PRELIMINARY DRAINAGE STUDY
IN THE
CITY OF VICTORVILLE
FOR
TENTATIVE TRACT 20274
SEPTEMBER 9TH, 2019

PREPARED BY:
Madole & Associates, Inc.
PRELIMINARY DRAINAGE STUDY
IN THE CITY OF VICTORVILLE FOR TENTATIVE TRACT 20274

SEPTEMBER 9TH, 2019

Reference: 652-1985

PREPARED BY:

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R.C.E. 42868
CONTENTS

SECTION   TITLE

1.   INTRODUCTION
   • Executive Summary
   • Vicinity and Site Maps

2.   SITE DISCUSSION
   • Existing Conditions
   • Proposed Site Development

3.   RAINFALL, HYDROLOGIC AND LAND USE DATA
   • Method of Study: Hydrology Study and Hydraulic Calculations
   • Rational Method & Unit Hydrograph Method
   • Hydrologic Data
   • Land Use
   • Pre-Developed and Developed Runoff Coefficient, C

4.   ONSITE STORM WATER RUNOFF
   • Discussion of Results
   • Pre-Developed and Developed Storm Water Runoff
   • Developed Condition Water Quality BMP

5.   OFFSITE STORM WATER RUNOFF
   • Discussion of Results

6.   STORM WATER QUALITY TREATMENT
   • Discussion of Results

7.   CONCLUSIONS

8.   APPENDIX
   • 8.1 100-YEAR HYDROLOGY STUDY
     • 8.1.1 Rational Method 100-Year Hydrology for PreDeveloped Conditions
       • PreDeveloped Conditions 100 year Hydrology Map
     • 8.1.2 Rational Method 100-Year Hydrology for Developed Conditions
       • Developed Condition 100 year Hydrology Map
     • 8.1.3 100-Year Detention Basin Flood Routing Analysis
       • Input Summary for Unit Hydrograph
       • Detention Basin Volume Data
       • Detention Basin Volume-Discharge Data
Detention Basin Unit Hydrograph Flood Routing Analysis

8.1.4 Hydrologic References & Maps
- 100 year 24 hour and 6 hour Isohyetal Maps (from San Bernardino County Hydrology Manual)
- Hydrologic Soils Group Map (from San Bernardino County Hydrology Manual).
- Impervious Cover for Developed Areas

8.3 Water Quality BMP Calculations
- Reference WQ Design Capture Volume Calculation

8.5 Victorville Master Plan of Drainage for Oro Grande Wash

8.6 Reference Maps and Details
- Tentative Tract Map 20274
- Reference Parcel Map No. 16983
- APN Map
- Typical Street Section
- Percolation Report – Geotek, Inc.
**LIST OF FIGURES**

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Vicinity Map (Thomas Guide Map)</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Vicinity Map (USGS Map)</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Location Map (Google)</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Detention / WQMP BMP Basin</td>
</tr>
<tr>
<td>Figure 5</td>
<td>PreDeveloped Condition Hydrologic Drainage Map</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Developed Condition Hydrologic Drainage Map</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Water Quality Management Plan Developed Condition</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Comprehensive Storm Drain Plan Line A-10C (Victorville Master Plan Drainage)</td>
</tr>
<tr>
<td>Table</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------------</td>
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<tr>
<td>Table 1-a</td>
<td>100-Year Stormwater Runoff</td>
</tr>
<tr>
<td>Table 1-b</td>
<td>Detention Basin Summary Data</td>
</tr>
<tr>
<td>Table 3-a</td>
<td>Rainfall Intensity Data</td>
</tr>
<tr>
<td>Table 3-b</td>
<td>Input Summary for Unit Hydrograph Developed Conditions</td>
</tr>
<tr>
<td>Table 3-c</td>
<td>Watershed Area-Average Point Rainfall Data Input for Unit Hydrograph</td>
</tr>
<tr>
<td>Table 8-a</td>
<td>Input Summary for Unit Hydrograph</td>
</tr>
<tr>
<td>Table 8-b</td>
<td>Watershed Land Use Data</td>
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</table>
SECTION 1.0

INTRODUCTION
INTRODUCTION

EXECUTIVE SUMMARY

The following report is a hydrologic analysis of the contributing drainage areas discharging storm water flows from the proposed development of Tentative Tract 20274 to the Oro Grande Wash. The proposed development is located approximately 4.2 miles southwest of the City Hall of the City of Victorville and 0.3 mile west of the Interstate Freeway 15 (See the following vicinity map (Figures 1, 2, and 3). The proposed development is adjacent to the east side of Amethyst Road about 450 feet north of Eucalyptus Street.

The proposed development will be a residential tract with 3.8 dwellings per acre on about 45.2 gross acres. There will be interior and exterior street improvements with an intract storm drain system that will collect the storm water runoff. The interior storm flows will be directed near the northeast corner of the tract where there will be a site detention and infiltration basin that will also serve as a Water Quality BMP Infiltration Basin. The proposed tract will be a Water Quality “Priority Project”.

Net Area: 43.6 acres
Numbered Lots: 168
Units per Acre: 3.8
Minimum Lot Size: 7,200 S.F.
Zoning Land Use: R-1
General Plan: Low Density Residential

Owner/Developer: KB Home
36310 Inland Valley Drive
Wildomar, CA 92595

The proposed development will intercept the intract storm water and mitigate the 100-year peak runoff flow with the detention basin. The Peak Flow from the proposed development will be reduced to less than the PreDeveloped Peak Flow generated from the project area.

The Basin will also serve to infiltrate runoff from the tract. The Basin will have 1.48 acre-feet of capacity for the infiltration of low flow runoff.
100-Year Stormwater Runoff
(Table 1-a)

<table>
<thead>
<tr>
<th>PROJECT AREA (ACRES)</th>
<th>COMBINED PRE-DEV. RUNOFF Q (C.F.S.)</th>
<th>0.9 * PRE-DEV. RUNOFF Q (C.F.S.)</th>
<th>TOTAL DEV. UNMITIGATED RUNOFF Q (C.F.S.)</th>
<th>BASIN PEAK DISCHARGE Q (C.F.S.)</th>
<th>CATCH BASIN 'H' DISCHARGE (C.F.S.)</th>
<th>TOTAL MITIGATED SITE DISCHARGE (C.F.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈45.2</td>
<td>97</td>
<td>87</td>
<td>113</td>
<td>39</td>
<td>10.5</td>
<td>50</td>
</tr>
<tr>
<td>3.86 (OFFSITE)</td>
<td>8.9</td>
<td>8.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NET AREA = 43.6 AC.
AMETHYST ROAD = 1.6 AC.

The Pre-Developed storm water runoff of 97 c.f.s. was estimated for the project site. This estimation was the combination of the runoff from the project site at six locations at the tract boundary.

The storm water analysis of the Developed Conditions estimated the unmitigated runoff flow rate of about 113 c.f.s. This included the intract flow of 97 c.f.s., 11 c.f.s. from the northern most catch basin, and the possible runoff from Amethyst Road half street improvements of about 5 c.f.s.

To mitigate Developed Condition storm water discharge to less than the Predeveloped discharge, the intract storm water runoff for the developed condition was routed into and through a proposed detention basin located near the northeasterly corner of the project site. The Developed peak flow of 113 c.f.s. was reduced to a discharged 50 c.f.s. Flows from offsite subarea adjacent the southern boundary of the project will be directed into a graded swale and enter a culvert underneath the proposed access road and released on the other side.

From the unit hydrograph flood routing analysis, the detention basin would fill to a water surface elevation of 3247.2. The elevation of the top of the basin was set at 3252. The following table is a summary of the detention basin hydrologic analysis performed.
Contributing Drainage Area: 45.2 acres.

TRACT 17046 DETENTION BASIN SUMMARY DATA
(TABLE 1-b)

<table>
<thead>
<tr>
<th></th>
<th>RATIONAL Qp INFLOW (C.F.S.)</th>
<th>UNIT HYDRO. Qp INFLOW (C.F.S.)</th>
<th>BASIN BOTTOM ELEV.</th>
<th>PEAK DISCHARGE (C.F.S.)</th>
<th>WATER SURFACE ELEV.</th>
<th>TOP OF BASIN ELEV.</th>
<th>FREEBOARD (FT)</th>
<th>PEAK VOL. STORED (AC.-FT.)</th>
<th>BASIN STORAGE VOL. AT ELEV. 3252 (AC.-FT.)</th>
<th>RUNOFF VOL. (AC.-FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREDEVEL</td>
<td>96.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEVELOPED (to Basin)</td>
<td>87.6</td>
<td>97</td>
<td>3240</td>
<td>39</td>
<td>3247.2</td>
<td>3252</td>
<td>4.8</td>
<td>2.6</td>
<td>5.54</td>
<td>6.1</td>
</tr>
<tr>
<td>DEVELOPED (to Catch Basin ‘H’)</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESTIMATED AMETHYST ROAD</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL DISCHARGE FROM SD LINE ‘C’ = 50 C.F.S.
TOTAL DISCHARGE FROM AMETHYST ROAD = 5 C.F.S.
SECTION 2.0
SITE DISCUSSION
EXISTING CONDITIONS

The U.S.G.S. topographic contours for this area indicate that the general terrain falls from the southwest to the northeast. The area is mostly undeveloped with few residential homes. There is cemetery located near the east side of the project with a commercial storage site further east. There is a water reservoir and residential homes located northwest, across the Oro Grande Wash.

The site itself is sparsely covered with desert brush.

For this general area, the soil is typically silty granular sand.

A review of the PreDeveloped drainage area of the topography over the project site indicates that the general area sheet flows in a northeasterly direction almost parallel to and in the flow path direction of the Oro Grande Wash (See enclosed Hydrologic Drainage Maps Fig. 6 and 7). The PreDeveloped topographic site conditions indicate that there are several subareas discharging runoff from the project site area. The estimated PreDeveloped runoff was taken from each of the subareas within the project site boundary, and then combined for the sum of the site runoff flows. It is understood that there is the possibility of runon from the adjacent areas, therefore those flows are excluded from the PreDeveloped flow rate generated from the project site. The sum total PreDeveloped flow was estimate as 97 c.f.s.

PROPOSED SITE DEVELOPMENT

This development is a tract in its entirety. The proposed site will intercept the onsite storm water and provide for Water Quality infiltration of the 85th percentile runoff. The 100-year storm water will be intercepted, detained in a detention basin, and discharged at a reduced flow rate. The reduced rate of flow will be discharged from a detention basin located near the northeast corner of the site. The discharge will be near the detention basin into the Oro Grande Wash. The Oro Grande Wash is designated as Line A-01 of the Victorville Master Plan of Drainage (See Figure 8 and Appendix, Section 8.5).

A future Line A-10-01 is designated in Eucalyptus Street south (upstream) from the proposed project site.

The following exhibit shows the location of the proposed Tentative Tract 20274 in relation to the surrounding streets and existing development.
SECTION 3.0

RAINFALL, HYDROLOGIC,
AND LAND USE DATA
METHOD OF STUDY: HYDROLOGY STUDY AND HYDRAULIC CALCULATIONS

Rational Method and Unit Hydrograph Method
The Rational Method of Hydrologic Modeling and the Unit Hydrograph for Catchment Runoff, as defined by the County of San Bernardino Hydrology Manual, 1986, was performed in the estimation of the storm water runoff peak flow rates (See Appendix, Sections 8.1.1 & 8.1.2) and flood routing analysis (Appendix, Section 8.1.3). AES software was utilized for the hydrologic calculations, street flow analysis, and detention basin analysis.

Hydrologic Data
The storm water runoff losses as listed in Section C of the County's Hydrology Manual were incorporated and accounted for in the study and analysis. The Hydrologic Soil Groups, the Hydrologic Conditions, and the Development Conditions were considered in the estimation of loss rates. For this project:

Soil Groups: B

Rainfall Intensities: Refer to the table on the following page.

(The Hydrologic Soil Group Map and the NOAA Atlas 14 Point Precipitation Frequency Estimates are attached in Appendix, Section 8.1.5. Hydrologic References & Maps).

Antecedent Moisture Condition

For this project, AMC II was used in the 100-year study.

(Reference is made to San Bernardino County Hydrology Manual, 1986 and the revision dated April 6, 2010).

Proposed Land Use

RESIDENTIAL
The data input of dwelling units / acre for computer software:

3-4 DU/Ac.

For this project, a Commercial designation was used for the street.

(Refer to Appendix, Section 8.1.4. Hydrologic References & Maps for Impervious Cover for Developed Areas).
## Rainfall Intensity Data

### TABLE 3-a

<table>
<thead>
<tr>
<th>Duration (hr)</th>
<th>Return Period (year)</th>
<th>Slope of Intensity/Duration curve</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>0.7</td>
<td>0.33</td>
<td>0.46</td>
<td>0.62</td>
<td>0.75</td>
<td>0.92</td>
<td>1.17</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>0.45</td>
<td>0.62</td>
<td>1.01</td>
<td>1.30</td>
<td>1.69</td>
<td>2.26</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>0.28</td>
<td>0.75</td>
<td>1.38</td>
<td>1.85</td>
<td>2.48</td>
<td>3.43</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td>0.79</td>
<td>1.20</td>
<td>1.74</td>
<td>2.15</td>
<td>2.68</td>
<td>3.50</td>
</tr>
</tbody>
</table>

Slope: -0.09 0.27 0.45 0.50 0.55 0.60

=values taken from Isohyetals, County Hydrology Manual

All other values "interpolated" using logarithmic equations as follows:

\[ \text{I}_{100} - \text{I}_{10} / \text{Ln}(100/10) \times \text{Ln} \text{(des Period / 10)} + \text{I}_{10} \]
SUMMARY:

Rational Method  (Reference Appendix, Sections 8.1.1 & 8.1.2)

100-Year Study
AMC II
1-Hour Rainfall Intensity: 1.17 in/hr.
Soil Group  B

PreDeveloped Conditions: Desert Brush 30% Coverage

Developed Conditions: 4 DU/Ac

Unit Hydrograph Method  (Reference Appendix, Section 8.1.3)

TENTATIVE TRACT 20274
INPUT SUMMARY FOR UNIT HYDROGRAPH
DEVELOPED CONDITIONS
(Table 3-b)

<table>
<thead>
<tr>
<th>NODE</th>
<th>SUBAREA</th>
<th>LAG TIME (HR.)</th>
<th>Tc (MIN.)</th>
<th>AREA (AC.)</th>
<th>S-GRAPH</th>
<th>MAX. LOSS, Fm (IN/HR)</th>
<th>LOW LOSS Y-BAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>140 &amp; 545</td>
<td>A-C</td>
<td>0.19</td>
<td>14.54 (USE 14)</td>
<td>41.1</td>
<td>DESERT</td>
<td>0.44</td>
<td>0.57</td>
</tr>
</tbody>
</table>

TENTATIVE TRACT No. 20274 – VICTORVILLE, CA
### Watershed Area-Averaged Point Rainfall Data

**Input for Unit Hydrograph**

*(Table 3-c)*

#### 100-Year Developed

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Rainfall (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-Minute Point Rainfall</td>
<td>0.43</td>
</tr>
<tr>
<td>30-Minute Point Rainfall</td>
<td>0.89</td>
</tr>
<tr>
<td>1-Hour Point Rainfall</td>
<td>1.17</td>
</tr>
<tr>
<td>3-Hour Point Rainfall</td>
<td>2.26</td>
</tr>
<tr>
<td>6-Hour Point Rainfall</td>
<td>3.43</td>
</tr>
<tr>
<td>24-Hour Point Rainfall</td>
<td>3.50</td>
</tr>
</tbody>
</table>
UNDEVELOPED CONDITION - RUNOFF COEFFICIENT, C

C=0.90(a_i + (((I - F_p)*a_p)/I))

COVER TYPE: DESERT BRUSH (30%)
CURVE NUMBER: 84
a_i (IMPERVIOUS AREA RATIO) = 0
a_p (PERVIOUS AREA RATIO) = 1

F_p = 0.31
I = 3.5 IN/HR

C = 0.82

DEVELOPED CONDITION - RUNOFF COEFFICIENT, C

C=0.90(a_i + (((I - F_p)*a_p)/I))

COVER TYPE: RESIDENTIAL 3-4 DU/ACRE
CURVE NUMBER: 56
a_i (IMPERVIOUS AREA RATIO) = 0.4
a_p (PERVIOUS AREA RATIO) = 0.6

F_p = 0.74
I = 3.5 IN/HR

C = 0.79
SECTION 4.0

ONSITE STORM WATER RUNOFF
DISCUSSION OF RESULTS
This drainage study estimated the storm water runoff from the existing predeveloped area of the project site and from the site when developed. A detention basin is proposed for the mitigation of the developed flows to less than the predeveloped discharge rate. The detention basin is proposed for near the northeast corner of the tract site. The detention basin will have a raised and grassy play area for recreational purposes when the basin is dry.

Basin Flood Routing
The flood routing analysis through the detention basin indicates that the water will fill to a depth of about 7.2 feet (Water Surface Elevation 3247.2) with a unit hydrograph peak inflow of about 97 c.f.s. and an outflow peak discharge flow rate of Q100=39 c.f.s. The stored volume at peak flow would be about 2.6 acre-feet. (Refer to Fig. 4 and Table 1-b).

Proposed Conceptual Inflow Drainage Facilities
The storm water will be intercepted by street improvements and underground storm drain system. The drainage system will convey the runoff to the detention basin.

Proposed Detention Basin Facilities
The detention basin will be constructed to allow retention for water quality low flow infiltration to occur. The basin outlet structure will be set at an elevation above the determined 85th percentile storm water volume to be captured and infiltrated. The water quality volume to be stored is 1.48 ac-ft. The basin outlet will be at elevation 3245.0, and allow a maximum discharge of 39 cfs through a 36" RCP to the Oro Grande Wash. The 100-year storm flow is estimated to fill the detention basin to elevation 3247.2, about 7.2 feet above the bottom of the basin.

Proposed Conceptual Outflow Drainage Facilities
The outflow will be metered by a 36" diameter pipe structure located on the north side of the basin. The structure will control the discharge flow rate and meter the flow to less than the pre-developed runoff flow rate.

RESULTS OF THE FLOOD ROUTING ANALYSIS
A flood routing analysis for the Detention Basin produced a metered peak discharge flow rate of 39 c.f.s. The peak water depth in the detention basin would be about 7.2 feet above the bottom of the Basin (elevation 3247.2) and a peak stored volume of approximately 2.6 ac-ft.
Contributing Drainage Area: 45.2 acres.

### TRACT 17046 DETENTION BASIN SUMMARY DATA
**(TABLE 1-b)**

<table>
<thead>
<tr>
<th></th>
<th>RATIONAL Qp INFLOW (C.F.S.)</th>
<th>UNIT HYDRO. Qp INFLOW (C.F.S.)</th>
<th>BASIN 1 BOTTOM ELEV.</th>
<th>PEAK DISCHARGE (C.F.S.)</th>
<th>WATER SURFACE ELEV.</th>
<th>TOP OF BASIN ELEV.</th>
<th>FREEBOARD (FT)</th>
<th>PEAK VOL. STORED (AC.-FT.)</th>
<th>BASIN STORAGE VOL. AT ELEV. 3252 (AC.-FT.)</th>
<th>RUNOFF VOL. (AC.-FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREDEVEL.</td>
<td>96.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEVELOPED (to Basin)</td>
<td>87.6</td>
<td>97</td>
<td>3240.0</td>
<td>39</td>
<td>3247.2</td>
<td>3252</td>
<td>4.8</td>
<td>2.6</td>
<td>5.54</td>
<td>6.1</td>
</tr>
<tr>
<td>DEVELOPED (to Catch Basin 'H')</td>
<td>10.5</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>ESTIMATED AMETHYST ROAD</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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</tbody>
</table>
SECTION 5.0

OFFSITE STORM WATER RUNOFF
DISCUSSION OF RESULTS
This drainage study estimated the storm water runoff from the developed project site. An onsite drainage system with a detention basin is proposed for the interception, conveyance, and the mitigation of the storm water discharge from the project development.

Referring to the Hydrologic Drainage Map for the Developed Conditions (Figure 6) and a copy of the portion of the Victorville Master Plan of Drainage for Line A-10C, the offsite storm water will be intercepted by the street improvements for Amethyst Road and Eucalyptus Street. The MPD Line A-10-01 proposed for Eucalyptus Street south of the project site will be an added drainage facility.

The street improvements immediately adjacent to the proposed tract was estimated to about 5 c.f.s. Offsite, upstream flows from the project area was not determined. The 5 c.f.s from the street improvements on Amethyst Road will be directed via gutterflow to a concreted rock drain splash pad at the northwest corner of the project boundary (See Rough Grading Sheet 8 in References).

Off-site flows that approach the southern tract boundary will be intercepted by Ditch “A”, and routed into an 18” CSP pipe. This culvert will carry flows away from the southern track boundaries and travel underneath the existing 30.0 ft wide emergency access easement (at the southeast corner of the project boundary), where it will outlet. A rational method analysis of this area determined approximately 8.9 cfs will be intercepted by Ditch “A” and travel through the a proposed storm drain, and outlet on the eastern side of the proposed EVA access road.
SECTION 6.0

STORM WATER QUALITY TREATMENT
DISCUSSION OF RESULTS
This preliminary drainage study estimated the storm water runoff from the developed project site. An onsite drainage system with a detention basin is proposed for the interception, conveyance, and the mitigation of the storm water discharge from the project development.

The detention basin will also serve as the Water Quality BMP. Referring to Figure 4 in Section 4.0, the basin will be constructed with a high outlet elevation to allow for the retention and infiltration of the determined low flow water quality runoff volume.

A function for the Basin will be to provide water quality interception and infiltration of low flow waters. For the development of Tentative Tract 20274, the Design Capture Volume (DCV) was estimated to 1.48 Acre-Feet (For Water Quality BMP Calculations, Refer to Section 8.3).

Water Quality Depth: 4.95-Feet (5 Feet)
Basin Elevation: 3244.95 (3245)

DCV: 1.48 Acre-Feet

Therefore, adequate volume capacity will be provided in Basin for the runoff infiltration.

Infiltration testing was performed on the site at the proposed area of the basin (See Percolation Report, by Geotek, Inc. in Appendix 8.6). An infiltration rate of 43 in/hr was calculated for the project site. After applying a Factor of Safety of 2, the design infiltration rate of the infiltration basin is 21.5 in/hr. Based on this rate the Design Capture Volume would drain within approximately 6.4 hours of filling, therefore avoiding any vector problems on site.
SECTION 7.0

CONCLUSION
CONCLUSION

The above hydrologic study showed that the interception of the onsite storm water (developed condition) with street improvements, storm drain system and the detention basin runoff is collected and routed (through the basin) for a reduction of the runoff discharge to less than the combined flows from the predeveloped project site.

PreDeveloped Combined Discharge: 97 c.f.s.
Mitigated Discharge (OVERALL SITE): =39+11+5= 55 c.f.s.
Mitigated Discharge from SD Line C: =39+11 = 50 c.f.s.

The storm water treatment for Water Quality is addressed with the Basin infiltration of the runoff.

Basin Water Quality Volume: 1.50 Acre-Feet
Project DCV: 1.48 Acre-Feet

The detention basin has adequate volume to detain flows during a 100-year storm event. The study also showed that there would remain about 4.8 feet freeboard within the basin.
A concrete emergency spillway will be implemented in the basin design to accommodate the 1000 year storm. See calculation below for the design width.

**EMERGENCY SPILLWAY**

**DESIGN CAPACITY = 1,000-YEAR PEAK FLOW RATE**

\[ Q = 1.35 \times Q_{100} \]

\[ Q_{100} = 97 \]

**DESIGN Q = 130.95 C.F.S.**

**Weir Discharge Equation** (Trapezoidal w/3:1 upstream slope)

\[ Q = C \times L \times H^{(3/2)} \]

\[ Q = 130.95 \]
\[ C = 3.08 \]
\[ H = 1.00 \]

\[ L = 42.5 \text{ FT.} \]

**DESIGN L = 43.0 FT.**
APPENDIX 8.1

100-YEAR HYDROLOGY STUDY

TENTATIVE TRACT No. 20274 – VICTORVILLE, CA
APPENDIX 8.1.1

100-YEAR RATIONAL METHOD HYDROLOGY STUDY FOR PRE-DEVELOPED CONDITIONS
RATIONAL ANALYSIS FOR THE CATCHMENT AREA

Pre-Developed Conditions

The following rational method analysis was performed on the existing project site, i.e. existing conditions. As shown on the Drainage Map for the Pre-Developed Conditions, the existing terrain tends fall generally northeasterly, parallel with the Oro Grande Wash. With the Oro Grande located along the northerly property boundary, there is a drop off along that location.

It should be noted that the site has several points of discharge along the property boundary.
**RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE**
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
(c) Copyright 1983-2014 Advanced Engineering Software (aes)
Ver. 21.0 Release Date: 06/01/2014 License ID 1251

Analysis prepared by:
MADOLE & ASSOCIATES, INC.
9302 Pittsburgh Avenue, Suite 230
Rancho Cucamonga, CA 91730

**************************** DESCRIPTION OF STUDY *****************************
* TRACT 17046 RATIONAL METHOD DRAINAGE STUDY  *
* 100 YEAR STUDY PREDEVELOPED CONDITIONS      *
* JN 652-1985 WLI 17046pre.dat                 *

FILE NAME: 17046pre.dat
TIME/DATE OF STUDY: 10:01 06/29/2016

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 = 0.95
*USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

SLOPE OF INTENSITY DURATION CURVE (LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY (INCH/HOUR) = 1.1700

*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)

<table>
<thead>
<tr>
<th>NO</th>
<th>Width</th>
<th>Height</th>
<th>Lip</th>
<th>Hike Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.0</td>
<td>10.0</td>
<td>0.02</td>
<td>0.20</td>
</tr>
</tbody>
</table>

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

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

FLOW PROCESS FROM NODE 9.00 TO NODE 11.00 IS CODE = 21

<<<<<<RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>USE TIME-OF-CONCENTRATION NOMOGRAM FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 1000.00
ELEVATION DATA: UPSTREAM (FEET) = 3288.00 DOWNSTREAM (FEET) = 3267.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 18.018
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 2.716

SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/SCS SOIL AREA Pp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)

NATURAL DESERT COVER
*DESERT BRUSH* (30.0%) B 18.40 0.34 1.000 82 18.02
SUBAREA AVERAGE Pervious Loss Rate, Pp(INCH/HR) = 0.34
SUBAREA AVERAGE Pervious AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF (CFS) = 39.28
TOTAL AREA (ACRES) = 18.40 PEAK FLOW RATE (CFS) = 39.28

*****************************************************************************
FLOW PROCESS FROM NODE 11.00 TO NODE 21.00 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.) = 18.02
RAINFALL INTENSITY (INCH/HR) = 2.72
AREA-AVERAGED Fm (INCH/HR) = 0.34
AREA-AVERAGED Fp (INCH/HR) = 0.34
AREA-AVERAGED Ap = 1.00
EFFECTIVE STREAM AREA (ACRES) = 18.40
TOTAL STREAM AREA (ACRES) = 18.40
PEAK FLOW RATE (CFS) AT CONFLUENCE = 39.28

*****************************************************************************
FLOW PROCESS FROM NODE 19.00 TO NODE 21.00 IS CODE = 21
*****************************************************************************

>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS <<<<
>>> USE TIME-OF-CONCENTRATION NOMOGRAPHF FOR INITIAL SUBAREA <<<<
*****************************************************************************
INITIAL SUBAREA FLOW-LENGTH (FEET) = 1100.00
ELEVATION DATA: UPSTREAM (FEET) = 3277.00 DOWNSTREAM (FEET) = 3256.00

Tc = K*[(LENGTH**3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 19.079
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 2.609
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 DESERT COVER
"DESERT BRUSH" (30.0%) B 3.60 0.34 1.000 82 19.08
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.34
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF (CFS) = 7.34
TOTAL AREA (ACRES) = 3.60 PEAK FLOW RATE (CFS) = 7.34

*****************************************************************************
FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 1
*****************************************************************************

>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCED <<<<
>>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES <<<<
*****************************************************************************
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION (MIN.) = 19.08
RAINFALL INTENSITY (INCH/HR) = 2.61
AREA-AVERAGED Fm (INCH/HR) = 0.34
AREA-AVERAGED Fp (INCH/HR) = 0.34
AREA-AVERAGED Ap = 1.00
EFFECTIVE STREAM AREA (ACRES) = 3.60
TOTAL STREAM AREA (ACRES) = 3.60
PEAK FLOW RATE (CFS) AT CONFLUENCE = 7.34

** CONFLUENCE DATA **
STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
1 39.28 18.02 2.716 0.34(0.34) 1.00 18.4 9.00
2 7.34 19.08 2.609 0.34(0.34) 1.00 3.6 19.00

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 46.53 18.02 2.716 0.34(0.34) 1.00 21.8 9.00
2  44.85  19.08  2.609  0.34 (0.34)  1.00  22.0  19.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 46.53  Tc(MIN.) = 18.02
EFFECTIVE AREA (ACRES) = 21.80  AREA-AVERAGED Pm(INCH/HR) = 0.34
AREA-AVERAGED Pp(INCH/HR) = 0.34  AREA-AVERAGED Ap = 1.00
TOTAL AREA (ACRES) = 22.0
LONGEST FLOWPATH FROM NODE 19.00 TO NODE 21.00 = 1100.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE 21.00 TO NODE 31.00 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.) = 18.02
RAINFALL INTENSITY (INCH/HR) = 2.72
AREA-AVERAGED Pm (INCH/HR) = 0.34
AREA-AVERAGED Pp (INCH/HR) = 0.34
AREA-AVERAGED Ap = 1.00
EFFECTIVE STREAM AREA (ACRES) = 21.80
TOTAL STREAM AREA (ACRES) = 22.00
PEAK FLOW RATE (CFS) AT CONFLUENCE = 46.53

******************************************************************************
FLOW PROCESS FROM NODE 29.00 TO NODE 31.00 IS CODE = 21

<<<<<<RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
<<<<<<USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 960.00
ELEVATION DATA: UPSTREAM (FEET) = 3274.00 DOWNSTREAM (FEET) = 3256.00
Tc = K[(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20]
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 18.133
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 2.704
SUBAREA Tc AND LOSS RATE DATA (AMC III):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE</th>
<th>SCS SOIL AREA</th>
<th>Pp</th>
<th>Ap</th>
<th>SCS</th>
<th>Tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND USE</td>
<td>GROUP (ACRES)</td>
<td>(INCH/HR)</td>
<td>(DECMIAL)</td>
<td>CN</td>
<td>(MIN.)</td>
</tr>
<tr>
<td>NATURAL DESERT COVER</td>
<td>&quot;DESSERT BRUSH&quot; (30.0%)</td>
<td>B</td>
<td>3.90</td>
<td>0.34</td>
<td>1.000</td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVIOUS LOSS RATE, Pp (INCH/HR) = 0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA RUNOFF (CFS) = 8.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL AREA (ACRES) = 3.90 PEAK FLOW RATE (CFS) = 8.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

******************************************************************************
FLOW PROCESS FROM NODE 31.00 TO NODE 31.00 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.) = 18.13
RAINFALL INTENSITY (INCH/HR) = 2.70
AREA-AVERAGED Pm (INCH/HR) = 0.34
AREA-AVERAGED Pp (INCH/HR) = 0.34
AREA-AVERAGED Ap = 1.00
EFFECTIVE STREAM AREA (ACRES) = 3.90
TOTAL STREAM AREA (ACRES) = 3.90
PEAK FLOW RATE (CFS) AT CONFLUENCE = 8.28

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Pp (INCH/HR)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46.53</td>
<td>18.02</td>
<td>2.716</td>
<td>0.34 (0.34)</td>
<td>1.00</td>
<td>21.8</td>
<td>9.00</td>
</tr>
<tr>
<td>1</td>
<td>44.85</td>
<td>19.08</td>
<td>2.609</td>
<td>0.34 (0.34)</td>
<td>1.00</td>
<td>22.0</td>
<td>19.00</td>
</tr>
<tr>
<td>2</td>
<td>8.28</td>
<td>18.13</td>
<td>2.704</td>
<td>0.34 (0.34)</td>
<td>1.00</td>
<td>3.9</td>
<td>29.00</td>
</tr>
</tbody>
</table>
** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity (INCH/HR)</th>
<th>Fp (FM) (INCH/HR)</th>
<th>Ap (ACRES)</th>
<th>Ae (ACRES)</th>
<th>HEADWATER NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54.81</td>
<td>18.02</td>
<td>2.716</td>
<td>0.34(0.34)</td>
<td>1.00</td>
<td>25.7</td>
<td>9.00</td>
</tr>
<tr>
<td>2</td>
<td>54.63</td>
<td>18.13</td>
<td>2.704</td>
<td>0.34(0.34)</td>
<td>1.00</td>
<td>25.7</td>
<td>29.00</td>
</tr>
<tr>
<td>3</td>
<td>52.80</td>
<td>19.08</td>
<td>2.609</td>
<td>0.34(0.34)</td>
<td>1.00</td>
<td>25.9</td>
<td>19.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 54.81
Tc (MIN.) = 18.02
EFFECTIVE AREA (ACRES) = 25.68
AREA-AVERAGED Fp (INCH/HR) = 0.34
AREA-AVERAGED Ap (ACRES) = 1.00
TOTAL AREA (ACRES) = 25.9
LONGEST FLOWPATH FROM NODE = 19.00 TO NODE = 31.00 = 1100.00 FEET.

FLOW PROCESS FROM NODE 31.00 TO NODE 41.00 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.) = 18.02
RAINFALL INTENSITY (INCH/HR) = 2.72
AREA-AVERAGED Fm (INCH/HR) = 0.34
AREA-AVERAGED Fp (INCH/HR) = 0.34
AREA-AVERAGED Ap = 1.00
EFFECTIVE STREAM AREA (ACRES) = 25.68
TOTAL STREAM AREA (ACRES) = 25.90
PEAK FLOW RATE (CFS) AT CONFLUENCE = 54.81

FLOW PROCESS FROM NODE 39.00 TO NODE 41.00 IS CODE = 21

** RATIONAL METHOD INITIAL SUBAREA ANALYSIS **

USE TIME-OF-CONCENTRATION NOMOGRAPh FOR INITIAL SUBAREA

INITIAL SUBAREA FLOW-LENGTH (FEET) = 920.00
ELEVATION DATA: UPSTREAM (FEET) = 3271.00 DOWNSTREAM (FEET) = 3248.00

Tc = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 16.830
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 2.849
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 DESERT COVER
"DESERT BRUSH" (30.0%) B 10.80 0.34 1.00 82 16.83
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.34
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF (CFS) = 24.34
TOTAL AREA (ACRES) = 10.80 PEAK FLOW RATE (CFS) = 24.34

FLOW PROCESS FROM NODE 41.00 TO NODE 71.00 IS CODE = 52

** COMPUTE NATURAL VALLEY CHANNEL FLOW **

ELEVATION DATA: UPSTREAM (FEET) = 3248.00 DOWNSTREAM (FEET) = 3244.00
CHANNEL LENGTH THRU SUBAREA (FEET) = 180.00 CHANNEL SLOPE = 0.0222
CHANNEL FLOW THRU SUBAREA (CFS) = 24.34
FLOW VELOCITY (FEET/SEC) = 4.71 (PER LACFCD/KCF/WD HYDROLOGY MANUAL)
TRAVEL TIME (MIN.) = 0.64 Tc (MIN.) = 17.47
LONGEST FLOWPATH FROM NODE 39.00 TO NODE 71.00 = 1100.00 FEET.

FLOW PROCESS FROM NODE 71.00 TO NODE 71.00 IS CODE = 81
MAINLINE Tc(MIN.) = 17.47
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.776
SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE
SCS SOIL AREA Fp Ap SCS CN
GROUP (ACRES) (INCH/HR) (DECIMAL)

NATURAL DESERT COVER
"DESERT BRUSH" (30.0%) B 4.30 0.34 1.000 82
NATURAL DESERT COVER
"DESERT BRUSH" (30.0%) B 4.20 0.34 1.000 82
SUBAREA AVERAGE PERVERSIVE LOSS RATE, Fp(INCH/HR) = 0.34
SUBAREA AVERAGE PERVERSIVE AREA FRACTION, Ap = 1.000
SUBAREA AREA(ACRES) = 8.50 SUBAREA RUNOFF(CFS) = 18.60
AREA- AVERAGED Fp(INCH/HR) = 0.34 AREA-AVERAGED Ap = 1.00
AREA-AVERAGED Fp(INCH/HR) = 0.34 AREA-AVERAGED Ap = 1.00
TOTAL AREA(ACRES) = 19.3 PEAK FLOW RATE(CFS) = 42.24

FLOW PROCESS FROM NODE 71.00 TO NODE 71.00 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.) = 17.47
RAINFALL INTENSITY(INCH/HR) = 2.78
AREA- AVERAGED Fm(INCH/HR) = 0.34
AREA-AVERAGED Fp(INCH/HR) = 0.34
AREA-AVERAGED Ap = 1.00
EFFECTIVE STREAM AREA(ACRES) = 19.30
PEAK FLOW RATE(CFS) AT CONFLUENCE = 42.24

** CONFLUENCE DATA **

STREAM Q Tc Intensity Fp Fm Ap Ae HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
1 54.81 18.02 2.716 0.34(0.34) 1.00 25.7 9.00
1 54.63 18.13 2.704 0.34(0.34) 1.00 25.7 29.00
1 52.80 19.08 2.609 0.34(0.34) 1.00 25.9 19.00
2 42.24 17.47 2.776 0.34(0.34) 1.00 19.3 39.00

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 96.70 17.47 2.776 0.34(0.34) 1.00 44.2 39.00
2 96.00 18.02 2.716 0.34(0.34) 1.00 45.0 9.00
3 95.62 18.13 2.704 0.34(0.34) 1.00 45.0 29.00
4 92.15 19.08 2.609 0.34(0.34) 1.00 45.2 19.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 96.70 Tc(MIN.) = 17.47
EFFECTIVE AREA(ACRES) = 44.19 AREA-AVERAGED Fm(INCH/HR) = 0.34
AREA-AVERAGED Fp(INCH/HR) = 0.34 AREA-AVERAGED Ap = 1.00
TOTAL AREA(ACRES) = 45.2 LONGEST FLOWPATH FROM NODE 19.00 TO NODE 71.00 = 1100.00 FEET.

FLOW PROCESS FROM NODE 49.00 TO NODE 51.00 IS CODE = 21

RATIONAL METHOD INITIAL SUBAREA ANALYSIS

USE TIME-OF-CONCENTRATION NOMOGRAP FOR INITIAL SUBAREA

INITIAL SUBAREA FLOW-LENGTH(Feet) = 840.00
ELEVATION DATA: UPSTREAM(Feet) = 3275.00 DOWNSTREAM(Feet) = 3235.00

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

Page 5 of 6
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 14.266
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.198
SUBAREA Tc AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>LAND USE</th>
<th>SOIL</th>
<th>AREA</th>
<th>Fp</th>
<th>Ap</th>
<th>SCS</th>
<th>Tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATURAL DESERT COVER</td>
<td>&quot;DESERT BRUSH&quot; (30.0%)</td>
<td>B</td>
<td>4.30</td>
<td>0.34</td>
<td>1.000</td>
<td>82</td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA RUNOFF (CFS) = 11.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL AREA (ACRES) = 4.30 PEAK FLOW RATE (CFS) = 11.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

******************************************************************************
FLOW PROCESS FROM NODE 59.00 TO NODE 61.00 IS CODE = 21

>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS <<<<
>> USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA <<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 760.00
ELEVATION DATA: UPSTREAM (FEET) = 3280.00 DOWNSTREAM (FEET) = 3242.00

Tc = K*[(LENGTH** 3.00)/[ELEVATION CHANGE]]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 13.573
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.111
SUBAREA Tc AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>LAND USE</th>
<th>SOIL</th>
<th>AREA</th>
<th>Fp</th>
<th>Ap</th>
<th>SCS</th>
<th>Tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATURAL DESERT COVER</td>
<td>&quot;DESERT BRUSH&quot; (30.0%)</td>
<td>B</td>
<td>4.20</td>
<td>0.34</td>
<td>1.000</td>
<td>82</td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA RUNOFF (CPS) = 11.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL AREA (ACRES) = 4.20 PEAK FLOW RATE (CFS) = 11.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 4.2 TC (MIN.) = 13.57
AVERAGE AREA (ACRES) = 4.20 AREA-AVERAGED Fp (INCH/HR) = 0.34
AVERAGE AREA (ACRES) = 4.30 AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE (CFS) = 11.22

******************************************************************************
END OF RATIONAL METHOD ANALYSIS
APPENDIX 8.1.2

100-YEAR RATIONAL METHOD
HYDROLOGY STUDY
FOR DEVELOPED CONDITIONS
RATIONAL ANALYSIS FOR THE CATCHMENT AREA

Developed Conditions

The following rational method analysis was performed along the mainline drainage paths of the catchment area. The rational hydrology study was performed to estimate the peak runoff data for the subject drainage areas. The data from the rational study will be used as input to obtain the unit hydrograph for the catchment area at the proposed detention basin.

The data from the rational hydrology study represents the future development within the catchment area.
Analysis prepared by:
MADOLE & ASSOCIATES, INC.
9302 PITTSBURGH AVENUE, SUITE 230
RANCHO CUCAMONGA, CA 91730

FILE NAME: 17046DEV.DAT
TIME/DATE OF STUDY: 14:41 04/09/2019

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 = 0.95
*USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1700

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

*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*

| NO. | CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING WIDTH CROSSFALL IN-/ OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR |
|-----|===============================================================================================================|
| 1   | 20.0 10.0 0.020/0.020/0.020 0.67 1.50 0.0300 0.100 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)

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) = 760.00
ELEVATION DATA: UPSTREAM (FEET) = 3287.50 DOWNSTREAM (FEET) = 3269.30

Tc = K*[(LENGTH ** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 12.342
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.539

SUBAREA Tc AND LOSS RATE DATA (AMC II):
<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS</th>
<th>Tc (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESIDENTIAL</td>
<td>&quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>1.47</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA RUNOFF (CFS) = 4.09
TOTAL AREA (ACRES) = 1.47 PEAK FLOW RATE (CFS) = 4.09

FLOW PROCESS FROM NODE 410.00 TO NODE 410.00 IS CODE = 81

FLOW PROCESS FROM NODE 410.00 TO NODE 419.00 IS CODE = 62

STREET FLOW MODEL RESULTS USING ESTIMATED FLOW (CFS) = 9.63

STREET FLOW DEPTH (FEET) = 0.45
HALFSTREET FLOOD WIDTH (FEET) = 17.70
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.98
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 1.35
STREET FLOW TRAVEL TIME (MIN.) = 1.17  Tc (MIN.) = 13.51
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.321

SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/   SCS SOIL  AREA   Fp  Ap  SCS
LAND USE            GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"3-4 DWELLINGS/ACRE"  B  1.47  0.75  0.600  56

SUBAREA AVERAGE Pervious Loss Rate, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE Pervious Area Fraction, Ap = 0.600
SUBAREA AREA (ACRES) = 1.47  SUBAREA RUNOFF (CFS) = 3.80

EFFECTIVE AREA (ACRES) = 4.25  AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 4.2  PEAK FLOW RATE (CFS) = 10.99

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.47  HALFSTREET FLOOD WIDTH (FEET) = 18.63
FLOW VELOCITY (FEET/SEC.) = 3.08  DEPTH*VELOCITY (FT*FT/SEC.) = 1.46

LONGEST FLOWPATH FROM NODE 400.00 TO NODE 419.00 = 970.00 FEET.

*****************************************************************************
FLOW PROCESS FROM NODE 419.00 TO NODE 425.00 IS CODE = 31
>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
*****************************************************************************

ELEVATION DATA:  UPSTREAM (FEET) = 3260.50  DOWNSTREAM (FEET) = 3258.30
FLOW LENGTH (FEET) = 330.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 15.2 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 5.91
ESTIMATED PIPE DIAMETER (INCH) = 21.00  NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 10.99
PIPE TRAVEL TIME (MIN.) = 0.93  Tc (MIN.) = 14.45
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 425.00 = 1300.00 FEET.

*****************************************************************************
FLOW PROCESS FROM NODE 425.00 TO NODE 425.00 IS CODE = 81
>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
*****************************************************************************

MAINLINE Tc (MIN.) = 14.45
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.170

SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/   SCS SOIL  AREA   Fp  Ap  SCS
LAND USE            GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"3-4 DWELLINGS/ACRE"  B  1.45  0.75  0.600  56
RESIDENTIAL
"3-4 DWELLINGS/ACRE"  B  1.32  0.75  0.600  56

SUBAREA AVERAGE Pervious Loss Rate, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE Pervious Area Fraction, Ap = 0.600
SUBAREA AREA (ACRES) = 2.77  SUBAREA RUNOFF (CFS) = 6.78

EFFECTIVE AREA (ACRES) = 7.02  AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 7.0 PEAK FLOW RATE (CFS) = 17.19

FLOW PROCESS FROM NODE 425.00 TO NODE 440.00 IS CODE = 31

>>> COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA <<<
>>> USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW) <<<

ELEVATION DATA: UPSTREAM (FEET) = 3258.30 DOWNSTREAM (FEET) = 3255.85
FLOW LENGTH (FEET) = 40.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.9 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 15.41
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 17.19
PIPE TRAVEL TIME (MIN.) = 0.04 Tc (MIN.) = 14.49
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 440.00 = 1340.00 FEET.

FLOW PROCESS FROM NODE 440.00 TO NODE 440.00 IS CODE = 1

>>> DESIGNEATE INDEPENDENT STREAM FOR CONFLUENCE <<<

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION (MIN.) = 14.49
RAINFALL INTENSITY (INCH/HR) = 3.16
AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.60
EFFECTIVE STREAM AREA (ACRES) = 7.02
TOTAL STREAM AREA (ACRES) = 7.02
PEAK FLOW RATE (CFS) AT CONFLUENCE = 17.19

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) = 360.00
ELEVATION DATA: UPSTREAM (FEET) = 3279.50 DOWNSTREAM (FEET) = 3269.10

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

SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.816
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.479
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
"3-4 DWELLINGS/ACRE" B 0.89 0.75 0.600 56 8.82
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA RUNOFF (CFS) = 3.23
TOTAL AREA (ACRES) = 0.89 PEAK FLOW RATE (CFS) = 3.23

FLOW PROCESS FROM NODE 310.00 TO NODE 320.00 IS CODE = 62
UPSTREAM ELEVATION (FEET) = 3269.10  DOWNSTREAM ELEVATION (FEET) = 3266.90
STREET LENGTH (FEET) = 270.00  CURB HEIGHT (INCHES) = 8.0
STREET HALFWIDTH (FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 4.55
STREET FLOW DEPTH (FEET) = 0.37
HALFSTREET FLOOD WIDTH (FEET) = 13.48
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.38
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 0.88
STREET FLOW TRAVEL TIME (MIN.) = 1.89  Tc (MIN.) = 10.71
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.910

SUBAREA LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>0.85</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA AREA (ACRES) = 0.85  SUBAREA RUNOFF (CFS) = 2.65
EFFECTIVE AREA (ACRES) = 1.74  AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 1.7  PEAK FLOW RATE (CFS) = 5.42

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.39  HALFSTREET FLOOD WIDTH (FEET) = 14.41
FLOW VELOCITY (FEET/SEC.) = 2.49  DEPTH*VELOCITY (FT*FT/SEC.) = 0.97
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 320.00 = 630.00 FEET.

FLOW PROCESS FROM NODE 320.00 TO NODE 330.00 IS CODE = 62

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

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 6.60
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.41
HALFSTREET FLOOD WIDTH (FEET) = 15.59
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.61
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 1.07
STREET FLOW TRAVEL TIME (MIN.) = 1.72 Tc (MIN.) = 12.43
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.522

SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL "3-4 DWELLINGS/ACRE" B 0.85 0.75 0.600 56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA AREA (ACRES) = 0.85 SUBAREA RUNOFF (CFS) = 2.35
EFFECTIVE AREA (ACRES) = 2.59 AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 2.6 PEAK FLOW RATE (CFS) = 7.16

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.42 HALFSTREET FLOOD WIDTH (FEET) = 16.13
FLOW VELOCITY (FEET/SEC.) = 2.65 DEPTH * VELOCITY (FT*FT/SEC.) = 1.12
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 330.00 = 900.00 FEET.

FLOW PROCESS FROM NODE 330.00 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) = 3256.00 DOWNSTREAM (FEET) = 3255.85
FLOW LENGTH (FEET) = 30.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 14.6 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.67
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 7.16
PIPE TRAVEL TIME (MIN.) = 0.11 Tc (MIN.) = 12.54
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 440.00 = 930.00 FEET.

FLOW PROCESS FROM NODE 440.00 TO NODE 440.00 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.) = 12.54
RAINFALL INTENSITY (INCH/HR) = 3.50
AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.60
EFFECTIVE STREAM AREA (ACRES) = 2.59
TOTAL STREAM AREA (ACRES) = 2.59
PEAK FLOW RATE (CFS) AT CONFLUENCE = 7.16

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17.19</td>
<td>14.49</td>
<td>3.163</td>
<td>0.75( 0.45)</td>
<td>0.60</td>
<td>7.0</td>
<td>400.00</td>
</tr>
<tr>
<td>2</td>
<td>7.16</td>
<td>12.54</td>
<td>3.501</td>
<td>0.75( 0.45)</td>
<td>0.60</td>
<td>2.6</td>
<td>300.00</td>
</tr>
</tbody>
</table>

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

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23.89</td>
<td>12.54</td>
<td>3.501</td>
<td>0.75( 0.45)</td>
<td>0.60</td>
<td>8.7</td>
<td>300.00</td>
</tr>
<tr>
<td>2</td>
<td>23.56</td>
<td>14.49</td>
<td>3.163</td>
<td>0.75( 0.45)</td>
<td>0.60</td>
<td>9.6</td>
<td>400.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 23.89
Tc (MIN.) = 12.54
EFFECTIVE AREA (ACRES) = 8.66
AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 9.6
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 440.00 = 1340.00 FEET.

FLOW PROCESS FROM NODE 440.00 TO NODE 340.00 IS CODE = 31

FLOW PROCESS FROM NODE 340.00 TO NODE 340.00 IS CODE = 81

MAINLINE Tc (MIN.) = 13.60
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.307

SUBAREA LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>1.31</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
<tr>
<td>&quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>2.09</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE Pervious Loss Rate, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE Pervious Area Fraction, Ap = 0.600
SUBAREA AREA (ACRES) = 3.40  SUBAREA RUNOFF (CFS) = 8.75  
EFFECTIVE AREA (ACRES) = 12.06  AREA-AVERAGED Fm (INCH/HR) = 0.45  
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60  
TOTAL AREA (ACRES) = 13.0  PEAK FLOW RATE (CFS) = 31.03  

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) = 3250.35  downstream (feet) = 3243.25  
Flow length (feet) = 290.00  Manning's N = 0.013  
Depth of flow in 24.0 inch pipe is 17.8 inches  
Pipe-flow velocity (feet/sec.) = 12.43  
Estimated pipe diameter (inch) = 24.00  Number of pipes = 1  
Pipe-flow (cfs) = 31.03  
Pipe travel time (min.) = 0.39  Tc (min.) = 13.99  
Longest flowpath from node 400.00 to node 350.00 = 2170.00 feet.  

Flow process from node 350.00 to node 350.00 is code = 81  

>>>>> Addition of subarea to mainline peak flow <<<<<

Mainline Tc (min.) = 13.99  
* 100 year rainfall intensity (inch/hr) = 3.242  
Subarea loss rate data (AMC II):  
Development type/ SCS Soil  Area  Fp  Ap  SCS  
Land use  group (acres) (inch/hr) (decimal) CN  
Residential  "3-4 dwellings/acre" B  2.00  0.75  0.600  56  
Residential  "3-4 dwellings/acre" B  1.15  0.75  0.600  56  
Subarea average pervious loss rate, Fp (inch/hr) = 0.75  
Subarea average pervious area fraction, Ap = 0.600  
Subarea area (acres) = 3.15  Subarea runoff (cfs) = 7.92  
Effective area (acres) = 15.21  Area-averaged Fm (inch/hr) = 0.45  
Area-averaged Fp (inch/hr) = 0.75  Area-averaged Ap = 0.60  
Total area (acres) = 16.2  Peak flow rate (cfs) = 38.25  

Flow process from node 350.00 to node 235.00 is code = 31  

>>>>> Compute pipe-flow travel time thru subarea <<<<<  
>>>>> Using computer-estimated pipesize (non-pressure flow) <<<<<

Elevation data: upstream (feet) = 3243.25  downstream (feet) = 3242.85  
Flow length (feet) = 55.00  Manning's N = 0.013  
Depth of flow in 33.0 inch pipe is 23.8 inches  
Pipe-flow velocity (feet/sec.) = 8.34  
Estimated pipe diameter (inch) = 33.00  Number of pipes = 1  
Pipe-flow (cfs) = 38.25  
Pipe travel time (min.) = 0.11  Tc (min.) = 14.10  
Longest flowpath from node 400.00 to node 235.00 = 2225.00 feet.
FLOW PROCESS FROM NODE 235.00 TO NODE 235.00 IS CODE = 10

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

FLOW PROCESS FROM NODE 100.00 TO NODE 111.00 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREOA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREOA<<

INITIAL SUBAREOA FLOW-LENGTH(FEET) = 620.00
ELEVATION DATA: UPSTREAM(FeET) = 3281.10 DOWNSTREAM(FeET) = 3266.60

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREAO ANALYSIS USED MINIMUM Tc(MIN.) = 11.430
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.735
SUBAREAO 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 "3-4 DWELLINGS/ACRE" B 1.31 0.75 0.600 56 11.43
SUBAREAO AVERAGE PERVERIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREAO AVERAGE PERVERIOUS AREA FRACTION, Ap = 0.600
SUBAREAO RUNOFF(CFS) = 3.87
TOTAL AREA(ACRES) = 1.31 PEAK FLOW RATE(CFS) = 3.87

FLOW PROCESS FROM NODE 111.00 TO NODE 115.00 IS CODE = 62

>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREAO<<<<<
>>>>>(STREET TABLE SECTION # 1 USED)<<<<<

UPSTREAM ELEVATION(FeET) = 3266.60 DOWNSTREAM ELEVATION(FeET) = 3260.00
STREET LENGTH(FeET) = 390.00 CURB HEIGHT(INCHES) = 8.0
STREET HALFWIDTH(FeET) = 20.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FeET) = 10.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.53
STREET FLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FeET) = 0.35
HALFSTREET FLOOD WIDTH(FeET) = 12.54
AVERAGE FLOW VELOCITY(FeET/SEC.) = 3.31
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.16
STREET FLOW TRAVEL TIME(MIN.) = 1.96 Tc(MIN.) = 13.39
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.342
SUBAREAO LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"3-4 DWELLINGS/ACRE" B 1.27 0.75 0.600 56
SUBAREA AVERAGE Pervious LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE Pervious AREA FRACTION, Ap = 0.600
SUBAREA AREA(ACRES) = 1.27 SUBAREA RUNOFF(CFS) = 3.31
EFFECTIVE AREA(ACRES) = 2.58 AREA-AVERAGED Fm(INCH/HR) = 0.45
AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.60
TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 6.72

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.37 HALFSTREET FLOOD WIDTH(FEET) = 13.55
FLOW VELOCITY(FEET/SEC.) = 3.47 DEPTH*VELOCITY(FT*FT/SEC.) = 1.29
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 115.00 = 1010.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE 115.00 TO NODE 215.00 IS CODE = 31


>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
******************************************************************************
ELEVATION DATA: UPSTREAM(FEET) = 3252.00 DOWNSTREAM(FEET) = 3251.75
FLOW LENGTH(FEET) = 50.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.7 INCHES
PIEVELOCITY(FT/SEC.) = 4.65
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.72
PIPE TRAVEL TIME(MIN.) = 0.18 Tc(MIN.) = 13.57
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 215.00 = 1060.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE 215.00 TO NODE 215.00 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.) = 13.57
RAINFALL INTENSITY(INCH/HR) = 3.31
AREA-AVERAGED Fm(INCH/HR) = 0.45
AREA-AVERAGED Fp(INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.60
EFFECTIVE STREAM AREA(ACRES) = 2.58
TOTAL STREAM AREA(ACRES) = 2.58
PEAK FLOW RATE(CFS) AT CONFLUENCE = 6.72

******************************************************************************
FLOW PROCESS FROM NODE 200.00 TO NODE 205.00 IS CODE = 21


>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
******************************************************************************
INITIAL SUBAREA FLOW-LENGTH(FEET) = 540.00
ELEVATION DATA: UPSTREAM(FEET) = 3287.50 DOWNSTREAM(FEET) = 3280.60

Tc = K[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 12.206
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.567
SUBAREA Tc AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS</th>
<th>Tc (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESIDENTIAL</td>
<td>B</td>
<td>1.47</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
<td>12.21</td>
</tr>
</tbody>
</table>

Subarea average pervious loss rate, Fp (INCH/HR) = 0.75
Subarea average pervious area fraction, Ap = 0.600
Subarea runoff (CFS) = 4.13
Total area (ACRES) = 1.47
Peak flow rate (CFS) = 4.13

Flow process from node 205.00 to node 206.00 is code = 62

>>>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA <<<<<
>>>>> (STREET TABLE SECTION #1 USED) <<<<<
============================================================================
Upstream elevation (FEET) = 3280.60
Downstream elevation (FEET) = 3270.90
Street length (FEET) = 440.00
Curb height (INCHES) = 8.0
Street halfwidth (FEET) = 20.00
Distance from crown to crossfall gradebreak (FEET) = 10.00
Inside street crossfall (DECIMAL) = 0.020
Outside street crossfall (DECIMAL) = 0.020
Specified number of halfstreets carrying runoff = 1
Street parkway crossfall (DECIMAL) = 0.020
Manning's friction factor for streetflow section (curb-to-curb) = 0.0150
Manning's friction factor for back-of-walk flow section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 6.22**
Streetflow model results using estimated flow:
Street flow depth (FEET) = 0.35
Halfstreet flood width (FEET) = 12.46
Average flow velocity (FEET/SEC.) = 3.77
Product of depth & velocity (FT*FT/SEC.) = 1.32
Street flow travel time (MIN.) = 1.95
Tc (MIN.) = 14.15
*100 year rainfall intensity (INCH/HR) = 3.216
Subarea loss rate data (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESIDENTIAL</td>
<td>B</td>
<td>1.68</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
</tbody>
</table>

Subarea average pervious loss rate, Fp (INCH/HR) = 0.75
Subarea average pervious area fraction, Ap = 0.600
Subarea area (ACRES) = 1.68
Subarea runoff (CFS) = 4.18
Effective area (ACRES) = 3.15
Area-averaged Fm (INCH/HR) = 0.45
Area-averaged Fp (INCH/HR) = 0.75
Area-averaged Ap = 0.60
Total area (ACRES) = 3.2
Peak flow rate (CFS) = 7.85

End of subarea street flow hydraulics:
Depth (FEET) = 0.37
Halfstreet flood width (FEET) = 13.71
Flow velocity (FEET/SEC.) = 3.97
Depth*velocity (FT*FT/SEC.) = 1.48
Longest flowpath from node 200.00 to node 206.00 = 980.00 FEET.

*****************************************************************************
FLOW PROCESS FROM NODE 206.00 TO NODE 210.00 IS CODE = 62
*****************************************************************************
COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA
(STREET TABLE SECTION # 1 USED)

UPSTREAM ELEVATION (FEET) = 3270.90
DOWNSTREAM ELEVATION (FEET) = 3259.50
STREET LENGTH (FEET) = 690.00
CURB HEIGHT (INCHES) = 8.0
STREET HALFWIDTH (FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

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

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 9.81**
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.42
HALFSTREET FLOOD WIDTH (FEET) = 15.82
AVERAGE FLOW VELOCITY (FEET/SEC.) = 3.77
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 1.57
STREET FLOW TRAVEL TIME (MIN.) = 3.05
Tc (MIN.) = 17.20
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 2.806

SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE /
SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL "3-4 DWELLINGS/ACRE" B 1.85 0.75 0.600 56

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA AREA (ACRES) = 1.85
SUBAREA RUNOFF (CFS) = 3.92
EFFECTIVE AREA (ACRES) = 5.00
AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 5.0
PEAK FLOW RATE (CFS) = 10.61

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.43
HALFSTREET FLOOD WIDTH (FEET) = 16.37
FLOW VELOCITY (FEET/SEC.) = 3.82
DEPTH*VELOCITY (FT*FT/SEC.) = 1.63
LONGEST FLOW PATH FROM NODE 200.00 TO NODE 210.00 = 1670.00 FEET.

FLOW PROCESS FROM NODE 210.00 TO NODE 215.00 IS CODE = 31

COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA
USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)

ELEVATION DATA: UPSTREAM (FEET) = 3252.00
DOWNSTREAM (FEET) = 3251.75
FLOW LENGTH (FEET) = 20.00
MANNING'S N = 0.013

DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.7 INCHES

PIE-FLOW VELOCITY (FEET/SEC.) = 7.36

ESTIMATED PIPE DIAMETER (INCH) = 18.00
NUMBER OF PIPES = 1
PIE-FLOW (CFS) = 10.61

PIPE TRAVEL TIME (MIN.) = 0.05
Tc (MIN.) = 17.25
LONGEST FLOW PATH FROM NODE 200.00 TO NODE 215.00 = 1690.00 FEET.

*************************************************************************
FLOW PROCESS FROM NODE 215.00 TO NODE 215.00 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.) = 17.25
- RAINFALL INTENSITY (INCH/HR) = 2.80
- AREA-AVERAGED F_m (INCH/HR) = 0.45
- AREA-AVERAGED F_p (INCH/HR) = 0.75
- AREA-AVERAGED A_p = 0.60
- EFFECTIVE STREAM AREA (ACRES) = 5.00
- TOTAL STREAM AREA (ACRES) = 5.00
- PEAK FLOW RATE (CFS) AT CONFLUENCE = 10.61

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>F_p (F_m)</th>
<th>A_p</th>
<th>A_e</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.72</td>
<td>13.57</td>
<td>3.312</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>2.6</td>
<td>100.00</td>
</tr>
<tr>
<td>2</td>
<td>10.61</td>
<td>17.25</td>
<td>2.800</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>5.0</td>
<td>200.00</td>
</tr>
</tbody>
</table>

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO

CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>F_p (F_m)</th>
<th>A_p</th>
<th>A_e</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.88</td>
<td>13.57</td>
<td>3.312</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>6.5</td>
<td>100.00</td>
</tr>
<tr>
<td>2</td>
<td>16.12</td>
<td>17.25</td>
<td>2.800</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>7.6</td>
<td>200.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

- PEAK FLOW RATE (CFS) = 16.88
- Tc (MIN.) = 13.57
- EFFECTIVE AREA (ACRES) = 6.52
- AREA-AVERAGED F_m (INCH/HR) = 0.45
- AREA-AVERAGED F_p (INCH/HR) = 0.75
- AREA-AVERAGED A_p = 0.60
- TOTAL AREA (ACRES) = 7.6
- LONGEST FLOWPATH FROM NODE 200.00 TO NODE 215.00 = 1690.00 FEET.

FLOW PROCESS FROM NODE 215.00 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) = 3251.75
DOWNSTREAM (FEET) = 3249.30
FLOW LENGTH (FEET) = 385.00
MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 18.9 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 6.37
ESTIMATED PIPE DIAMETER (INCH) = 24.00
NUMBER OFPIPES = 1
PIPE-FLOW (CFS) = 16.88
PIPE TRAVEL TIME (MIN.) = 1.01
Tc (MIN.) = 14.58
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 220.00 = 2075.00 FEET.

FLOW PROCESS FROM NODE 220.00 TO NODE 220.00 IS CODE = 81

>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
MAINLINE Tc(MIN.) = 14.58
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.150
SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/  SCS SOIL AREA   Fp   Ap   SCS
LAND USE            GROUP   (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"3-4 DWELLINGS/ACRE"  B      1.70   0.75  0.600   56
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA AREA(ACRES) = 1.70  SUBAREA RUNOFF(CFS) = 4.13
EFFECTIVE AREA(ACRES) = 8.22  AREA-AVERAGED Fm(INCH/HR) = 0.45
AREA-AVERAGED Fp(INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60
TOTAL AREA(ACRES) = 9.3  PEAK FLOW RATE(CFS) = 19.97

FLOW PROCESS FROM NODE 220.00 TO NODE 235.00 IS CODE = 31

>>> COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA <<<<<

ELEVATION DATA: UPSTREAM(FEET) = 3248.85  DOWNSTREAM(FEET) = 3244.12
FLOW LENGTH( FEET) = 540.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 19.0 INCHES
PIPE-FLOW VELOCITY( FEET/SEC.) = 7.48
ESTIMATED PIPE DIAMETER(INCH) = 24.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 19.97
PIPE TRAVEL TIME(MIN.) = 1.20  Tc(MIN.) = 15.78
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 235.00 = 2615.00 FEET.

FLOW PROCESS FROM NODE 235.00 TO NODE 235.00 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) (INCH/HR) (ACRES) NODE
1   19.97 15.78 2.980  0.75(0.45) 0.60  8.2  100.00
2   18.73 19.47 2.573 0.75(0.45) 0.60  9.3  200.00
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 235.00 = 2615.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM Q  Tc  Intensity  Fp(Fm)  Ap  Ae  HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (INCH/HR) (ACRES) NODE
1   38.25 14.10 3.225  0.75(0.45) 0.60 15.2  300.00
2   36.50 16.05 2.944 0.75(0.45) 0.60 16.2  400.00
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 235.00 = 2225.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM Q  Tc  Intensity  Fp(Fm)  Ap  Ae  HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (INCH/HR) (ACRES) NODE
1   57.82 14.10 3.225 0.75(0.45) 0.60 22.6  300.00
2   56.72 15.78 2.980 0.75(0.45) 0.60 24.2  100.00
3   56.38 16.05 2.944 0.75(0.45) 0.60 24.5  400.00
4   49.79 19.47 2.573 0.75(0.45) 0.60 25.4  200.00
TOTAL AREA (ACRES) = 25.4

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 57.82  Tc (MIN.) = 14.098
EFFECTIVE AREA (ACRES) = 22.55  AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 25.4
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 235.00 = 2615.00 FEET.

FLOW PROCESS FROM NODE 235.00 TO NODE 230.00 IS CODE = 31

FLOW PROCESS FROM NODE 230.00 TO NODE 130.00 IS CODE = 31

MAINLINE Tc (MIN.) = 14.12
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.222

SUBAREA LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESIDENTIAL</td>
<td>B</td>
<td>1.36</td>
<td>0.75</td>
<td>0.60</td>
<td>56</td>
</tr>
<tr>
<td>RESIDENTIAL</td>
<td>B</td>
<td>2.21</td>
<td>0.75</td>
<td>0.60</td>
<td>56</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA AREA (ACRES) = 3.57  SUBAREA RUNOFF (CFS) = 8.91
EFFECTIVE AREA (ACRES) = 26.12  AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 29.0  PEAK FLOW RATE (CFS) = 65.20

FLOW PROCESS FROM NODE 230.00 TO NODE 130.00 IS CODE = 31

FLOW PROCESS FROM NODE 235.00 TO NODE 230.00 IS CODE = 81

ELEVATION DATA: UPSTREAM (FEET) = 3244.21  DOWNSTREAM (FEET) = 3244.12
FLOW LENGTH (FEET) = 10.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 36.0 INCH PIPE IS 27.7 INCHES
PIPE FLOW VELOCITY (FEET/SEC.) = 9.91
ESTIMATED PIPE DIAMETER (INCH) = 36.00  NUMBER OF LANES = 1
PIPE FLOW (CFS) = 57.82
PIPE TRAVEL TIME (MIN.) = 0.02  Tc (MIN.) = 14.12
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 230.00 = 2625.00 FEET.

FLOW PROCESS FROM NODE 235.00 TO NODE 230.00 IS CODE = 81

FLOW PROCESS FROM NODE 230.00 TO NODE 130.00 IS CODE = 31

ELEVATION DATA: UPSTREAM (FEET) = 3244.12  DOWNSTREAM (FEET) = 3243.50
FLOW LENGTH (FEET) = 90.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 39.0 INCH PIPE IS 31.2 INCHES
PIPE FLOW VELOCITY (FEET/SEC.) = 9.18
ESTIMATED PIPE DIAMETER (INCH) = 39.00  NUMBER OF PIPES = 1
PIPE FLOW (CFS) = 65.20
PIPE TRAVEL TIME(MIN.) = 0.16   Tc(MIN.) = 14.28
LONGEST FLOWPATH FROM NODE  200.00 TO NODE  130.00 = 2715.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE  130.00 TO NODE  130.00 IS CODE = 81

>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<

MAINLINE Tc(MIN.) = 14.28
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.196

SUBAREA LOSS RATE DATA(AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESIDENTIAL &quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>0.84</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
<tr>
<td>RESIDENTIAL &quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>1.47</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVERSIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVERSIOUS AREA FRACTION, Ap = 0.600
SUBAREA AREA(ACRES) = 2.31   SUBAREA RUNOFF(CFS) = 5.71
EFFECTIVE AREA(ACRES) = 28.43   AREA-AVERAGED Fm(INCH/HR) = 0.45
AREA-AVERAGED Fp(INCH/HR) = 0.75   AREA-AVERAGED Ap = 0.60
TOTAL AREA(ACRES) = 31.3   PEAK FLOW RATE(CFS) = 70.30

****************************************************************************
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) = 3243.50  DOWNSTREAM(FEET) = 3242.50
FLOW LENGTH(FEET) = 124.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 39.0 INCH PIPE IS 31.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.93
ESTIMATED PIPE DIAMETER(INCH) = 39.00   NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 70.30
PIPE TRAVEL TIME(MIN.) = 0.21   Tc(MIN.) = 14.49
LONGEST FLOWPATH FROM NODE  200.00 TO NODE  140.00 = 2839.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE  140.00 TO NODE  140.00 IS CODE = 10

>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<

****************************************************************************
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) = 450.00
ELEVATION DATA: UPSTREAM(FEET) = 3271.90  DOWNSTREAM(FEET) = 3259.40
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.715
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.185
SUBAREA Tc AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS</th>
<th>Tc (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>1.07</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
<td>9.71</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA RUNOFF (CFS) = 3.60
TOTAL AREA (ACRES) = 1.07 PEAK FLOW RATE (CFS) = 3.60

FLOW PROCESS FROM NODE 510.00 TO NODE 520.00 IS CODE = 62

>>>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA <<<<<
>>>>>(STREET TABLE SECTION # 1 USED)<<<<<

**FLOW PROCESS FROM NODE 510.00 TO NODE 520.00 IS CODE = 62**

UPSTREAM ELEVATION (FEET) = 3259.40 DOWNSTREAM ELEVATION (FEET) = 3253.40
STREET LENGTH (FEET) = 640.00 CURB HEIGHT (INCHES) = 8.0
STREET HALFWIDTH (FEET) = 20.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 6.24**
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.40
HALFSTREET FLOOD WIDTH (FEET) = 14.80
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.73
PRODUCT OF DEPTH*VELOCITY (FT*FT/SEC.) = 1.08
STREET FLOW TRAVEL TIME (MIN.) = 3.91 Tc (MIN.) = 13.63
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.302

SUBAREA LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B</td>
<td>2.05</td>
<td>0.75</td>
<td>0.600</td>
<td>56</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA AREA (ACRES) = 2.05 SUBAREA RUNOFF (CFS) = 5.26
EFFECTIVE AREA (ACRES) = 3.12 AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp(INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 3.1 PEAK FLOW RATE (CFS) = 8.01

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.43 HALFSTREET FLOOD WIDTH (FEET) = 16.37
FLOW VELOCITY (FEET/SEC.) = 2.89 DEPTH*VELOCITY (FT*FT/SEC.) = 1.23
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 520.00 = 1090.00 FEET.

FLOW PROCESS FROM NODE 520.00 TO NODE 525.00 IS CODE = 31
>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<
>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<

ELEVATION DATA: UPSTREAM(Feet) = 3246.35 DOWNSTREAM(Feet) = 3246.05
FLOW LENGTH(Feet) = 20.00 MANNING'S N = 0.013
DEPT OF FLOW IN 18.0 INCH PIPE IS 10.5 INCHES
PIPE-FLOW VELOCITY(Feet/Sec.) = 7.52
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 8.01
PIPE TRAVEL TIME(MIN.) = 0.04 Tc(MIN.) = 13.67
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 525.00 = 1110.00 FEET.

Flow Process from Node 525.00 to Node 525.00 IS CODE = 1

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 13.67
RAINFALL INTENSITY(INCH/HR) = 3.29
AREA-AVERAGED Fm(INCH/HR) = 0.45
AREA-AVERAGED Fp(INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.60
EFFECTIVE STREAM AREA(ACRES) = 3.12
TOTAL STREAM AREA(ACRES) = 3.12
PEAK FLOW RATE(CFS) AT CONFLUENCE = 8.01

Flow Process from Node 600.00 to Node 610.00 IS CODE = 21

RATIONAL METHOD INITIAL SUBAREA ANALYSIS
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW LENGTH(Feet) = 480.00
ELEVATION DATA: UPSTREAM(Feet) = 3271.80 DOWNSTREAM(Feet) = 3259.40

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.115
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.068
SUBAREA Tc AND LOSS RATE DATA(AMC II):
<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/</th>
<th>SCS SOIL</th>
<th>AREA</th>
<th>Fp</th>
<th>Ap</th>
<th>SCS</th>
<th>Tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND USE</td>
<td>GROUP</td>
<td>(ACRES)</td>
<td>(INCH/HR)</td>
<td>(DECIMAL)</td>
<td>CN</td>
<td>(MIN.)</td>
</tr>
<tr>
<td>RESIDENTIAL</td>
<td>B</td>
<td>1.70</td>
<td>0.75</td>
<td>0.60</td>
<td>56</td>
<td>10.11</td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVERSIOUS LOSS RATE, Fp(INCH/HR) = 0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA AVERAGE PERVERSIOUS AREA FRACTION, Ap = 0.600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBAREA RUNOFF(CFS) = 5.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL AREA(ACRES) = 1.70 PEAK FLOW RATE(CFS) = 5.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Flow Process from Node 610.00 to Node 620.00 IS CODE = 62

Street Flow Travel Time Thru Subarea

UPSTREAM ELEVATION(Feet) = 3259.40 DOWNSTREAM ELEVATION(Feet) = 3253.50
STREET LENGTH (FEET) = 640.00  CURB HEIGHT (INCHES) = 8.0
STREET HALFWIDTH (FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

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

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 8.28**
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.43
HALFSTREET FLOOD WIDTH (FEET) = 16.60
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.90
PRODUCT OF DEPTH*VELOCITY (FT*FT/SEC.) = 1.25
STREET FLOW TRAVEL TIME (MIN.) = 3.68  Tc (MIN.) = 13.79
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.275

SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/  SCS SOIL  AREA      Fp         Ap     SCS
LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"3-4 DWELLINGS/ACRE"  B     2.15    0.75    0.600    56
SUBAREA AVERAGE PERVERIS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVERIS AREA FRACTION, Ap = 0.600
SUBAREA AREA (ACRES) = 2.15  SUBAREA RUNOFF (CFS) = 5.47
EFFECTIVE AREA (ACRES) = 3.85  AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 3.9  PEAK FLOW RATE (CFS) = 9.79

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.46  HALFSTREET FLOOD WIDTH (FEET) = 17.77
FLOW VELOCITY (FEET/SEC.) = 3.01  DEPTH*VELOCITY (FT*FT/SEC.) = 1.37
LONGEST FLOWPATH FROM NODE  600.00 TO NODE  620.00 = 1120.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE  620.00 TO NODE  525.00 IS CODE = 31
******************************************************************************

>>> COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>> USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
******************************************************************************
ELEVATION DATA: UPSTREAM (FEET) = 3246.74  DOWNSTREAM (FEET) = 3246.03
FLOW LENGTH (FEET) = 64.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.5 INCHES
PIPE FLOW VELOCITY (FEET/SEC.) = 6.91
ESTIMATED PIPE DIAMETER (INCH) = 18.00  NUMBER OF PIPES = 1
PIPE FLOW (CFS) = 9.79
PIPE TRAVEL TIME (MIN.) = 0.15  Tc (MIN.) = 13.94
LONGEST FLOWPATH FROM NODE  600.00 TO NODE  525.00 = 1184.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE  525.00 TO NODE  525.00 IS CODE = 1
******************************************************************************

>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION (MIN.) = 13.94
RAINFALL INTENSITY (INCH/HR) = 3.25
AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75
AREA-AVERAGED Ap = 0.60
EFFECTIVE STREAM AREA (ACRES) = 3.85
TOTAL STREAM AREA (ACRES) = 3.85
PEAK FLOW RATE (CFS) AT CONFLUENCE = 9.79

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae (ACRES)</th>
<th>HEADWATER NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.01</td>
<td>13.67</td>
<td>3.295</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>3.1</td>
<td>500.00</td>
</tr>
<tr>
<td>2</td>
<td>9.79</td>
<td>13.94</td>
<td>3.249</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>3.9</td>
<td>600.00</td>
</tr>
</tbody>
</table>

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

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae (ACRES)</th>
<th>HEADWATER NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17.77</td>
<td>13.67</td>
<td>3.295</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>6.9</td>
<td>500.00</td>
</tr>
<tr>
<td>2</td>
<td>17.68</td>
<td>13.94</td>
<td>3.249</td>
<td>0.75 (0.45)</td>
<td>0.60</td>
<td>7.0</td>
<td>600.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 17.77 Tc (MIN.) = 13.67
EFFECTIVE AREA (ACRES) = 6.89 AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.60
TOTAL AREA (ACRES) = 7.0
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 525.00 = 1184.00 FEET.

** MAIN STREAM CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
</table>

FLOW PROCESS FROM NODE 525.00 TO NODE 545.00 IS CODE = 31

ELEVATION DATA: UPSTREAM (FEET) = 3246.03 DOWNSTREAM (FEET) = 3242.50
FLOW LENGTH (FEET) = 104.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.9 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 12.14
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 17.77
PIPE TRAVEL TIME (MIN.) = 0.14 Tc (MIN.) = 13.81
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 545.00 = 1288.00 FEET.

FLOW PROCESS FROM NODE 140.00 TO NODE 140.00 IS CODE = 11

CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY

** MAIN STREAM CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
</table>

Page 20 of 22
### **MEMORY BANK # 2 CONFLUENCE DATA**

<table>
<thead>
<tr>
<th>STREAM</th>
<th>Q</th>
<th>Tc</th>
<th>Intensity</th>
<th>Fp(Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER</td>
<td>(CFS)</td>
<td>(MIN.)</td>
<td>(INCH/HR)</td>
<td>(INCH/HR)</td>
<td>(ACRES)</td>
<td>NODE</td>
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</tr>
<tr>
<td>1</td>
<td>70.30</td>
<td>14.49</td>
<td>3.164</td>
<td>0.75</td>
<td>0.60</td>
<td>28.4</td>
<td>300.00</td>
</tr>
<tr>
<td>2</td>
<td>67.98</td>
<td>16.17</td>
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<td>0.60</td>
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<td>100.00</td>
</tr>
<tr>
<td>3</td>
<td>67.50</td>
<td>16.44</td>
<td>2.895</td>
<td>0.75</td>
<td>0.60</td>
<td>30.3</td>
<td>400.00</td>
</tr>
<tr>
<td>4</td>
<td>59.39</td>
<td>19.86</td>
<td>2.537</td>
<td>0.75</td>
<td>0.60</td>
<td>31.3</td>
<td>200.00</td>
</tr>
</tbody>
</table>

**LONGEST FLOWPATH FROM NODE 600.00 TO NODE 140.00 = 1288.00 FEET.**

### **PEAK FLOW RATE TABLE**

<table>
<thead>
<tr>
<th>STREAM</th>
<th>Q</th>
<th>Tc</th>
<th>Intensity</th>
<th>Fp(Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER</td>
<td>(CFS)</td>
<td>(MIN.)</td>
<td>(INCH/HR)</td>
<td>(INCH/HR)</td>
<td>(ACRES)</td>
<td>NODE</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>87.45</td>
<td>13.81</td>
<td>3.271</td>
<td>0.75</td>
<td>0.60</td>
<td>34.0</td>
<td>500.00</td>
</tr>
<tr>
<td>2</td>
<td>87.62</td>
<td>14.09</td>
<td>3.226</td>
<td>0.75</td>
<td>0.60</td>
<td>34.6</td>
<td>600.00</td>
</tr>
<tr>
<td>3</td>
<td>87.58</td>
<td>14.49</td>
<td>3.164</td>
<td>0.75</td>
<td>0.60</td>
<td>35.4</td>
<td>300.00</td>
</tr>
<tr>
<td>4</td>
<td>83.76</td>
<td>19.86</td>
<td>2.537</td>
<td>0.75</td>
<td>0.60</td>
<td>37.1</td>
<td>200.00</td>
</tr>
<tr>
<td>5</td>
<td>83.07</td>
<td>16.44</td>
<td>2.895</td>
<td>0.75</td>
<td>0.60</td>
<td>37.3</td>
<td>400.00</td>
</tr>
<tr>
<td>6</td>
<td>72.68</td>
<td>19.86</td>
<td>2.537</td>
<td>0.75</td>
<td>0.60</td>
<td>38.3</td>
<td>200.00</td>
</tr>
</tbody>
</table>

**TOTAL AREA (ACRES) = 38.3**

**FLOW PROCESS FROM NODE 200.00 TO NODE 140.00 = 2839.00 FEET.**
SUBAREA RUNOFF (CFS) = 10.46
TOTAL AREA (ACRES) = 4.07  PEAK FLOW RATE (CFS) = 10.46

END OF STUDY SUMMARY:
TOTAL AREA (ACRES) = 4.1  TC (MIN.) = 13.62
EFFECTIVE AREA (ACRES) = 4.07  AREA-AVERAGED Fm (INCH/HR) = 0.45
AREA-AVERAGED Fp (INCH/HR) = 0.75  AREA-AVERAGED Ap = 0.600
PEAK FLOW RATE (CFS) = 10.46

END OF RATIONAL METHOD ANALYSIS
APPENDIX 8.1.3

100-YEAR DETENTION BASIN
FLOOD ROUTING ANALYSIS
### WATERSHED AREA-AVERAGED POINT RAINFALL DATA
### INPUT FOR UNIT HYDROGRAPH

*(Table 3-c)*

#### 100-YEAR DEVELOPED

<table>
<thead>
<tr>
<th>Type of Rainfall</th>
<th>Duration</th>
<th>Rainfall Depth</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-Minute Point Rainfall</td>
<td>inches</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>30-Minute Point Rainfall</td>
<td>inches</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
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Low Loss Fraction & Maximum Loss Rate

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<th>Area</th>
<th>Soil type</th>
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<th>CN-III</th>
<th>Ap</th>
<th>%</th>
<th>S</th>
<th>Ia</th>
<th>Y</th>
<th>Y (wght)</th>
<th>Fp (F.C-6)</th>
<th>Fm</th>
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<td>76</td>
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<td>A</td>
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<td>0.41</td>
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</tbody>
</table>

P-24= 3.50 in

Est Vol = 0.79 ac-ft

Low Loss Fraction, Y-bar = 0.562

Return Period 100

AMC Type II (II, III)

Lag Time

Tc = 14 min from Rational Method Study

Lag = 11.2 min Run:

Lag = 0.19 hr

24-hr Rainfall (other than 100 yr)

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<th>I (in)</th>
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<td>100</td>
<td>3.5</td>
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Tributary area

WATERSHED LOSS DETERMINATIONS
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<th>Units</th>
<th>1st-24hr</th>
<th>2nd-24hr</th>
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<td>Design Storm</td>
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<td>2</td>
<td>Catchment Lag time</td>
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<tr>
<td>3</td>
<td>Catchment Area</td>
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<tr>
<td>4</td>
<td>Base flow</td>
<td>cfs/sq mi</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>S-graph</td>
<td></td>
<td></td>
<td>Desert</td>
</tr>
<tr>
<td>6</td>
<td>Maximum loss rate, Fm</td>
<td>in/hr</td>
<td></td>
<td>0.44</td>
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<td>7</td>
<td>Low loss fraction, Y-bar</td>
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<td>9</td>
<td>24-hour storm unit interval</td>
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</table>

Point rainfall unadjusted by depth-area factors

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<th>Depth-area adjustment factors (Fig E-4)</th>
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</thead>
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<td></td>
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<td>30-min</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>1-hr</td>
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</tr>
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<td></td>
<td></td>
<td>3-hr</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>24-hr</td>
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</table>
DETENTION BASIN VOLUME-DISCHARGE DATA

CALCULATION SET-UP

The detention basin will have a bottom elevation set at 3240, and a top elevation of 3252 with 3:1 side slopes.

This study included a preliminary outlet structure with a 36" pipe that will control the outflow. The pipe would be placed above the required retention of the water quality volume at an invert elevation of 3245.

DEPTH OF WATER AT THE OUTLET STRUCTURE

Therefore, the output data from the Unit Hydrograph Flood Routing indicates that the depth of the water in the basin is 7.2 feet.

Bottom of Basin: 3240.
Top Basin: 3252
Depth of Basin: 3252-3240=12 Feet

Water needs to fill the basin with the water quality volume before entering the outlet structure. The maximum retained water quality volume is 1.50 ac-ft at a depth of 5 feet. After this volume is filled the 36" RCP storm drain will start metering the outflow to the Oro Grande Wash.

Maximum 100 year Water Surface: El 3247.2 = 7.2 ft
## Detention Basin Volume

<table>
<thead>
<tr>
<th>Contours Elevation</th>
<th>Area (Sq Ft)</th>
<th>Depth (Ft)</th>
<th>Volume (Cu. Ft)</th>
<th>Volume (Ac. Ft)</th>
<th>Total Volume (Ac-Ft)</th>
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<tbody>
<tr>
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<td>0</td>
<td>0</td>
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<tr>
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<td>0.18</td>
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<tr>
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<tr>
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<td>10,048</td>
<td>1</td>
<td>13,370</td>
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<td>8,564</td>
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OUTLET

WQ VOLUME = 1.48 AC. FT
### BASIN - DEPTH VS. DISCHARGE

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<th>Area</th>
<th>Head</th>
<th>H0</th>
<th>Volume</th>
<th>Infiltration</th>
<th>Single Pipe Outflow</th>
<th>Total Pipe Outflow</th>
<th>Effective Outflow</th>
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<td>ft</td>
<td>sq. ft</td>
<td>ft</td>
<td>ft</td>
<td>ac-ft</td>
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<td>122.4</td>
<td>138.5</td>
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</table>

Infiltration Rate: 43 in/hr
Factor of Safety: 2

\( Q = C \times A \times (2gH_0)^{0.5} \)

**COEFFICIENT OF DISCHARGE CALIBRATED TO REFLECT PIPE FLOW @ S=0.005
SEE HYDRAULIC CALCULATIONS ATTACHED.
>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<

PIPE DIAMETER(FEET) = 3.000
FLOWDEPTH(FEET) = 0.500
PIPE SLOPE(FEET/FEET) = 0.0050
MANNINGS FRICTION FACTOR = 0.013000

>>>>> NORMAL DEPTH FLOW(CFS) = 2.85

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH(Feet) = 0.50
FLOW AREA(SQUARE FEET) = 0.77
FLOW TOP-WIDTH(Feet) = 2.236
FLOW PRESSURE + MOMENTUM(POUNDS) = 30.36
FLOW VELOCITY(Feet/SEC.) = 3.678
FLOW VELOCITY HEAD(Feet) = 0.210
HYDRAULIC DEPTH(Feet) = 0.35
FROUDE NUMBER = 1.101
SPECIFIC ENERGY(Feet) = 0.71

>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<

PIPE DIAMETER(FEET) = 3.000
FLOWDEPTH(Feet) = 1.000
PIPE SLOPE(Feet/Feet) = 0.0050
MANNINGS FRICTION FACTOR = 0.013000

>>>>> NORMAL DEPTH FLOW(CFS) = 11.31

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH(Feet) = 1.00
FLOW AREA(SQUARE FEET) = 2.06
FLOW TOP-WIDTH(Feet) = 2.828
FLOW PRESSURE + MOMENTUM(POUNDS) = 173.73
FLOW VELOCITY(Feet/SEC.) = 5.482
FLOW VELOCITY HEAD(Feet) = 0.467
HYDRAULIC DEPTH(Feet) = 0.73
FROUDE NUMBER = 1.131
SPECIFIC ENERGY(Feet) = 1.47
PIPEFLOW HYDRAULIC INPUT INFORMATION

PIPE DIAMETER (FEET) = 3.000
FLOW DEPTH (FEET) = 1.500
PIPE SLOPE (FEET/FEET) = 0.0050
MANNINGS FRICTION FACTOR = 0.013000

NORMAAL DEPTH FLOW (CFS) = 23.58

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH (FEET) = 1.50
FLOW AREA (SQUARE FEET) = 3.53
FLOW TOP-WIDTH (FEET) = 3.000
FLOW PRESSURE + MOMENTUM (POUNDS) = 445.17
FLOW VELOCITY (FEET/SEC.) = 6.672
FLOW VELOCITY HEAD (FEET) = 0.691
HYDRAULIC DEPTH (FEET) = 1.18
FROUDE NUMBER = 1.083
SPECIFIC ENERGY (FEET) = 2.19

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DETENTION BASIN UNIT HYDROGRAPH
FLOOD ROUTING ANALYSIS
## TENTATIVE TRACT No. 20274 – VICTORVILLE, CA

### INPUT SUMMARY FOR UNIT HYDROGRAPH

#### DEVELOPED CONDITIONS

*(Table 3-b)*

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<th>NODE</th>
<th>SUBAREA</th>
<th>LAG TIME (HR.)</th>
<th>Tc (MIN.)</th>
<th>AREA (AC.)</th>
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**Note:** Use 14.
Problem Descriptions:
100 YEAR DEVELOPED UNIT HYDROGRAPH AND BASIN ROUTING ANALYSIS

RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
TOTAL CATCHMENT AREA (ACRES) = 41.10
SOIL-LOSS RATE, Fm, (INCH/HR) = 0.440
LOW LOSS FRACTION = 0.570
TIME OF CONCENTRATION (MIN.) = 14.00

SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
USER SPECIFIED RAINFALL VALUES ARE USED
RETURN FREQUENCY (YEARS) = 100
5-MINUTE POINT RAINFALL VALUE (INCHES) = 0.43
30-MINUTE POINT RAINFALL VALUE (INCHES) = 0.89
1-HOUR POINT RAINFALL VALUE (INCHES) = 1.17
3-HOUR POINT RAINFALL VALUE (INCHES) = 2.26
6-HOUR POINT RAINFALL VALUE (INCHES) = 3.43
24-HOUR POINT RAINFALL VALUE (INCHES) = 3.50

TOTAL CATCHMENT RUNOFF VOLUME (ACRE-FEET) = 6.09
TOTAL CATCHMENT SOIL-LOSS VOLUME (ACRE-FEET) = 5.90

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Problem Descriptions:

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT (MINUTES) = 14.000
DEAD STORAGE (AF) = 0.00
SPECIFIED DEAD STORAGE (AF) FILLED = 0.00
ASSUMED INITIAL DEPTH (FEET) IN STORAGE BASIN = 0.00

INFLOW

v
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| | | | |
| detention | | | | outflow
| basin |<--| outflow
---
| | storage | basin outlet
v

OUTFLOW

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 16

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APPENDIX 8.1.4
HYDROLOGIC REFERENCES AND MAPS
REFERENCE SOURCES

- NOAA ATLAS 14 Point Precipitation Frequency Estimates.
RAINFALL INTENSITY DATA,
SOIL GROUP MAP,
## Rainfall Intensity Data

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All other values "interpolated" using logarithmic equations as follows:

\[
\text{I}_{100} - \frac{I_{10}}{\ln(100/10) \times \ln(\text{des Period} / 10)} + I_{10}
\]

=values taken from Isohyetals, County Hydrology Manual
IMPERVIOUS COVER
FOR DEVELOPED AREAS

TENTATIVE TRACT No. 20274 – VICTORVILLE, CA
# Actual Impervious Cover

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<td>0 - 0</td>
<td>0</td>
</tr>
<tr>
<td>Public Park</td>
<td>10 - 25</td>
<td>15</td>
</tr>
<tr>
<td>School</td>
<td>30 - 50</td>
<td>40</td>
</tr>
<tr>
<td>Single Family Residential: (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 acre lots</td>
<td>5 - 15</td>
<td>10</td>
</tr>
<tr>
<td>1 acre lots</td>
<td>10 - 25</td>
<td>20</td>
</tr>
<tr>
<td>2 dwellings/acre</td>
<td>20 - 40</td>
<td>30</td>
</tr>
<tr>
<td>3-4 dwellings/acre</td>
<td>30 - 50</td>
<td>40</td>
</tr>
<tr>
<td>5-7 dwellings/acre</td>
<td>35 - 55</td>
<td>50</td>
</tr>
<tr>
<td>8-10 dwellings/acre</td>
<td>50 - 70</td>
<td>60</td>
</tr>
<tr>
<td>More than 10 dwellings/acre</td>
<td>65 - 90</td>
<td>80</td>
</tr>
<tr>
<td>Multiple Family Residential:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condominiums</td>
<td>45 - 70</td>
<td>65</td>
</tr>
<tr>
<td>Apartments</td>
<td>65 - 90</td>
<td>80</td>
</tr>
<tr>
<td>Mobile Home Park</td>
<td>60 - 85</td>
<td>75</td>
</tr>
<tr>
<td>Commercial, Downtown Business or Industrial</td>
<td>80 - 100</td>
<td>90</td>
</tr>
</tbody>
</table>

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

**San Bernardino County Hydrology Manual**

ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS

Figure C-4
HYDRAULIC CALCULATIONS
OUTLET STRUCTURES

TENTATIVE TRACT No. 20274 – VICTORVILLE, CA
EMERGENCY SPILLWAY

DESIGN CAPACITY = 1,000-YEAR PEAK FLOW RATE

\[ Q = 1.35 \times Q_{100} \]

\[ Q_{100} = 97 \]

DESIGN Q = 130.95 C.F.S.

Weir Discharge Equation \((\text{Trapezoidal w/3:1 upstream slope})\)

\[ Q = C \times L \times H^{3/2} \]

\[ Q = 130.95 \]

\[ C = 3.08 \]
\[ H = 1.00 \]

\[ L = 42.5 \text{ FT.} \]

DESIGN L = 43.0 FT.
APPENDIX 8.3

WATER QUALITY BMP CALCULATIONS
# Form 4.2-3 Hydromodification Assessment for Runoff Volume (DA 1)

<table>
<thead>
<tr>
<th>Weighted Curve Number Determination for: Pre-developed DA</th>
<th>DMA A</th>
<th>DMA B</th>
<th>DMA C</th>
<th>DMA D</th>
<th>DMA E</th>
<th>DMA F</th>
<th>DMA G</th>
<th>DMA H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a Land Cover type</td>
<td>OPEN</td>
<td>PUD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a Hydrologic Soil Group (HSG)</td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3a DMA Area, ( ft^2 ) sum of areas of DMA should equal area of DA</td>
<td>1,972,008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4a Curve Number (CN) use items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</td>
<td>710</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weighted Curve Number Determination for: Post-developed DA</th>
<th>DMA A</th>
<th>DMA B</th>
<th>DMA C</th>
<th>DMA D</th>
<th>DMA E</th>
<th>DMA F</th>
<th>DMA G</th>
<th>DMA H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b Land Cover type</td>
<td>RESIDENTIAL</td>
<td>STREET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2b Hydrologic Soil Group (HSG)</td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3b DMA Area, ( ft^2 ) sum of areas of DMA should equal area of DA</td>
<td>1,199,250</td>
<td>771,012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4b Curve Number (CN) use items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</td>
<td>510</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Pre-Developed area-weighted CN:

5 Pre-Developed area-weighted CN: 710

7 Pre-Developed soil storage capacity, \( S \) (in): \( 3.11 \)

9 Initial abstraction, \( I_o \) (in):

\( I_o = 0.2 \times \text{Item } 7 \)

\( 0.43 \)

### Post-Developed area-weighted CN:

6 Post-Developed area-weighted CN: 73

8 Post-Developed soil storage capacity, \( S \) (in):

\( S = (1,000 \times \text{Item } 6) - 10 \)

3.70

10 Initial abstraction, \( I_o \) (in):

\( I_o = 0.2 \times \text{Item } 8 \)

\( 0.74 \)

### Precipitation for 10 yr, 24 hr storm (in):

11 Precipitation for 10 yr, 24 hr storm (in):

\( 3.01 \)

Go to: [http://hdsr.nws.noaa.gov/hdss/pfds/ca/sca_pfds.html](http://hdsr.nws.noaa.gov/hdss/pfds/ca/sca_pfds.html)

### Pre-developed Volume (ft\(^3\)):

12 Pre-developed Volume (ft\(^3\)):

\[ V_{pre} = \frac{(1/12) \times \text{item sum of item } 3 \times ((\text{item } 11 - \text{item } 9) \times 2 / (\text{item } 11 - \text{item } 9 + \text{item } 7))}{187,270 \text{ ft}^3} \]

### Post-developed Volume (ft\(^3\)):

13 Post-developed Volume (ft\(^3\)):

\[ V_{post} = \frac{(1/12) \times \text{item sum of item } 3 \times ((\text{item } 11 - \text{item } 10) \times 2 / (\text{item } 11 - \text{item } 10 + \text{item } 8))}{141,717 \text{ ft}^3} \]

### Volume Reduction needed to meet hydromodification requirement, (ft\(^3\)):

14 Volume Reduction needed to meet hydromodification requirement, (ft\(^3\)):

\[ V_{hydro} = (\text{item } 13 \times 0.95) - \text{item } 12 \]

\( \text{item } 12 \)
## Form 4.2-4 Hydromodification Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-developed DA1</th>
<th>Post-developed DA1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DMA A</td>
<td>DMA B</td>
</tr>
<tr>
<td><strong>1</strong> Length of flowpath (ft)</td>
<td>Use Form 3.2 Item 5 for pre-developed condition</td>
<td></td>
</tr>
<tr>
<td><strong>2</strong> Change in elevation (ft)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3</strong> Slope (ft/ft), $S_s$ = Item 2 / Item 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4</strong> Land cover</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5</strong> Initial DMA Time of Concentration (min) Appendix C.1 of the TGD for WQMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6</strong> Length of conveyance from DMA outlet to project site outlet (ft) May be zero if DMA outlet is at project site outlet</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>7</strong> Cross-sectional area of channel (ft$^2$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>8</strong> Wetted perimeter of channel (ft)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>9</strong> Manning's roughness of channel (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>10</strong> Channel flow velocity (ft/sec) $V_{ch} = (1.49 / \text{Item 9}) \times (\text{Item 7/Item 8})^{0.67} \times (\text{Item 3})^{0.5}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>11</strong> Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} \times 60)$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>12</strong> Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13 Pre-developed time of concentration (min): $[7.40]$ Minimum of Item 12 pre-developed DMA

14 Post-developed time of concentration (min): $[5.06]$ Minimum of Item 12 post-developed DMA

15 Additional time of concentration needed to meet hydromodification requirement (min): $[5.7]$ $T_{c,\text{hydra}} = (\text{Item 13} \times 0.95) - \text{Item 14}$
Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-developed DA to Project Outlet (Use additional forms if more than 3 DMA)</th>
<th>Post-developed DA to Project Outlet (Use additional forms if more than 3 DMA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DMA A</td>
<td>DMA B</td>
</tr>
<tr>
<td>1. Rainfall intensity for storm duration equal to time of concentration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ \text{I}_{\text{orm}} = 10^{* \text{LOG Form 4.2-1 Item 4} - 0.7 \text{LOG Form 4.2-4 Item 5} / 60} ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Drainage Area of each DMA (Acres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Ratio of pervious area to total area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Pervious area infiltration rate (in/hr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Maximum loss rate (in/hr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ \text{F}_m = \text{Item 3} * \text{Item 4} ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use area-weighted \text{F}_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Peak Flow from DMA (cfs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ \text{Q}_p = \text{item 2} * 0.9 * (\text{item 1} - \text{item 5}) ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Time of concentration adjustment factor for other DMA to site discharge point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (if ratio is greater than 1.0, then use maximum value of 1.0)</td>
<td>DMA A</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>DMA B</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>DMA C</td>
<td>n/a</td>
</tr>
<tr>
<td>8. Pre-developed \text{Q}_p at \text{T}_2 for DMA A: [ \text{Q}_p = \text{Item 6 MMA} + [\text{Item 6 MMA} * (\text{Item 1 MMA} - \text{Item 5 MMA})] * \text{Item 7 MMA} ] + [\text{Item 6 MMA} * (\text{Item 1 MMA} - \text{Item 5 MMA})] / (\text{Item 1 MMA} - \text{Item 5 MMA}) * \text{Item 7 MMA} ] ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Pre-developed \text{Q}_p at \text{T}_2 for DMA B: [ \text{Q}_p = \text{Item 6 MMA} + [\text{Item 6 MMA} * (\text{Item 1 MMA} - \text{Item 5 MMA})] * \text{Item 7 MMA} ] + [\text{Item 6 MMA} * (\text{Item 1 MMA} - \text{Item 5 MMA})] / (\text{Item 1 MMA} - \text{Item 5 MMA}) * \text{Item 7 MMA} ] ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Pre-developed \text{Q}_p at \text{T}_2 for DMA C: [ \text{Q}_p = \text{Item 6 MMA} + [\text{Item 6 MMA} * (\text{Item 1 MMA} - \text{Item 5 MMA})] * \text{Item 7 MMA} ] + [\text{Item 6 MMA} * (\text{Item 1 MMA} - \text{Item 5 MMA})] / (\text{Item 1 MMA} - \text{Item 5 MMA}) * \text{Item 7 MMA} ]]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Peak runoff from pre-developed condition confuence analysis (cfs): [ \text{Maximum of Item 8, 9, and 10 (including additional forms as needed)} ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Post-developed \text{Q}_p at \text{T}_2 for DMA A: Same as item 8 for post-developed values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Post-developed \text{Q}_p at \text{T}_2 for DMA B: Same as item 9 for post-developed values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Peak runoff from post-developed condition confuence analysis (cfs): [ \text{Maximum of Item 11, 12, and 13 (including additional forms as needed)} ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Peak runoff reduction needed to meet Hydromodification Requirement (cfs): [ \text{Q}_{\text{Red}} = \text{Item 14} * 0.95 - \text{Item 10} ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### DESIGN CAPTURE VOLUME - POST DEVELOPED

<table>
<thead>
<tr>
<th>DEVELOPMENT AREA</th>
<th>1,912,035 ft²</th>
<th>43.9 ACRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DU/ACRE</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>IMPERVIOUSNESS</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>$R_C$</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>$P_{2YR-1HR}$</td>
<td>0.408 in</td>
<td></td>
</tr>
<tr>
<td>$P_6 = P_{2YR-1HR} \times 1.2371$</td>
<td>0.505 in</td>
<td></td>
</tr>
<tr>
<td>DRAWDOWN RATE</td>
<td>1.963</td>
<td>*48 HOUR</td>
</tr>
</tbody>
</table>

Design Capture Volume (DCV) = \((1/12)(\text{AREA})(R_C)(P_6)(\text{DRAWDOWN RATE})\)

| DCV = 64,558 ft³ | 1.48 AC-FT |
1. All stormwater runoff and nuisance flows from the project site will sheetflow, gutterflow, and travel via Q100 storm drain to a detention/infiltiration basin in the north east corner of the project site. All water quality flows will be detained for infiltration through the bottom of the basin.

2. Since all flows from the post-developed project site will be directed to the basin, the site is broken up into two DMA's to account for the streets and the 3-4 Du/Acre residential development land cover types. DMA A represents all of the lots, while DMA B accounts for the streets within the development.

**WATER QUALITY MITIGATION SUMMARY**

1. The volume reduction needed to meet hydromodification requirement is 0 CF.

2. Water quality infiltration basin - design capture volume:
   - Design capture volume = 40.9 AC-FT
   - Design rate = 1.48 AC-FT
   - Design duration = 1 hour
   - Water level = 3245.3

**WATER QUALITY INFILTRATION BASIN - DESIGN CAPTURE VOLUME**

<table>
<thead>
<tr>
<th>DESIGN CAPTURE VOLUME</th>
<th>POST DEVELOPED</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEVELOPMENT AREA =</td>
<td>1,512,935 SQ FT</td>
</tr>
<tr>
<td>EAVEN =</td>
<td>41</td>
</tr>
<tr>
<td>IMPERVIOUSNESS =</td>
<td>0.41</td>
</tr>
<tr>
<td>Fp = Fp,m = 1.2271 =</td>
<td>0.565</td>
</tr>
<tr>
<td>PG = PG,rate = 1.883 =</td>
<td></td>
</tr>
<tr>
<td>Design Capture Volume (DCV) = (L/V)(A/AC-FT)(DRAINDOWN RATE)</td>
<td></td>
</tr>
<tr>
<td>DCV =</td>
<td>40.9 4.99 FT</td>
</tr>
<tr>
<td></td>
<td>1.48 AC-FT</td>
</tr>
</tbody>
</table>
APPENDIX 8.5

VICTORVILLE
MASTER PLAN OF DRAINAGE
FOR ORO GRANDE WASH

TENTATIVE TRACT No. 20274 – VICTORVILLE, CA
VICTORVILLE

MASTER PLAN OF DRAINAGE

FOR

ORO GRANDE WASH AND ADJACENT WATERSHEDS
THAT ARE TRIBUTARY TO THE MOJAVE RIVER

MARCH 1992

VOLUME I - Final Report

PREPARED FOR

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

WILLIAMSON & SCHMID
CONSULTING CIVIL ENGINEERS AND LAND SURVEYORS
VICTORVILLE

MASTER PLAN OF DRAINAGE

FOR

ORO GRANDE WASH AND ADJACENT WATERSHEDS
THAT ARE TRIBUTARY TO THE MOJAVE RIVER

MARCH 1992

VOLUME II - Plans and Profiles - Line A
(Oro Grande Wash)

PREPARED FOR

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

WILLIAMSON & SCHMID
CONSULTING CIVIL ENGINEERS AND LAND SURVEYORS
APPENDIX 8.6
REFERENCE MAPS AND DETAILS
TYPICAL SECTION

EMERY STREET, EVA COURT, CARVER COURT,
ASPREY STREET, FERRO STREET, SUNNY WAY,
OSBORNE STREET, RAVEN STREET, HALTER STREET
GRADY COURT
N.T.S.
KB Home | Southern California
36310 Inland Valley Drive
Wildomar, California 92595

Attention: Mr. Rudy Provoost

Subject: Percolation Evaluation
Proposed Temporary Basin
Tract 17406
City of Victorville, San Bernardino County, California

References: See Page 5

Dear Mr. Provoost:

As requested and authorized, GeoTek, Inc. (GeoTek) has performed a percolation evaluation for the temporary basin within the planned single-family residential development located in the City of Victorville, San Bernardino County, California. This report presents the results of our study and discussion of our findings. The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

Edward H. LaMont
CEG 1892, Exp. 07/31/16
Principal Geologist/Branch Manager

Distribution: (1) Addressee via email
G:\Projects\1201 to 1250\1228CR3 KB Home Tract 17046 Victorville\Percolation Report\1228CR3 Percolation Evaluation Temporary Basin Tract 17046 Victorville.doc
TABLE OF CONTENTS

1 PURPOSE AND SCOPE OF SERVICES.................................................. 1

2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT ............................................... 1
   2.1 SITE DESCRIPTION............................................................................. 1
   2.2 PROPOSED DEVELOPMENT............................................................... 2
   2.3 FIELD EXPLORATION........................................................................ 2

3 GEOLOGIC AND SOILS CONDITIONS....................................................... 2
   3.1 SUBSURFACE SOIL CONDITIONS.......................................................... 2

4 PERCOLATION TESTING........................................................................... 3
   4.1 PERCOLATION TESTING................................................................. 3
   4.2 SUMMARY OF PERCOLATION TEST RESULTS.................................... 3
      4.2.1 Pre-Soaking............................................................................. 3
      4.2.2 Testing Procedures................................................................. 3

5 INTENT.................................................................................................. 4

6 LIMITATIONS..................................................................................... 4

7 REFERENCES....................................................................................... 5

ENCLOSURES
   Figure 1 – Site Location Map
   Figure 2 – Rough Grading Plan
   Figure 3 – Boring Location Map

   Appendix A – Log of Exploratory Excavation
   Appendix B – Percolation Data Sheet and Percolation Conversation Sheet
1 PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the percolation rates and physical characteristics of the onsite soils within the area of the proposed temporary basin. Services provided for this study included the following:

- Research and review of available published and other data regarding geologic and soil conditions at the site.
- Site exploration consisting of the excavation and logging of one (1) exploratory boring.
- Percolation testing within the exploratory boring on September 6, 2014.
- Compilation of this report that presents our findings.

2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

Tract 17406, which consists of approximately 44 acres, is bounded by Amethyst Road (paved road) on the west, vacant land to the east and south and Oro Grande Wash to the north in the City of Victorville, San Bernardino County, California (see Figure 1). The County of San Bernardino Assessor Parcel Number for the site is APN 3072-251-34-0000.

The site is generally bounded by vacant land. Overall, the project site area is generally irregular in shape and consists of relatively flat terrain, with surface drainage generally directed toward the north-northeast. Site specific topography is shown on the enclosed Rough Grading Plan (see Figure 2) for the project, prepared by Madole & Associates, Inc. Vegetation on the site consists of native vegetation which will be removed during the earthwork construction of the project. No existing structures are located on the site. No rock outcroppings exist on the site.

No known wells are located within 300 feet of the site. It is our understanding that the source of domestic water will be via a new water line located within the site street areas.
2.2 PROPOSED DEVELOPMENT

It is our understanding that currently proposed site improvements include a single-family residential development (179 residences), with associated streets and utility improvements. The proposed residences will be wood-framed, utilizing conventionally reinforced slab-on-grade with continuous wall and/or spread footings. A temporary storm water basin is proposed to be constructed within the northeast corner of the site in the vicinity of Lots 69 through 75 (see Figure 3). Current elevations within the area of the basin range from approximately 3240 to 3250. It is our understanding that the bottom of the proposed basin is to be constructed at an approximate elevation of 3240 msl, which is approximately at to 10 feet below existing grades.

2.3 FIELD EXPLORATION

GeoTek’s field exploration was conducted on August 29, 2014. One (1) boring was excavated with a CME 75 hollow-stem auger drill rig to a maximum depth of approximately twenty feet below the existing grade (i.e. approximately 10 feet below the bottom of the proposed basin).

The boring diameter was approximately eight (8) inches. A three (3) inch diameter perforated PVC pipe, wrapped in a filter sock and surrounded by gravel, was placed in the boring excavation prior to percolation testing. The approximate location of the boring is shown on Figure 3 (Boring Location Map). A geologist representing our firm logged the boring (see Appendix A).

3 GEOLOGIC AND SOILS CONDITIONS

3.1 SUBSURFACE SOIL CONDITIONS

A brief description of the earth materials encountered in our exploratory boring is presented in the following sections. A more detailed description of these materials is provided on the log of exploratory boring included in Appendix A. Based on our site reconnaissance, subsurface excavation, and review of published geologic maps, the site is underlain by alluvium to the depths explored.
Alluvium

Alluvium, comprised primarily of gravelly silty sand, was encountered in our exploratory excavation (see log in Appendix A). This alluvial material predominantly appeared to be medium dense becoming dense at depth.

4 PERCOLATION TESTING

4.1 PERCOLATION TESTING

Percolation testing was performed in general accordance with the procedures of the Technical Guidance Document for Water Quality Management Plans prepared for The County of San Bernardino Areawide Stormwater Program with an effective date of September 19, 2013.

4.2 SUMMARY OF PERCOLATION TEST RESULTS

Percolation test data (field data) is included in Appendix B. A percolation conversion to infiltration data sheet is also included in Appendix B.

Based on the obtained rates, the onsite soils displayed adequate percolation rates for the proposed basin.

4.2.1 Pre-Soaking

The boring (Boring B-1) was initially filled with clear water upon completion of excavation. The water seeped away faster than half the initial wetted depth for four (4) consecutive readings in 30 minutes or less for the percolation boring.

4.2.2 Testing Procedures

GeoTek performed testing per the above requirements by the Technical Guidance Document for Water Quality Management Plans prepared for The County of San Bernardino Areawide Stormwater Program with an effective date of September 19, 2013. Test results are included herein in Appendix B.

The test hole remained open to the original drilled depth of approximately 20 feet due to the placement of the perforated PVC pipe in the test hole. Some caving occurred around the piping in all due to the gravelly and sandy nature of the underlying materials.
Measurements, utilizing a measuring tape with 1/8-inch divisions, were taken at timed intervals for the test period.

The test resulted in an infiltration rate of 43 inches per hour after the infiltration rate had generally stabilized.

Over the lifetime of the storm water disposal area(s), the infiltration rates may be affected by silt build up and biological activities, as well as local variations in near surface soil conditions. An appropriate factor of safety no less than 2.0 should be applied to the measured infiltration rate based on the suitability of the underlying soils for infiltration and the infiltration design.

5 INTENT

It is the intent of this report to aid in the design and construction of the proposed development. The professional opinions and geotechnical information contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our study is limited to the area explored, which is shown on Figure 3 (Boring Location Map). This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. The scope is based on our understanding of the project and the client’s needs and geotechnical engineering standards normally used on similar projects in this region.

6 LIMITATIONS

The materials observed on the project site appear to be representative of the area; however, soil and natural materials vary in character between excavations and natural outcrops or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusion and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to
allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

7 REFERENCES


LOR Geotechnical Group, Inc., 2003, “Preliminary Geotechnical Investigation, 71± acres at the SEC Sycamore Street and Amethyst Road, Victorville, California,” Project No. 11775.1, dated August 14.
KB Home Southern California
Tract 17046
Proposed Temporary Basin
City of Victorville, San Bernardino County, California
GeoTek Project No. 1228-CR3

Figure 1
Site Location Map
KB Home Southern California
Proposed Temporary Basin
Tract 17046
City of Victorville
County of San Bernardino, California

GeoTek Project No. 1228-CR3

Figure 3
Boring Location Map
APPENDIX A

LOG OF EXPLORATORY EXCAVATION

(Boring B-1)

Tract 17046
Victorville, San Bernardino County, California
Project No. 1228-CR3
# GeoTek, Inc.
## LOG OF EXPLORATORY BORING

**CLIENT:** KB Home  
**PROJECT NAME:** Tract 17546  
**PROJECT NO.:** 1228-CR3  
**LOGGED BY:** AMS  
**DATE:** 8/29/2014  
**LOCATION:** See Boring Location Map

### BORING NO.: B-I

#### Material Description and Comments

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>SM</td>
<td>Alluvium: Silty s-c SAND with gravel, light brown, dry, loose</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Silty s-c SAND with gravel, light brown, slightly moist, medium dense to dense</td>
</tr>
</tbody>
</table>

### Boring Terminated at 20 Feet

- No groundwater encountered

---

**Legend:**
- **Ring**
- **SPT**
- **Small Bulk**
- **Large Bulk**
- **No Recovery**
- **Water Table**

**Lab Testing:**
- **AL** = Atterberg Limits
- **EI** = Expansion Index
- **SA** = Sand Analysis
- **RV** = R-Value Test
- **SR** = Saturated Resistivity Test
- **SH** = Shear Test
- **HC** = Consolidation
- **MD** = Maximum Density
APPENDIX B

PERCOLATION DATA SHEET AND
PERCOLATION CONVERSION SHEET

Tract 17406
Victorville, San Bernardino County, California
Project No. 1228-CR3
PERCOLATION DATA SHEET

TRACK 17046

Project: S. OF SYCAMORE ST & NW OF AMARGOSA RD.  Job No: 1228-CR3
Test Hole No: B-1  Tested By: DUG  Date: ____________
Depth of Hole As Drilled: 240 INCHES  Before Test: 240 INCHES  After Test: 240 INCHES

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<th>Reading No.</th>
<th>Time PM</th>
<th>Time Interval (Min)</th>
<th>Total Depth of Hole (Inches)</th>
<th>Initial Water Level (Inches)</th>
<th>Final Water Level (Inches)</th>
<th>Δ In Water Level (Inches)</th>
<th>Comments</th>
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<td>240</td>
<td>240</td>
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<td>2</td>
<td>1:16</td>
<td>5:15</td>
<td>240</td>
<td>120</td>
<td>120</td>
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<td>10' DROP</td>
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<tr>
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<td>1:24</td>
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<td>240</td>
<td>240</td>
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<td>FILL TO TOP 2ND TRIAL</td>
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<tr>
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<td>1:34</td>
<td>10:15</td>
<td>240</td>
<td>120</td>
<td>120</td>
<td></td>
<td>10' DROP</td>
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<tr>
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<td>1:54</td>
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<td>240</td>
<td>240</td>
<td></td>
<td></td>
<td>FILL TO TOP 3RD TRIAL</td>
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<tr>
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<td>2:06</td>
<td>11:15</td>
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<td>10' DROP SANDY SOIL</td>
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</tr>
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<td></td>
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<td>192</td>
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<td>6TH 10 MIN FROM 48 INCHES</td>
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<td>10</td>
<td>240</td>
<td>120</td>
<td>72</td>
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</tbody>
</table>
Percolation Rate (Porchet Method)

Time Interval, $\Delta t = 10$ minutes

Final Depth to Water, $D_F = 72$ inches

Test Hole Radius, $r = 8$ inches

Initial Depth to Water, $D_O = 0$ inches

Total Test Hole Depth, $D_T = 192$ inches

Equation: $I_t = \frac{\Delta H \cdot (60r)}{\Delta t \cdot (r + 2 \cdot Havg)}$

$H_O = D_T - D_O = 192 - 0 = 192$ inches

$H_F = D_T - D_F = 192 - 72 = 120$ inches

$\Delta H = \Delta D = H_O - H_F = 192 - 120 = 72$ inches

$Havg = \frac{(H_O - H_F)}{2} = \frac{72}{2} = 36$ inches

$I_t = \frac{(72 \text{ inches}) \cdot (60 \text{ min}) \cdot (8 \text{ inches})}{(10 \text{ minutes}) \cdot [8 \text{ inches} + 2 \cdot (36 \text{ inches})]}$

$= \frac{34560}{800} = 43 \text{ in./hr.}$