Source Control BMPs

| Non-Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| N1 | Education for Property Owners, Tenants and Occupants | ☒ | ☐ | |
| N2 | Activity Restrictions | ☒ | ☐ | |
| N3 | Common Area Landscape Management | ☒ | ☐ | |
| N4 | BMP Maintenance | ☒ | ☐ | |
| N5 | Title 22 CCR Compliance (How development will comply) | ☐ | ☒ | This project is a multi-family development. |
| N6 | Local Industrial Permit Compliance | ☐ | ☒ | Local agency does not have a local industrial permit applicable for the project. |
| N7 | Spill Contingency Plan | ☐ | ☒ | The project will not have bulk storage of liquids. |
| N8 | Underground Storage Tank Compliance | ☐ | ☒ | The project is not proposing the use of storage tanks. |
| N9 | Hazardous Materials Disclosure Compliance | ☐ | ☒ | This project is a multi-family development. |
| N10 | Uniform Fire Code Implementation | ☐ | ☒ | This project is a multi-family development. |
| N11 | Common Area Litter Control | ☒ | ☐ | |
| N12 | Employee Training | ☐ | ☒ | The project does not have individual businesses. |
| N13 | Housekeeping of Loading Docks | ☐ | ☒ | The project does not have loading docks. |
| N14 | Common Area Catch Basin Inspection | ☒ | ☐ | |
| N15 | Street Sweeping Private Streets and Parking Lots | ☒ | ☐ | |
| N16 | Retail Gasoline Outlets | ☐ | ☒ | This project does not contain Retail Gasoline Outlets. |

*N1-Education for property Owners, Tenants and occupants*

Education materials will be provided to homeowners at close of escrow by owner/developer and periodically thereafter by the Home Owners Association (HOA) to inform homeowners of their potential impacts to downstream water quality. Materials include those described in Section VII of this WQMP and provided in Attachment A of this WQMP. Additional education material may be found in the following website: http://www.ocwatershed.com/PublicEd/resources/business-brochures.html

*N2-Activity Restrictions*

Activity restrictions to minimize potential impacts to water quality and with the purpose of protecting water quality will be prescribed by the project's Covenant, Conditions and Restrictions (CC&R's), or other equally effective measure. These may include restrictions or guideline for activities such as home repair/painting, landscaping, vehicle washing/repair, proper disposal of residential waste and chemical/fluids.

*N3-Common Area Landscape Management*

Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.

All maintenance must be consistent with the County of Orange requirements. Proper maintenance practices should help reduce and/or eliminate pollution from pesticides, nutrients, trash/debris and sediments. The project common area landscape maintenance should be consistent with the documents included in Attachment A.

*N4-BMP Maintenance*

BMP maintenance, implementation schedules and responsible parties are included with each specific BMP narrative in section V.

*N11-Common area litter control*

The homeowners or a HOA will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The homeowners or a HOA may contract with their landscape maintenance firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations for investigation.

*N14-Common area catch basin inspection*

The homeowners or a HOA must ensure that the on-site drain inlets, grates, and drain pipes will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year). As required by the Technical Guidance Document, at least 80% of the project's private drainage facilities must be inspected,

cleaned/maintained annually, with 100% of facilities inspected and maintained within a two-year period.

*N15-Street Sweeping Private Streets and Parking Lots*

The homeowners or a HOA must sweep outdoor streets regularly (minimum monthly), and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are streets or driveways/drive isles are to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer).

## IV.3.9 Structural Source Control BMPs

| Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| S1 | Provide storm drain system stenciling and signage | ☒ | ☐ | |
| S2 | Design and construct outdoor material storage areas to reduce pollution introduction | ☐ | ☒ | This project is a multi-family development. |
| S3 | Design and construct trash and waste storage areas to reduce pollution introduction | ☒ | ☐ | |
| S4 | Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control | ☒ | ☐ | |
| S5 | Protect slopes and channels and provide energy dissipation | ☐ | ☒ | The site is relatively flat. Slopes adjacent to the site are the responsibility of others. |
| | Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit) | ☐ | ☒ | This project is not located within the San Diego Regional Water Quality Control Board. |
| S6 | Dock areas | ☐ | ☒ | This project is a multi-family development. |
| S7 | Maintenance bays | ☐ | ☒ | This project is a multi-family development. |
| S8 | Vehicle wash areas | ☐ | ☒ | This project is a multi-family development. |
| S9 | Outdoor processing areas | ☐ | ☒ | This project is a multi-family development. |
| S10 | Equipment wash areas | ☐ | ☒ | This project is a multi-family development. |

| | | | | |
|---|---|---|---|---|
| S11 | Fueling areas | ☐ | ☒ | This project is a multi-family development. |
| S12 | Hillside landscaping | ☐ | ☒ | The site is relatively flat. Hillsides adjacent to the site are the responsibility of others. |
| S13 | Wash water control for food preparation areas | ☐ | ☒ | This project is a multi-family development. |
| S14 | Community car wash racks | ☐ | ☒ | Community car wash racks are not proposed for this project. |

*S1-Provide storm drain system stenciling and signage*

All catch basins/inlets/outlets on site must be marked using the County's "No Dumping – Drains to Ocean" curb marker or stenciled. An approved stencil shall be used to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the homeowners or a HOA. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.

*S3-Design and construct trash and waste storage areas to reduce pollution introduction*

The homeowners or a HOA shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The homeowners or a HOA will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The homeowners or a HOA shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The homeowners or a HOA will observe and damage to the trash enclosure wall and any discharge from the trash storage area.

*S4-Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control*

All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.

## IV.4 Alternative Compliance Plan (If Applicable)

### IV.4.1 Water Quality Credits

| Description of Proposed Project | | | | |
|---|---|---|---|---|
| Project Types that Qualify for Water Quality Credits (Select all that apply): | | | | |
| ☐Redevelopment projects that reduce the overall impervious footprint of the project site. | ☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped. | | ☒ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance). | |
| ☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution). | | ☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned | | ☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping). |
| ☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses. | ☐ Developments in a city center area. | ☐ Developments in historic districts or historic preservation areas. | ☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories. | ☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas. |
| Calculation of Water Quality Credits (if applicable) | | | | |

### IV.4.2 Alternative Compliance Plan Information

None

# Section V Inspection/Maintenance Responsibility for BMPs

The responsible party of inspection and Maintenance for the plan will be the project owner. The "Owner" as referred below is Orange County Public Works and their information is listed below:

Orange County Public Works
County Executive Office – Land Development
445 Civic Center Drive West, 2nd Floor
Santa Ana, CA

The owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification or other equally effective measure. The certification shall verify that the inspection and maintenance of all BMPs are performed in accordance with the requirements of this WQMP.

| BMP Inspection/Maintenance | | | |
|---|---|---|---|
| **BMP** | **Reponsible Party(s)** | **Inspection/ Maintenance Activities Required** | **Minimum Frequency of Activities** |
| Non-Structural Source Control BMPs | | | |
| N1 – Education for Property Owners, Tenants and Occupants | Homeowners/ HOA | Educational materials will be provided to homeowners at close of escrow by the developer and thereafter on an annual basis by the HOA. Materials shall include those shown in Section VII and provided in Attachment A of this WQMP. | At close of escrow and annually |
| N2 – Activity Restrictions | Homeowners/ HOA | The Owner will prescribe activity restrictions to protect surface water quality, through a Covenant, Conditions and Restrictions (CC&Rs) agreement, or other equally effective measure, for the property. Upon takeover of the site responsibilities by the HOA. The HOA shall be responsible for ensuring residents compliance. | Ongoing |

| | | | |
|---|---|---|---|
| N3 – Common Area Landscape Management | Homeowners/ HOA | Maintenance shall be consistent with County requirements; any fertilizer and/or pesticide usage shall be consistent with County guidelines for use of fertilizers and pesticides (OC DAMP Section 5.5). Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis. Trimmings, clippings, and other waste shall be properly disposed of off-site in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and drain inlets. | Weekly |
| N4 – BMP Maintenance | Homeowners/ HOA | Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP. Records of inspections and BMP maintenance shall be maintained by the responsible party and documented with the WQMP, and shall be available for review upon request. | Ongoing |
| N11 – Common Area Litter Control | Homeowners/ HOA | Litter patrol, violations investigation, reporting and other litter control activities shall be performed by the Owner/HOA in conjunction with maintenance activities for common areas. | Weekly |
| N14 – Common Area Catch Basin Inspection | Homeowners/ HOA | Catch basins inlets, area drains, curb-and-gutter systems and other drainage systems shall be inspected prior to Oct. 1st of each year and after large storm events. If necessary, drains shall be cleaned prior to any succeeding | Annual |

| | | | |
|---|---|---|---|
| | | rain events. 80% of private facilities shall be inspected and cleaned annually, with 100% of private facilities inspected and maintained within a 2-year period. | |
| N15 – Street Sweeping Private Streets | Homeowners/ HOA | Private streets and public streets shall be swept at a minimum of monthly, and prior to the start of the rainy season (Oct. 1st). | Monthly |
| Structural Source Control BMPs | | | |
| S1 – Provide Storm Drain System Stencilling and Signage | Homeowners/ HOA | Storm drain stencils shall be inspected for legibility, at a minimum, once prior to the storm season, no later than Oct. 1st each year. Those determined to be illegible will be re-stencilled as soon as possible. | Annual |
| S3 – Design and Construct Trash and Waste Storage Areas to Reduce Pollution Introduction | Homeowners/ HOA | The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owner will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owner shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owner will observe and damage to the trash enclosure wall and any discharge from the trash storage area. | Continually |
| S4 – Use Efficient Irrigation Systems & Landscape Design, Water | Homeowners/ HOA | In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting overspray to hardscape areas to be eliminated, and to verify that | Weekly |

| | | | |
|---|---|---|---|
| Conservation, Smart Controllers, and Source Control | | irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, day or night time temperatures based on system specifications and local climate patterns. | |
| Infiltration BMPs | | | |
| Infiltration Basins | HOA | Inspection/ Maintenance Activities will be updated with Final WQMP | Minimum Frequency of Activities will be updated with Final WQMP |
| Biotreatment BMPs | | | |
| Proprietary Biotreatment (Modular Wetlands) | HOA | Remove Trash from Screening Device. | Average maintenance interval is 6 to 12 months |
| | | Remove Sediment from Separation Chamber | Average maintenance interval is 12 to 24 months |
| | | Replace Cartridge Filter Media | Average maintenance interval is 12 to 24 months |
| | | Trim Vegetation | Average maintenance interval is 6 to 12 months |

| | | | |
|---|---|---|---|
| | | For more detailed information on "Inspection/ Maintenance Activities Required" refer to Maintenance Guidelines for Modular Wetlands System – Linear in Attachment F. | For more detailed information on "Minimum Frequency of Activities" refer to Maintenance Guidelines for Modular Wetlands System – Linear in Attachment F. |
| Treatment Control BMPs | | | |
| Proprietary Biotreatment | HOA | See Above | See Above |

# Section VI BMP Exhibit (Site Plan)

## VI.1 BMP Exhibit (Site Plan)

See the following page for the WQMP Plot Plan.

## VI.2 Submittal and Recordation of Water Quality Management Plan

Upon approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) will be submitted. In addition, these documents will be submitted in a PDF format.

# Section VII Educational Materials

| Education Materials | | | |
|---|---|---|---|
| **Residential Material (http://www.ocwatersheds.com)** | **Check If Applicable** | **Business Material (http://www.ocwatersheds.com)** | **Check If Applicable** |
| The Ocean Begins at Your Front Door | ☒ | Tips for the Automotive Industry | ☐ |
| Tips for Car Wash Fund-raisers | ☒ | Tips for Using Concrete and Mortar | ☐ |
| Tips for the Home Mechanic | ☒ | Tips for the Food Service Industry | ☐ |
| Homeowners Guide for Sustainable Water Use | ☒ | Proper Maintenance Practices for Your Business | ☐ |
| Household Tips | ☒ | **Other Material** | **Check If Attached** |
| Proper Disposal of Household Hazardous Waste | ☒ | | |
| Recycle at Your Local Used Oil Collection Center (North County) | ☐ | R-1 AUTOMOBILE REPAIR AND MAINTENANCE | ☒ |
| Recycle at Your Local Used Oil Collection Center (Central County) | ☐ | R-2 AUTOMOBILE WASHING | ☒ |
| Recycle at Your Local Used Oil Collection Center (South County) | ☒ | R-3 AUTOMOBILE PARKING | ☒ |
| Tips for Maintaining a Septic Tank System | ☐ | R-4 HOME AND GARDEN CARE ACTIVITIES | ☒ |
| Responsible Pest Control | ☒ | R-5 DISPOSAL OF PET WASTES | ☒ |
| Sewer Spill | ☒ | R-6 DISPOSAL OF GREEN WASTES | ☒ |
| Tips for the Home Improvement Projects | ☒ | R-7 HOUSEHOLD HAZARDOUS WASTE | ☒ |
| Tips for Horse Care | ☐ | R-8 WATER CONSERVATION | ☒ |
| Tips for Landscaping and Gardening | ☒ | FP-2 LANDSCAPE MAINTENANCE | ☒ |
| Tips for Pet Care | ☒ | FP-3 ROADS, STREETS, AND HIGHWAYS OPERATION AND MAINTENANCE | ☒ |
| Tips for Pool Maintenance | ☒ | FP-4 SIDEWALK, PLAZA, AND FOUTAIN MAINTENANCE AND CLEANING | ☒ |
| Tips for Residential Pool, Landscape and Hardscape Drains | ☒ | | ☐ |
| Tips for Projects Using Paint | ☒ | | ☐ |

# Attachment A

# Educational Materials

# Attachment B

# -Hydrology Maps,

# -HCOC Backup Calculations

# - Modular Wetlands Unit 48 Hour Draw Down Volumes

# Attachment C

# Supporting Maps and Exhibits

**-Watershed Map for Newport Bay**

**-Base Map of Drainage Facilities in Orange County**

**-Rainfall zones (Figure XVI-1)**

**-Susceptibility Analysis Newport Bay – Newport Coastal Streams**

**-North OC Ground Water Protection Areas**

**-2010 CA 303(d) List of Water Quality Limited Segments**

# Attachment D

# OC- Specific Design Criteria and Considerations & BMP Information and Details

# Attachment E

## -Infiltration Feasibility Worksheet

## -Summary of Harvested Water Demand and Feasibility Worksheet

## -Soils Report Information (Percolation and Infiltration Testing)

# Attachment F

# Operations and Maintenance (O&M) & Inspection Form

(Section to be updated with Final WQMP)

# Attachment G

# Conditions of Approval

(Section to be updated with Final WQMP)

# Attachment H

# California Department of Public Health

## Regulations Related to Recycled Water – June 2014

# Attachment I

# 25-yr & 100-yr Hydrograph and Basin Stage-Storage Curve

**WQ XX-XXXX**

# CONCEPTUAL
# County of Orange/Santa Ana Region Priority Project Water Quality Management Plan (WQMP)

**Project Name:**

**WESTERN ALTON PARCEL – SOUTHERN PARCEL**

**IRVINE BOULEVARD**

**IRVINE, CA 92618**

**Prepared for:**

**Orange County Public Works**

**County Executive Office – Land Development**

**445 Civic Center Drive West, 2nd Floor**

**Santa Ana, CA**

**Prepared by:**

**Tait & Associates, Inc.**

**701 N. Parkcenter Drive**

**Santa Ana, CA 92705**

**714-560-8200**

**Prepared: August 7, 2015**

**Revised: February 3, 2016**

**County of Orange**
**Orange County Public Works - Grading Section**
**300 North Flower Street - P.O. Box 4048**
**Santa Ana, California 92702-4048** **(714) 667-8871**

# OC Great Park

**C-WQMP**

## Conceptual WQMP
## REVIEW SHEET

**Permits Numbers: TBD**

| ***Plan Date*** | ***Date Received*** | ***Date Reviewed*** | ***Plan Check Status*** |
|---|---|---|---|
| 02/03/2016 | 02/18/2016 | 03/09/2016 | Approval |

**By the Consulting Firm: Tait & Associates, Inc. (714) 560-8200**
**Project: Western Alton Parcel – Southern Parcel**
Site Address: OC Great Park, Irvine, CA 90242
APN: 591-073-20, 591-073-19, 591-121-01
**Civil Engineer: Todd Schmieder,** tschmieder@tait.com

Developer/Owner: OCPW, CEO - Land Development
Address: 445 Civic Center Drive West, 2nd Floor
**Contact: Eric Hull**, eric.hull@ocpw.ocgov.com
Tel: (714) 667-8833, Cell: (714) 415-8099

**The Conceptual WQMP was approved based on the conditions below:**

**I. Project Site Condition:**
Project Area: 10.34 acres – Planned Community of Multi-Family Residential Units.
Impervious Area: 6.72 acres (65%)
Pervious Area: 3.62 acres (35%)
Priority Project Category: New development greater than 10,000 square feet.

**II. Proposed BMPs:**
1. Bio-treatment & Hydromodification BMPs for Development Site:
   a) BIO-1: Bio-retention with underdrain (Cudo Water Storage System) for Hydromodification and LID/DCV.
   b) BlO-7: proprietary vegetated bio-treatment system (Modular Wetland System MWS Units).
   c) Infiltration/Detention Basin BMP (INF) for Hydromodification and LID/DCV.

The details of the proposed BMP is to be determined in future permit application.

**III. Approval:**
The locations, section details, and the treatment areas of the above BMPs as shown in the WQMP Exhibit were reasonable and adequate to meet the water quality and hydromodification requirements set forth in, Order No. R8-2009-0030 /NPDES No. CAS618030, of Santa Ana Regional Water Quality Control Board. The above referenced conceptual WQMP was approved.

**Report Reviewed by:** J T Yean **Date: 03-09-2016**
J.T. Yean, Civil Engineer

| Project Owner's Certification | | | |
|---|---|---|---|
| Planning Application No. (If applicable) | T.B.D. | Grading Permit No. | T.B.D. |
| Tract/Parcel Map and Lot(s) No. | Lot 299, Block 174, M.B. 1/88 | Building Permit No. | T.B.D. |
| Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers) | | | Address: T.B.D.<br>APN: 591-073-20, 591-073-19, 591-121-01 |

This Water Quality Management Plan (WQMP) has been prepared for Orange County Public Works by Tait & Associates, Inc. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

| **Owner:** | | | |
|---|---|---|---|
| Title | County of Orange | | |
| Company | County Executive Office – Land Development | | |
| Address | 445 Civic Dr. West, 2nd Floor, Santa Ana, CA | | |
| Email | T.B.D. | | |
| Telephone # | 714-667-9673 | | |
| I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein. | | | |
| Owner Signature | | Date | |

| **Preparer (Engineer): Todd Schmieder** | | | |
|---|---|---|---|
| Title | Project Manager | PE Registration # | C37167 |
| Company | Tait & Associates | | |
| Address | 701 N. Parkcenter Drive, Santa Ana, CA 92705 | | |
| Email | tschmieder@tait.com | | |
| Telephone # | 714-560-8200 | | |
| I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board. | | | |
| Preparer Signature | | Date | |
| Place Stamp Here | | | |

# Contents

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**Section III** Site Description ..... 9
**Section IV** Best Management Practices (BMPs) ..... 13
**Section V** Inspection/Maintenance Responsibility for BMPs ..... 35
**Section VI** BMP Exhibits (Site Plan) ..... 40
**Section VII** Educational Materials ..... 41

## Attachments

**Attachment A** . ..... Educational Materials

**Attachment B** ..... Hydrology Maps, HCOC Backup Calculations (2yr, 24hr AES files), Modular Wetlands Unit 48 Hour Draw Down Volumes

**Attachment C** ..... Supporting Maps & Exhibits

**Attachment D** ..... OC-Specific Design Criteria and Considerations & Proprietary BMP information and details

**Attachment E** ..... Infiltration Feasibility worksheet/Summary of Harvested Water Demand and Feasibility Worksheet/Soils Report Information

**Attachment F** ..... Operations and Maintenance (O&M) & Inspection Form

**Attachment G** ..... Conditions of Approval

**Attachment H** ..... California Department of Public Health Regulations

**Attachment I** ..... 25-yr & 100-yr Hydrograph and Basin Stage-Storage Curve

# Section I Permit(s) and Water Quality Conditions of Approval or Issuance

| Project Infomation | | | |
|---|---|---|---|
| Permit/Application No. (If applicable) | T.B.D. | Grading or Building Permit No. (If applicable) | T.B.D. |
| Address of Project Site (or Tract Map and Lot Number if no address) and APN | Lot 299, Block 174, M.B. 1/88<br>APN: 591-073-20, 591-073-19, 591-121-01 | | |

| Water Quality Conditions of Approval or Issuance | |
|---|---|
| Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.) | Conditions of Approval have not yet been applied. |

| Conceptual WQMP | |
|---|---|
| Was a Conceptual Water Quality Management Plan previously approved for this project? | No. |

| Watershed-Based Plan Conditions | |
|---|---|
| Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS. | Borrego Creek – No TMDLs<br>San Diego Creek/Newport Bay – Sediment, Nutrient, Toxics, Fecal Coliform |

# Section II Project Description

## II.1 Project Description

| Description of Proposed Project | | | | |
|---|---|---|---|---|
| Development Category (From Model WQMP, Table 7.11-2; or -3): | This project is considered a priority project under the following categories:<br>Category 1 – New development projects that create 10,000 square feet or more of impervious surface (collectively over the entire site). This category includes commercial, industrial, residential, mixed-use, and public projects on private, or public, property that falls under the planning and building authority or the Permittees. | | | |
| Project Area (ft²): 450,410 | Number of Dwelling Units: T.B.D. | | SIC Code: N.A. for Residential | |
| Project Area | Pervious | | Impervious | |
| | Area (acres or sq ft) | Percentage | Area (acres or sq ft) | Percentage |
| Pre-Project Conditions | 9.31 ac | 90% | 1.03 ac | 10% |
| Post-Project Conditions | 3.62 ac | 35% | 6.72 ac | 65% |
| Drainage Patterns/Connections | The proposed drainage pattern will follow the existing drainage pattern. The 10.34 acres of proposed development will direct runoff westward through a storm drain system to several on-site detention basins. The on-site basins will eventually discharge to the existing 30-inch RCP in Irvine Boulevard that is currently serving the site. | | | |

| | |
|---|---|
| Narrative Project Description:<br>(Use as much space as necessary.) | The proposed construction involves the development of approximately 10.34 acres for a planned community of multifamily dwelling units. |

## II.2 Potential Stormwater Pollutants

Based on Table 2.1 "Anticipated and Potential Pollutants Generated by Land Use Type" in the Technical Guidance Document, under the category of Attached and Detached Residential Development, the pollutants of concerns are listed below.

| **Pollutants of Concern** | | | |
|---|---|---|---|
| Pollutant | Check One for each: E=Expected to be of concern N=Not Expected to be of concern | | Additional Information and Comments |
| Suspended-Solid/ Sediment | E ☒ | N ☐ | |
| Nutrients | E ☒ | N ☐ | |
| Heavy Metals | E ☐ | N ☒ | |
| Pathogens (Bacteria/Virus) | E ☒ | N ☐ | |
| Pesticides | E ☒ | N ☐ | |
| Oil and Grease | E ☒ | N ☐ | |
| Toxic Organic Compounds | E ☐ | N ☒ | |
| Trash and Debris | E ☒ | N ☐ | |

## II.3 Hydrologic Conditions of Concern

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below.

Per Section 2.2.3.1 in the TGD and the map provided in Appendix XVI, the project site is located in a potential area of erosion, habitat, & physical structure susceptibility due to the presence of an un-stabilized natural drainage channels downstream of the project area. See the HCOC map in Appendix C for project site and drainage channel locations.
The calculations shown on the following pages indicate that the post-development peak flow and runoff volume for the project will increase with the proposed improvements due to a decrease in the pervious area. Therefore the project has been determined to have HCOC's.

The results for the 2 year 24 hour storm event calculations for peak flows, time of concentrations and runoff volumes are as follows:

This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both pre and post development volume calculations. The resultant files are included in Attachment B. These files have been added together to generate a **total** pre- and post-project volume as shown in the table in this Section. **Pre = 0.26 ac-ft or 11,326 cu-ft** & **Post = 1.17 ac-ft or 50,965 cu-ft.** The total delta volume for HCOC is **39,639 cu-ft.** The calculations are shown in Section IV.3.5. For this project, the HCOC Volume exceeds the DCV.

| | **Total Area (acres)** | | **Peak Flow Rate (cfs)** | | **Time of Concentration (min.)** | | **Volume** | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Totals | **10.34** | **10.34** | **6.53** | **13.57** | **19.52** | **9.25** | **0.26 ac-ft Or 11,325.6 $ft^2$** | **1.17 ac-ft or 50,965.2 $ft^2$** |
| **Increase % or Amount** | **0** | | **108%** | | **-53%** | | **350%** | |

## II.4 Post Development Drainage Characteristics

The project site discharges to an existing 30-inch RCP located within Irvine Boulevard (a City of Irvine Public Street) and is tributary to the Borrego Canyon Channel which eventually joins the Agua Chinon Channel before discharging to the San Diego Creek and eventually the Upper Newport Bay.

The existing 30-inch RCP located within Irvine Boulevard receives runoff from 3 sources: the project site, a catch basin serving a 0.81 acre portion of Irvine Boulevard, and an interim Wild Life Corridor storm drain traversing through the site.

The 10.34 acres of proposed development will direct runoff westward through a storm drain system to several on-site detention basins. The on-site basins will eventually discharge to the existing 30-inch RCP in Irvine Boulevard that is currently serving the site.

## II.5 Property Ownership/Management

Orange County Public Works

County Executive Office – Land Development

445 Civic Center Drive West, 2nd Floor

Santa Ana, CA

# Section III Site Description

## III.1 Physical Setting

| | |
|---|---|
| Name of Planned Community/Planning Area (if applicable) | Western Alton Parcel – Southern Parcel |
| Location/Address | The project is located in the northeasterly quadrant of the former El Toro Marine Corps Air Station, northerly of the intersection of Alton Parkway and Irvine Blvd, within the City of Irvine, California. |
| | |
| General Plan Land Use Designation | T.B.D. |
| Zoning | T.B.D. |
| Acreage of Project Site | 10.34 |
| Predominant Soil Type | The project site location resides within the hydrology soil group A. |

## III.2 Site Characteristics

| Site Characteristics | |
|---|---|
| Precipitation Zone | The rainfall zone for the project has a design capture storm depth of 0.85″ based on the Rainfall zones map on the TGD figure XVI. |
| Topography | The topography of the project site is relatively flat with a gentle slope downward to the west with ground surface elevations ranging from +479 to +450 feet above mean sea level. A private paved service road (former Magazine Road) provides access to the. Located adjacent to Irvine Boulevard and at the lowest elevation on the site is a small detention pond lined with rip-rap that serves as the projects only existing storm improvement. Runoff discharging from the detention pond passes through a 30-inch RCP within a raised vertical headwall and discharges from the site to an existing 30-inch RCP located within Irvine Boulevard. |
| Drainage Patterns/Connections | The project site discharges to an existing 30-inch RCP located within Irvine Boulevard (a City of Irvine Public Street) and is tributary to the Borrego Canyon Channel which eventually joins the Agua Chinon Channel before discharging to the San Diego Creek and eventually the Upper Newport Bay.<br><br>The existing 30-inch RCP located within Irvine Boulevard receives runoff from 3 sources: the project site, a catch basin serving a 0.81 acre portion of Irvine Boulevard, and an interim Wild Life Corridor storm drain traversing through the site.<br><br>The 10.34 acres of proposed development will direct runoff westward through a storm drain system to several on-site detention basins. The on-site basins will eventually discharge to the existing 30-inch RCP in Irvine Boulevard that is currently serving the site. |
| Soil Type, Geology, and Infiltration Properties | The project site location resides within the hydrology soil group A. These soils have a low run-off potential and high infiltration rates even when thoroughly wetted. |
| Hydrogeologic (Groundwater) Conditions | The historic high groundwater was reported to be as shallow as 60 feet below the existing ground surface. |
| Geotechnical Conditions | Dense sand with isolated layers of stiff silt and clay. |

| | |
|---|---|
| (relevant to infiltration) | |
| Off-Site Drainage | No changes to the existing site drainage are anticipated. |
| Utility and Infrastructure Information | The proposed utilities will be located under asphaltic paving with surface drainage, infiltration impacting the subsurface utilities is not a concern for the proposed project. |

## III.3 Watershed Description

| | |
|---|---|
| Receiving Waters | Agua Chinon Channel<br>Borrego Canyon Wash<br>San Diego Creek Reach 2<br>San Diego Creek Reach 1<br>Newport Bay, Upper<br>Newport Bay, Lower |
| 303(d) Listed Impairments | Borrego Creek – Ammonia, Indicator Bacteria<br>San Diego Creek Reach 2 – Indicator Bacteria, Nutrients, Sedimentation/Siltation, Unknown Toxicity<br>San Diego Creek Reach 1 – Fecal Coliform, Nutrients, Pesticides, Sedimentation/Siltation, Selenium, Toxaphene<br>Newport Bay, Upper – Chlordane, Copper, DDT, Indicator Bacteria, Metals, Nutrients, PCBs, Pesticides, Sediment Toxicity, Sedimentation/Siltation<br>Newport Bay, Lower – Chlordane, Copper, DDT, Indicator Bacteria, Nutrients, PCBs, Pesticides, Sediment Toxicity |
| Applicable TMDLs | San Diego Creek/Newport Bay (Sediment, Nutrients, Toxics, Fecal Coliform |
| Pollutants of Concern for the Project | Suspended-Solid/ Sediment, Nutrients, Pathogens (Bacteria/Virus), Pesticides, Oil and Grease, Trash and Debris |
| Environmentally Sensitive and Special Biological Significant Areas | None |

# Section IV Best Management Practices (BMPs)

## IV. 1 Project Performance Criteria

| | | |
|---|---|---|
| (NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis? | YES ☐ | NO ☒ |
| If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities. | There are currently no applicable approved WHIMP's within the watershed for this project. | |

| Project Performance Criteria | |
|---|---|
| If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP) | Hydrologic Conditions of Concern are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts if either the post-development runoff volume or time of concentration for the 2-year, 24-hour storm exceeds the pre-development runoff volume or the time of concentration for the 2-year, 24-hour storm event by more than 5 percent.<br><br>This project is located within an area of hydrologic concern and will increase the peak flow and decrease the time of concentration for the storm event described above, therefore, this project is considered for Hydrologic Conditions of Concern.<br><br>For this project, HCOC for the **Stormwater Design Volume** is the controlling sizing standard as dictated in Appendix I of the Technical Guidance Document. The difference in runoff volume form the 2-year, 24-hour storm from the pre- to post-project **is** greater than the runoff volume from the 85th storm depth (Design Capture Volume, DCV) by at least 5 percent.<br><br>This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both pre and post development volume calculations. The resultant files are included in Attachment B.<br><br>HCOC will be mitigated through the use of underground detention basins to store the difference in runoff volumes with downstream Proprietary Bio-Treatment Units (Modular Wetlands). In addition, an Infiltration Basin will also detain runoff to serve as additional mitigation to address the project HCOC's. |
| List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP) | Where feasible, Infiltration BMP's will be utilized for the entire DCV/HCOC. Harvest and Reuse BMP's are not an option for this project. This project does not consist of enough landscape for irrigation reuse. In addition, dual plumbed recycled water systems are not accepted by the California State Health Department (See section 60313.General Requirements, attachment H for a copy of the "Regulations Related to Recycled Water"). "No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility." This project is a multi-family development and Evapotranspiration and Evaporation BMP's are not feasible. In location where Infiltration BMP's are not feasible, Proprietary Biotreatment BMP's with upstream underground detention will be utilized for this project. |

| | |
|---|---|
| List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP) | Infiltration BMP's and Proprietary Biotreatment BMP's will be utilized for the entire DCV/HCOC for this project. Treatment Control BMP's are not required. |
| Calculate LID design storm capture volume for Project. | <u>Project Information:</u><br>Imperviousness = 0.65%<br>d=0.85" ( See the "Rainfall Zones" Map in Attachment C)<br>See the following pages for calculations. The calculations have been broken down by Drainage Management Areas (DMA's). |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.83 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,639 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.28 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2,528 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-3)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.66 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,303 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA A-4)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.00 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,974 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA B-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.31 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 612 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA B-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.21 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 415 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.46 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 908 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.72 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,422 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-3)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.06 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 118 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-4)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.77 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,521 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-5)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.60 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,185 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-6)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.33 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2,626 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA C-7)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.19 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2,350 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA D-1)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.55 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,086 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

## Worksheet B: Simple Design Capture Volume Sizing Method (DMA D-2)

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.85 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.85 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.37 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.65 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.64 | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 731 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | N.A. | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | N.A. | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | N.A. | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | N.A. | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | N.A. | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | N.A. | sq-ft |

# DMA'S EXHIBIT & TABLE

## IV.2. Site Design and Drainage

The project site discharges to an existing 30-inch RCP located within Irvine Boulevard (a City of Irvine Public Street) and is tributary to the Borrego Canyon Channel which eventually joins the Agua Chinon Channel before discharging to the San Diego Creek and eventually the Upper Newport Bay.

The existing 30-inch RCP located within Irvine Boulevard receives runoff from 3 sources: the project site, a catch basin serving a 0.81 acre portion of Irvine Boulevard, and an interim Wild Life Corridor storm drain traversing through the site.

The 10.34 acres of proposed development will direct runoff westward through a storm drain system to several on-site detention basins. The on-site basins will eventually discharge to the existing 30-inch RCP in Irvine Boulevard that is currently serving the site.

## IV.3 LID BMP Selection and Project Conformance Analysis

### IV.3.1 Hydrologic Source Controls (HSCs)

| Name | Included? |
|---|---|
| Localized on-lot infiltration | ☐ |
| Impervious area dispersion (e.g. roof top disconnection) | ☐ |
| Street trees (canopy interception) | ☒ |
| Residential rain barrels (not actively managed) | ☐ |
| Green roofs/Brown roofs | ☐ |
| Blue roofs | ☐ |
| Impervious area reduction (e.g. permeable pavers, site design) | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Future calculations will be provided for Street Trees (canopy interception) upon final WQMP and landscape plans have been incorporated into the design.

## IV.3.2 Infiltration BMPs

Infiltration is not feasible for the entire project due to site location and infiltration infeasiblility. For DMA's C-1 through C-7, D-1, and D-2, and infiltration basin is proposed to treat/retain the delta 2-year 24-hour storm event (HCOC). In addition, see Attachment E "Infiltration Feasibility Worksheet". For DMA's A-1 through A-4, and B-1 and B-2 this project will utilize Proprietary Bio-treatment BMP's with upstream underground detention for the HCOC's.

| Name | Included? |
|---|---|
| Bioretention without underdrains | ☐ |
| Rain gardens | ☐ |
| Porous landscaping | ☐ |
| Infiltration planters | ☐ |
| Retention swales | ☐ |
| Infiltration trenches | ☐ |
| Infiltration basins | ☒ |
| Drywells | ☐ |
| Subsurface infiltration galleries | ☐ |
| French drains | ☐ |
| Permeable asphalt | ☐ |
| Permeable concrete | ☐ |
| Permeable concrete pavers | ☐ |
| Other: Underground Infiltration | ☐ |
| Other: | ☐ |

**Area's A-1 through A-4, and B-1 and B-2**

Currently the measured infiltration rate obtained from field testing taken within the location of DMA's A-1 through A-4, and B-1 and B-2is 0.3 in/hr. After a factor from the "Factor of safety and Design Infiltration Rate Worksheet" has been applied to the infiltration rate, the result is 0.07 in/hr. The minimum infiltration rate, from the Technical Guidance Document, is 0.3 in/hr. Further testing will be required if Infiltration BMP's will be utilized for DMA's A-1 through A-4, and B-1 and B-2.

**Area's C-1 through C-7, D-1, and D-2**

For this project, the HCOC Volume exceeds the DCV. The total delta volume for HCOC is **26,192.8 cu-ft.** Currently, there is insufficient data on the anticipated infiltration rate for this location, with a nearby measured rate of 3.6 in/hr approx. 520' away that resulted in a design rate of 0.85 in/hr. The minimum infiltration rate, from the Technical Guidance Document, is 0.3 in/hr. From the following pages, the required minimum footprint(s) for an infiltration basin for DMA's C-1 through C-7, D-1, and D-2 is **7,703 sq-ft** with a maximum depth of **3.4 ft** in order to maintain a drawdown time less than 48 hours. The current footprint for the infiltration basin is **9,032 sq-ft** with a ponding depth of **2.90 ft** will provide a total volume of **26,192.8 cu-ft** for infiltration exceeding the HCOC requirement. An infiltration basin is a possible option for these areas. Further percolation rate testing will be required in order to determine if an infiltration basin is a viable option for these areas.

For HCOC calculations, see Section IV.3.5. & the following pages for sizing of the Infiltration Basin.

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA C-1

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.46 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,763.9 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 518.8 | sq-ft |

## DMA C-1 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 608.24 sf
Volume provided = 1763.9 cu-ft

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA C-2

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.72 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2,758.9 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 811.4 | sq-ft |

## DMA C-2 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 951.34 sf
Volume provided = 2758.9 cu-ft

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA C-3

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.06 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 229.9 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 67.6 | sq-ft |

## DMA C-3 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 79.28 sf
Volume provided = 229.9 cu-f

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA C-4

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.77 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2,953.1 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 868.6 | sq-ft |

## DMA C-4 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 1018.31 sf
Volume provided = 2953.1 cu-f

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA C-5

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.60 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 5,299.1 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1558.6 | sq-ft |

## DMA C-5 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 1827.28 sf
Volume provided = 5299.1 cu-f

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA C-6

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.33 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 5,097.6 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1,499.3 | sq-ft |

## DMA C-6 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 1757.79 sf
Volume provided = 5097.6 cu-f

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA C-7

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 1.19 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 4,562.5 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 1,341.9 | sq-ft |

## DMA C-7 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 1573.28 sf
Volume provided = 4562.5 cu-f

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA D-1

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.55 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 2,108.8 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 620.2 | sq-ft |

## DMA D-1 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 727.17 sf
Volume provided = 2108.8 cu-f

## HCOC Volume Sizing Method ( Infiltration Basin) – DMA D-2

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 0.37 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 1,419.0 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 417.4 | sq-ft |

## DMA D-2 Contributory to Total Basin Size

Depth provided = 2.90ft
Footprint provided = 489.31 sf
Volume provided = 1419.0 cu-f

## HCOC Volume Sizing Method ( Infiltration Basin) – Total of all DMA's

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | N/A | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | N/A | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | N/A | inches |
| ***Step 2: HCOC*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 6.05 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | N/A | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | N/A | |
| 4 | Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$ | $V_{design}$= | 26,192.8 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the HCOC*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII) | $K_{measured}$= | 3.6 | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{final}$ (unitless) | $S_{final}$= | 4.25 | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$ | $K_{design}$= | 0.85 | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | 48 | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | 3.4 | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | 7,703.8 | sq-ft |

**<u>Total of All DMA's for Basin Size</u>**

Depth provided = 2.90ft
Footprint provided = 9032.00 sf
Volume provided = 26192.8 cu-f

# INFILTRATION BMP EXHIBIT & TABLE

## IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

| Name | Included? |
|---|---|
| All HSCs; *See Section IV.3.1* | ☐ |
| Surface-based infiltration BMPs | ☒ |
| Biotreatment BMPs | ☒ |
| Above-ground cisterns and basins | ☐ |
| Underground detention | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Evapotranspiration, Rainwater Harvesting BMPs are not proposed; however, the proposed Bio-treatment BMPs and Infiltration Basin may result in subsequent evapotranspiration. See section IV.3.2 & IV3.4. This project is a multi-family development and Evapotranspiration and Evaporation BMP's are not feasible.

Dual plumbed recycled water systems are not accepted by the California State Health Department (See section 60313.General Requirements, attachment E for a copy of the "Regulations Related to Recycled Water"). "No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility."

Rainwater harvest for irrigation reuse is no feasible for this project due to the landscape area required. Per the TGD, the site requires 6.25 acres of landscape area for irrigation reuse, but only has an effective area of 3.62 Acres provided.

See Attachment E: Summary of Harvested Water Demand and Feasibility" for calculations.

## IV.3.4 Biotreatment BMPs

For DMA's A-1 through A-4, B-1, and B-2, this project will utilize Proprietary Bio-treatment BMP's (Modular Wetlands Linear System) with underground detention for the HCOC Volume for this project. HCOC is the governing volume for this project.

| Name | Included? |
|---|---|
| Bioretention with underdrains | ☐ |
| Stormwater planter boxes with underdrains | ☐ |
| Rain gardens with underdrains | ☐ |
| Constructed wetlands | ☐ |
| Vegetated swales | ☐ |
| Vegetated filter strips | ☐ |
| Proprietary vegetated biotreatment systems | ☒ |
| Wet extended detention basin | ☐ |
| Dry extended detention basins | ☐ |
| Other: | ☐ |
| Other: | ☐ |

DMA's A-1 through A-4, B-1, and B-2 have been designed to capture the HCOC. For HCOC calculations, see Section IV.3.5. Modular Wetland Unit 48 hour Draw Down Volumes are shown in Attachment B. These DMA's will utilize a proprietary bioretention system (Modular Wetlands Linear System). The HCOC will be captured by a CUDO storage system. This system has 95% void space. See storage calculations below.

**HCOC RESULTS:**

**DMA A-1 = 3183.0 cu-ft**
20′ wide by 84′ long by 2′ deep.
(20′ x 84′ x 2′) x 95% void space = 3192 cu-ft Volume Provided
A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

**DMA A-2 = 4907.3 cu-ft**
20′ wide by 130′ long by 2′ deep.
(20′ x 130′ x 2′) x 95% void space = 4940 cu-ft Volume Provided
A MWS-L-4-8 has a 5036 cu-ft Drain Down @ 48 hours.

**DMA A-3 = 2529.0 cu-ft**
20′ wide by 68′ long by 2′ deep.
(20′ x 68′ x 2′) x 95% void space = 2584 cu-ft Volume Provided
A MWS-L-4-6 has a 3200 cu-ft Drain Down @ 48 hours.

**DMA A-4 = 3833.1 cu-ft**
**DMA B-1 = 1189.2 cu-ft**
**DMA B-2 = 804.7 cu-ft**
**DMA Total = 5826.8 cu-ft**
40′ wide by 80′ long by 2′ deep.
(40′ x 80′ x 2′) x 95% void space = 6080 cu-ft Volume Provided
A MWS-L-4-13 has a 6261 cu-ft Drain Down @ 48 hours.

# BIO-TREATMENT BMP's EXHIBIT & TABLE

### IV.3.5 Hydromodification Control BMPs

Hydromodification BMPs are required for this site as the 2-year, 24-hour pre-developed site has a lower peak flow and higher time of concentration than the 2-year, 24-hour post-developed site. A combination of hydromodification control BMPs will be utilized for this project. This project will utilized Proprietary Bio-treatment BMP's (Modular Wetlands Linear System) with underground detention and an infiltration basin to match the pre and post development volumes and flowrates, thereby controlling hydromodification/hydrologic conditions of concern. A "Drainage Analysis" report has been prepared for this project, to demonstrate compliance with the requirements of the Orange County Drainage Area Management Plan.

| Hydromodification Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| Infiltration Basin | Infiltration BMP's are LID BMPs that capture, store and infiltrate stormwater runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. These types of BMPs may also lose some water to evapotranspiration, but are characterized by having their most dominant volume losses due to infiltration. |
| Biotreatment BMP's | Biotreatment BMPs are a broad class of LID BMPs that reduce stormwater volume to the maximum extent practicable, treat stormwater using a suite of treatment mechanisms characteristic of biologically active systems, and discharge water to the downstream storm drain system or directly to receiving waters. Treatment mechanisms include media filtration (through biologically-active media), vegetative filtration (straining, sedimentation, interception and stabilization of particles resulting from shallow flow through vegetation), general sorption processes, biologically-mediated transformations, and other processes to address both suspended and dissolved constituents. |
| Proprietary Biotreatment | Proprietary Biotreatment falls under the category of Biotreatment BMP's. See above. |
| Detention Basins | Volume and Flow based BMP. |

This project has utilized the County of Orange approved AES (Advanced Engineering Software) software for the 2-year, 24-hour storm event for both pre and post development volume calculations. The resultant files are included in Attachment B. These files have been added together to generate a **total** pre- and post-project volume as shown in the table in Section II.3. **Pre = 0.26 ac-ft or 11,326 cu-ft** & **Post = 1.17 ac-ft or 50,965 cu-ft.** The pre- and post-project volumes have been broken down by percentage based on each individual DMA's. The volume of each DMA has been pro-rated based on the individual DMA's area divided by the total project area. The calculations are shown on the following pages.

## 2 YEAR 24 HOUR CALCULATIONS

Given: Total Acres for all DMA's – 10.34 acres
Pre-development Total Volume – 11,326 cu-ft (From AES Files)
Post-development Total Volume – 50,965 cu-ft (From AES Files)

Calculations:

DMA A-1
DMA A-1 = 0.83 ac
0.83 ac/10.34 ac = 0.0803
Pre = 0.0803 x 11,326 cu-ft = **909.5 cu-ft**
Post = 0.0803 x 50,965 cu-ft = **4,092.5 cu-ft**

DMA A-2
DMA A-2 = 1.28 ac
1.28 ac/10.34 ac = 0.1238
Pre = 0.1238 x 11,326 cu-ft = **1,402.2 cu-ft**
Post = 0.1238 x 50,965 cu-ft = **6,309.5 cu-ft**

DMA A-3
DMA A-3 = 0.66 ac
0.66 ac/10.34 ac = 0.0638
Pre = 0.0638 x 11,326 cu-ft = **722.6 cu-ft**
Post = 0.0638 x 50,965 cu-ft = **3,251.6 cu-ft**

DMA A-4
DMA A-4 = 1.00 ac
1.00 ac/10.34 ac = 0.0967
Pre = 0.0967 x 11,326 cu-ft = **1,095.2 cu-ft**
Post = 0.0967 x 50,965 cu-ft = **4,928.3 cu-ft**

DMA B-1
DMA B-1 = 0.31 ac
0.31 ac/10.34 ac = 0.0300
Pre = 0.0300 x 11,326 cu-ft = **339.8 cu-ft**
Post = 0.0300 x 50,965 cu-ft = **1,529.0 cu-ft**

DMA B-2
DMA B-2 = 0.21 ac
0.21 ac/10.34 ac = 0.0203
Pre = 0.0203 x 11,326 cu-ft = **229.9 cu-ft**
Post = 0.0203 x 50,965 cu-ft = **1,034.6 cu-ft**

DMA C-1
DMA C-1 = 0.46 ac
0.46 ac/10.34 ac = 0.0445
Pre = 0.0445 x 11,326 cu-ft = **504.0 cu-ft**
Post = 0.0445 x 50,965 cu-ft = **2,267.9 cu-ft**

DMA C-2
DMA C-2 = 0.72 ac
0.72 ac/10.34 ac = 0.0696
Pre = 0.0696 x 11,326 cu-ft = **788.3 cu-ft**
Post = 0.0696 x 50,965 cu-ft = **3,547.2 cu-ft**

DMA C-3
DMA C-3 = 0.06 ac
0.06 ac/10.34 ac = 0.0058
Pre = 0.0058 x 11,326 cu-ft = **65.7 cu-ft**
Post = 0.0058 x 50,965 cu-ft = **295.6 cu-ft**

DMA C-4
DMA C-4 = 0.77 ac
0.77 ac/10.34 ac = 0.0745
Pre = 0.0745 x 11,326 cu-ft = **843.8 cu-ft**
Post = 0.0745 x 50,965 cu-ft = **3,796.9 cu-ft**

DMA C-5
DMA C-5 = 0.60 ac
0.60 ac/10.34 ac = 0.0580
Pre = 0.0580 x 11,326 cu-ft = **656.9 cu-ft**
Post = 0.0580 x 50,965 cu-ft = **5,956.0 cu-ft**

DMA C-6
DMA C-6 = 1.33 ac
1.33 ac/10.34 ac = 0.1286
Pre = 0.1286 x 11,326 cu-ft = **1,456.5 cu-ft**
Post = 0.1286 x 50,965 cu-ft = **6,554.1 cu-ft**

DMA C-7
DMA C-7 = 1.19 ac
1.19 ac/10.34 ac = 0.1151
Pre = 0.1151 x 11,326 cu-ft = **1,303.6 cu-ft**
Post = 0.1151 x 50,965 cu-ft = **5,866.1 cu-ft**

DMA D-1
DMA D-1 = 0.55 ac
0.55 ac/10.34 ac = 0.0532
Pre = 0.0532 x 11,326 cu-ft = **602.5 cu-ft**
Post = 0.0532 x 50,965 cu-ft = **2,711.3 cu-ft**

DMA D-2
DMA D-2 = 0.37 ac
0.37 ac/10.34 ac = 0.0358
Pre = 0.0358 x 11,326 cu-ft = **405.5 cu-ft**
Post = 0.0358 x 50,965 cu-ft = **1,824.5 cu-ft**

# HYDROMODIFICATION BMP EXHIBIT & TABLE

### IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub Regional LID BMPs are not applicable for the project.

### IV.3.7 Treatment Control BMPs

Infiltration BMP's and Biotreatment BMP's have been sized for the HCOC for this project, and therefore Treatment Control BMP's are not required.

| Treatment Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## IV.3.8 Non-structural Source Control BMPs

| Non-Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| N1 | Education for Property Owners, Tenants and Occupants | ☒ | ☐ | |
| N2 | Activity Restrictions | ☒ | ☐ | |
| N3 | Common Area Landscape Management | ☒ | ☐ | |
| N4 | BMP Maintenance | ☒ | ☐ | |
| N5 | Title 22 CCR Compliance (How development will comply) | ☐ | ☒ | This project is a multi-family development. |
| N6 | Local Industrial Permit Compliance | ☐ | ☒ | Local agency does not have a local industrial permit applicable for the project. |
| N7 | Spill Contingency Plan | ☐ | ☒ | The project will not have bulk storage of liquids. |
| N8 | Underground Storage Tank Compliance | ☐ | ☒ | The project is not proposing the use of storage tanks. |
| N9 | Hazardous Materials Disclosure Compliance | ☐ | ☒ | This project is a multi-family development. |
| N10 | Uniform Fire Code Implementation | ☐ | ☒ | This project is a multi-family development. |
| N11 | Common Area Litter Control | ☒ | ☐ | |
| N12 | Employee Training | ☐ | ☒ | The project does not have individual businesses. |
| N13 | Housekeeping of Loading Docks | ☐ | ☒ | The project does not have loading docks. |
| N14 | Common Area Catch Basin Inspection | ☒ | ☐ | |
| N15 | Street Sweeping Private Streets and Parking Lots | ☒ | ☐ | |
| N16 | Retail Gasoline Outlets | ☐ | ☒ | |

*N1-Education for property Owners, Tenants and occupants*

Education materials will be provided to homeowners at close of escrow by owner/developer and periodically thereafter by the Home Owners Association (HOA) to inform homeowners of their potential impacts to downstream water quality. Materials include those described in Section VII of this WQMP and provided in Attachment A of this WQMP. Additional education material may be found in the following website: http://www.ocwatershed.com/PublicEd/resources/business-brochures.html

*N2-Activity Restrictions*

Activity restrictions to minimize potential impacts to water quality and with the purpose of protecting water quality will be prescribed by the project's Covenant, Conditions and Restrictions (CC&R's), or other equally effective measure. These may include restrictions or guideline for activities such as home repair/painting, landscaping, vehicle washing/repair, proper disposal of residential waste and chemical/fluids.

*N3-Common Area Landscape Management*

Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.

All maintenance must be consistent with the City of Irvine requirements. Proper maintenance practices should help reduce and/or eliminate pollution from pesticides, nutrients, trash/debris and sediments. The project common area landscape maintenance should be consistent with the documents included in Attachment A.

*N4-BMP Maintenance*

BMP maintenance, implementation schedules and responsible parties are included with each specific BMP narrative in section V.

*N11-Common area litter control*

The homeowners or a HOA will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The homeowners or a HOA may contract with their landscape maintenance firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations for investigation.

*N14-Common area catch basin inspection*

The homeowners or a HOA must ensure that the on-site drain inlets, grates, and drain pipes will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year). As required by the Technical Guidance Document, at least 80% of the project's private drainage facilities must be inspected,

cleaned/maintained annually, with 100% of facilities inspected and maintained within a two-year perior.

*N15-Street Sweeping Private Streets and Parking Lots*

The homeowners or a HOA must sweep outdoor streets regularly (minimum monthly), and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are streets or driveways/drive isles are to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer).

## IV.3.9 Structural Source Control BMPs

| Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| S1 | Provide storm drain system stenciling and signage | ☒ | ☐ | |
| S2 | Design and construct outdoor material storage areas to reduce pollution introduction | ☐ | ☒ | This project is a multi-family development. |
| S3 | Design and construct trash and waste storage areas to reduce pollution introduction | ☒ | ☐ | |
| S4 | Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control | ☒ | ☐ | |
| S5 | Protect slopes and channels and provide energy dissipation | ☐ | ☒ | The site is relatively flat. Slopes adjacent to the site are the responsibility of others. |
| | Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit) | ☐ | ☒ | This project is not located within the San Diego Regional Water Quality Control Board. |
| S6 | Dock areas | ☐ | ☒ | This project is a multi-family development. |
| S7 | Maintenance bays | ☐ | ☒ | This project is a multi-family development. |
| S8 | Vehicle wash areas | ☐ | ☒ | This project is a multi-family development. |
| S9 | Outdoor processing areas | ☐ | ☒ | This project is a multi-family development. |
| S10 | Equipment wash areas | ☐ | ☒ | This project is a multi-family development. |

| | | | | |
|---|---|---|---|---|
| S11 | Fueling areas | ☐ | ☒ | This project is a multi-family development. |
| S12 | Hillside landscaping | ☐ | ☒ | The site is relatively flat. Hillsides adjacent to the site are the responsibility of others. |
| S13 | Wash water control for food preparation areas | ☐ | ☒ | This project is a multi-family development. |
| S14 | Community car wash racks | ☐ | ☒ | Community car wash racks are not proposed for this project. |

*S1-Provide storm drain system stenciling and signage*

All catch basins/inlets/outlets on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled. An approved stencil shall be used to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the homeowners or a HOA. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.

*S3-Design and construct trash and waste storage areas to reduce pollution introduction*

The homeowners or a HOA shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The homeowners or a HOA will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The homeowners or a HOA shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The homeowners or a HOA will observe and damage to the trash enclosure wall and any discharge from the trash storage area.

*S4-Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control*

All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.

## IV.4 Alternative Compliance Plan (If Applicable)

### IV.4.1 Water Quality Credits

| Description of Proposed Project | | | | |
|---|---|---|---|---|
| Project Types that Qualify for Water Quality Credits (Select all that apply): | | | | |
| ☐Redevelopment projects that reduce the overall impervious footprint of the project site. | ☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped. | | ☒ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance). | |
| ☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution). | | ☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned | | ☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping). |
| ☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses. | ☐ Developments in a city center area. | ☐ Developments in historic districts or historic preservation areas. | ☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories. | ☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas. |
| Calculation of Water Quality Credits (if applicable) | | | | |

### IV.4.2 Alternative Compliance Plan Information

None

# Section V Inspection/Maintenance Responsibility for BMPs

The responsible party of inspection and Maintenance for the plan will be the project owner. The "Owner" as referred below is Orange County Public Works and their information is listed below:

Orange County Public Works
County Executive Office – Land Development
445 Civic Center Drive West, 2nd Floor
Santa Ana, CA

The owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification or other equally effective measure. The certification shall verify that the inspection and maintenance of all BMPs are performed in accordance with the requirements of this WQMP.

| BMP Inspection/Maintenance | | | |
|---|---|---|---|
| **BMP** | **Reponsible Party(s)** | **Inspection/ Maintenance Activities Required** | **Minimum Frequency of Activities** |
| Non-Structural Source Control BMPs | | | |
| N1 – Education for Property Owners, Tenants and Occupants | Homeowners/ HOA | Educational materials will be provided to homeowners at close of escrow by the developer and thereafter on an annual basis by the HOA. Materials shall include those shown in Section VII and provided in Attachment A of this WQMP. | At close of escrow and annually |
| N2 – Activity Restrictions | Homeowners/ HOA | The Owner will prescribe activity restrictions to protect surface water quality, through a Covenant, Conditions and Restrictions (CC&Rs) agreement, or other equally effective measure, for the property. Upon takeover of the site responsibilities by the HOA. The HOA shall be responsible for ensuring residents compliance. | Ongoing |

| | | | |
|---|---|---|---|
| N3 – Common Area Landscape Management | Homeowners/ HOA | Maintenance shall be consistent with County requirements; any fertilizer and/or pesticide usage shall be consistent with County guidelines for use of fertilizers and pesticides (OC DAMP Section 5.5). Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis. Trimmings, clippings, and other waste shall be properly disposed of off-site in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and drain inlets. | Weekly |
| N4 – BMP Maintenance | Homeowners/ HOA | Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP. Records of inspections and BMP maintenance shall be maintained by the responsible party and documented with the WQMP, and shall be available for review upon request. | Ongoing |
| N11 – Common Area Litter Control | Homeowners/ HOA | Litter patrol, violations investigation, reporting and other litter control activities shall be performed by the Owner/HOA in conjunction with maintenance activities for common areas. | Weekly |
| N14 – Common Area Catch Basin Inspection | Homeowners/ HOA | Catch basins inlets, area drains, curb-and-gutter systems and other drainage systems shall be inspected prior to Oct. 1st of each year and after large storm events. If necessary, drains shall be cleaned prior to any succeeding | Annual |

| | | | |
|---|---|---|---|
| | | rain events. 80% of private facilities shall be inspected and cleaned annually, with 100% of private facilities inspected and maintained within a 2-year period. | |
| N15 – Street Sweeping Private Streets | Homeowners/ HOA | Private streets and public streets shall be swept at a minimum of monthly, and prior to the start of the rainy season (Oct. 1st). | Monthly |
| Structural Source Control BMPs | | | |
| S1 – Provide Storm Drain System Stencilling and Signage | Homeowners/ HOA | Storm drain stencils shall be inspected for legibility, at a minimum, once prior to the storm season, no later than Oct. 1st each year. Those determined to be illegible will be re-stencilled as soon as possible. | Annual |
| S3 – Design and Construct Trash and Waste Storage Areas to Reduce Pollution Introduction | Homeowners/ HOA | The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owner will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owner shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owner will observe and damage to the trash enclosure wall and any discharge from the trash storage area. | Continually |
| S4 – Use Efficient Irrigation Systems & Landscape Design, Water | Homeowners/ HOA | In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting overspray to hardscape areas to be eliminated, and to verify that | Weekly |

| | | | |
|---|---|---|---|
| Conservation, Smart Controllers, and Source Control | | irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, day or night time temperatures based on system specifications and local climate patterns. | |
| Infiltration BMPs | | | |
| Infiltration Basins | HOA | Inspection/ Maintenance Activities will be updated with Final WQMP | Minimum Frequency of Activities will be updated with Final WQMP |
| Biotreatment BMPs | | | |
| Proprietary Biotreatment (Modular Wetlands) | HOA | Refer to the "Maintenance Guidelines for Modular Wetlands System – Linear" in Attachment D for inspection/maintenance activities required. | Refer to the "Maintenance Guidelines for Modular Wetlands System – Linear" in Attachment D for minimum frequency of activities. |
| Treatment Control BMPs | | | |
| N.A. | N.A. | N.A. | N.A. |

# Section VI BMP Exhibit (Site Plan)

## VI.1 BMP Exhibit (Site Plan)

See the following page for the WQMP Plot Plan.

## VI.2 Submittal and Recordation of Water Quality Management Plan

Upon approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) will be submitted. In addition, these documents will be submitted in a PDF format.

# Section VII Educational Materials

| Education Materials | | | |
|---|---|---|---|
| **Residential Material (http://www.ocwatersheds.com)** | **Check If Applicable** | **Business Material (http://www.ocwatersheds.com)** | **Check If Applicable** |
| The Ocean Begins at Your Front Door | ☒ | Tips for the Automotive Industry | ☐ |
| Tips for Car Wash Fund-raisers | ☒ | Tips for Using Concrete and Mortar | ☐ |
| Tips for the Home Mechanic | ☒ | Tips for the Food Service Industry | ☐ |
| Homeowners Guide for Sustainable Water Use | ☒ | Proper Maintenance Practices for Your Business | ☐ |
| Household Tips | ☒ | **Other Material** | **Check If Attached** |
| Proper Disposal of Household Hazardous Waste | ☒ | | |
| Recycle at Your Local Used Oil Collection Center (North County) | ☐ | R-1 AUTOMOBILE REPAIR AND MAINTENANCE | ☒ |
| Recycle at Your Local Used Oil Collection Center (Central County) | ☐ | R-2 AUTOMOBILE WASHING | ☒ |
| Recycle at Your Local Used Oil Collection Center (South County) | ☒ | R-3 AUTOMOBILE PARKING | ☒ |
| Tips for Maintaining a Septic Tank System | ☐ | R-4 HOME AND GARDEN CARE ACTIVITIES | ☒ |
| Responsible Pest Control | ☒ | R-5 DISPOSAL OF PET WASTES | ☒ |
| Sewer Spill | ☒ | R-6 DISPOSAL OF GREEN WASTES | ☒ |
| Tips for the Home Improvement Projects | ☒ | R-7 HOUSEHOLD HAZARDOUS WASTE | ☒ |
| Tips for Horse Care | ☐ | R-8 WATER CONSERVATION | ☒ |
| Tips for Landscaping and Gardening | ☒ | FP-2 LANDSCAPE MAINTENANCE | ☒ |
| Tips for Pet Care | ☒ | FP-3 ROADS, STREETS, AND HIGHWAYS OPERATION AND MAINTENANCE | ☐ |
| Tips for Pool Maintenance | ☒ | FP-4 SIDEWALK, PLAZA, AND FOUTAIN MAINTENANCE AND CLEANING | ☐ |
| Tips for Residential Pool, Landscape and Hardscape Drains | ☒ | | ☐ |
| Tips for Projects Using Paint | ☒ | | ☐ |

# Attachment A

# Educational Materials

# Attachment B

# -Hydrology Maps,

# -HCOC Backup Calculations

# - Modular Wetlands Unit 48 Hour Draw Down Volumes

# Attachment C

# Supporting Maps and Exhibits

**-Watershed Map for Newport Bay**

**-Base Map of Drainage Facilities in Orange County**

**-Rainfall zones (Figure XVI-1)**

**-Susceptibility Analysis Newport Bay – Newport Coastal Streams**

**-North OC Ground Water Protection Areas**

**-2010 CA 303(d) List of Water Quality Limited Segments**

# Attachment D

# OC- Specific Design Criteria and Considerations & BMP Information and Details

# Attachment E

## -Infiltration Feasibility Worksheet

## -Summary of Harvested Water Demand and Feasibility Worksheet

## -Soils Report Information (Percolation and Infiltration Testing)

# Attachment F

# Operations and Maintenance (O&M) & Inspection Form

(Section to be updated with Final WQMP)

# Attachment G

# Conditions of Approval

(Section to be updated with Final WQMP)

# Attachment H

# California Department of Public Health

## Regulations Related to Recycled Water – June 2014

# Attachment I

# 25-yr & 100-yr Hydrograph and Basin Stage-Storage Curve