Altec Engineering, Inc.
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Tract 20581
City of Hesperia

Hydrology and Retention Basin Study

Date Prepared: April 25, 2006
Amended: March 7, 2008
Updated: March 2018
Tract #17690 Updated: September 2018
Tract #20581 Updated: August 9,2022

Prepared For:
PARK VIEW TRAIL
15550 MAIN STREET, SUITE C-11
HESPERIA, CA 92345

Prepared under the supervision of:

Carl P. Coleman RCE 30322 Exp. 3-31-2024

REGISTERED PROFESSIONAL ENGINEER
CARL P. COLEMAN
No. 30322
Exp. 3-31-24
8/08/2022
DATE SIGNED
CIVIL
STATE OF CALIFORNIA

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DISCUSSION

PURPOSE

This study was performed to determine the on-site drainage flows and retention volume required, so that an adequate drainage plan could be designed to prevent the increased flows caused by the development of the site will not adversely affect downstream properties.

LOCATION & DISCUSSION

This lot is located on the southwest corner of Sultana Street and "G" Avenue. The site is square in shape. It is approximately 660 feet by 660 feet (±10.0 acres). It is bordered on the west, south and southwest by vacant land. The site will be developed as a 74 unit townhome project and the associated improvements such as a club house, pool, picnic areas and open space.

METHODOLOGY

The on-site flows were determined using The Rational Method as outlined in the San Bernardino County Hydrology Manual. The required retention volume was determined using The Rational Method to determine the time of concentration and The Unit Hydrograph Method to determine the runoff volume. The following analysis values were used:

(a) 100-year design storm frequency.
(b) 1-hour point rainfall intensity of 1.18 inches.
(c) 6-hour point rainfall intensity of 2.51 inches.
(d) 24-hour point rainfall intensity of 4.87 inches.
(e) Hydrologic soils group "C".
(f) Development type - Condominium

The off-site flows were determined using the unit hydrograph method as outlined in the San Bernardino County Hydrology Manual.

ON-SITE HYDROLOGY

The on-site drainage area was divided into three separate areas. The flows from these areas originate and terminate at the nodes as shown on drawing 3. Some landscape areas

will be depressed to help reduce runoff and porous brick pavers will be used for walks and patios.

AREA #1

Tributary Area 1 covers the south and east ends of the site. The total area covered is 4.03 acres. The area originates at node 1 (3213 feet) and terminates at node 4 (3201 feet). The flows from this area merge with the flows from Area 3 at node 4 (near the northeast corner of the site).

Developed 100 Year Storm Runoff -	10.91 cfs
Developed 100 Year Runoff Volume -	1.1732 a.f. (51,104 c.f.)
Existing 100 Year Runoff Volume -	1.0625 a.f. (46,282 c.f.)
Required Retention This Area -	4,822 cubic feet

The retention for this area will be provided by a Stormtech system and an open basin near the northeast corner of the site.

AREA #2

Tributary Area 2 covers the middle of the site. The total area covered is 1.75 acres. The area originates at node 5 (3209 feet) and terminates at node 6 (3204 feet).

Developed 100 Year Storm Runoff -	5.7 cfs
Developed 100 Year Runoff Volume -	0.5100 a.f. (22,216 c.f.)
Existing 100 Year Runoff Volume -	0.4604 a.f. (20,055 c.f.)
Required Retention This Area -	2,161 cubic feet

The retention for this area will be provided by a Stormtech system near the entrance across from the clubhouse area.

AREA #3

Tributary Area 3 covers the west and north ends of the site. The total area covered is 3.18 acres. The area originates at node 1 (3213 feet) and terminates at node 4 (3201 feet). The flows from this area merge with the flows from Area 1 at node 4 (near the northeast corner of the site).

Developed 100 Year Storm Runoff -	9.04 cfs
Developed 100 Year Runoff Volume -	0.9260 a.f. (40,336 c.f.)
Existing 100 Year Runoff Volume -	0.8389 a.f. (36,542 c.f.)
Required Retention This Area -	3,794 cubic feet

The retention for this area will be provided by a Stormtech system and an open basin near the northeast corner of the site.

The total developed on-site storm runoff for a 100 year storm event was found to be 26 cubic feet per second (cfs). The on-site storm and nuisance waters will flow north and east by either street flow or swales that cross the site. These flows will be directed to two subsurface retention systems as shown on the grading plan. The storm runoff will be contained in the subsurface systems. Overflow from the subsurface basins will enter a surface basin at the northeast corner of the site. A weir structure will allow the overflow to exit and flow into Sultana Avenue.

Hydraulic Analysis Report

Project Data

Project Title: Tract 17690

Designer:

Project Date: Wednesday, September 19, 2018

Project Units: U.S. Customary Units

Notes: Interior Street Capacity Worst Case

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
0.00	99.84	0.0300
10.00	99.64	0.0300
11.00	99.31	0.0130
23.00	99.57	0.0160
35.00	99.31	0.0160
36.00	99.64	0.0130
46.00	99.84	-----

Longitudinal Slope: 0.0154 ft/ft

Flow: 20.0000 cfs

Result Parameters

Depth: 0.3192 ft

Area of Flow: 4.8502 ft^2

Wetted Perimeter: 26.0430 ft

Hydraulic Radius: 0.1862 ft

Average Velocity: 4.1235 ft/s

Top Width: 25.9347 ft

Froude Number: 1.6804

Critical Depth: 0.4090 ft

Critical Velocity: 2.6683 ft/s

Critical Slope: 0.0042 ft/ft

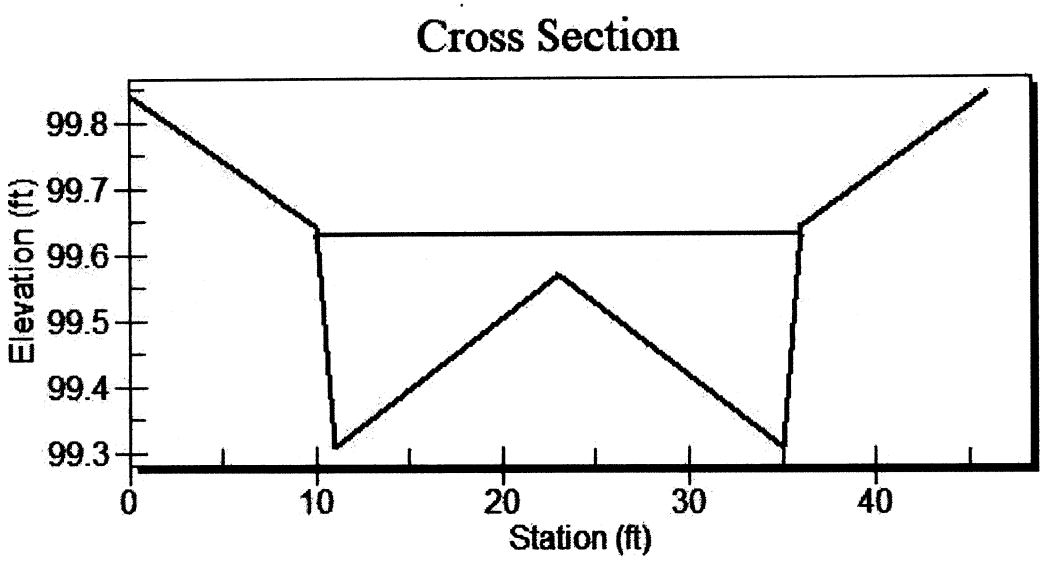
Critical Top Width: 33.90 ft

Calculated Max Shear Stress: 0.3068 lb/ft^2

Calculated Avg Shear Stress: 0.1790 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0146



INTERIOR STREET CROSS SECTION – ROBIN EAST OF SKYLARK

OFF-SITE HYDROLOGY

The off-site storm waters originate approximately 960 feet southwest of the site and arrive at the site in the form of sheet flows. The tributary area covers of 5.8 acres (See attached USDA Web Soil Survey Map). This flow for the undeveloped area was found to be 12.6 cfs for a 100 year storm event. Assuming the offsite area to be fully developed with no retention facilities, the flow will increase to 16 cfs. These flows will not be altered by the development of this site and will be carried north past the site in "F" Avenue.

Hydraulic Analysis Report

Project Data

Project Title: Tract 17690 [Revised to New Tract # 20581]

Designer:

Project Date: Monday, September 17, 2018

Project Units: U.S. Customary Units

Notes: "F" Street Carrying Capacity

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
0.00	3210.50	0.0130
10.00	3210.30	0.0130
10.08	3209.63	0.0130
12.00	3209.80	0.0130
30.00	3210.16	0.0160
48.00	3209.80	0.0160
49.92	3209.63	0.0130
50.00	3210.30	0.0130
60.00	3210.50	-----

Longitudinal Slope: 0.0125 ft/ft

Flow: 16.0000 cfs

Result Parameters

Depth: 0.4314 ft

Area of Flow: 4.7700 ft^2

Wetted Perimeter: 30.8729 ft

Hydraulic Radius: 0.1545 ft

Average Velocity: 3.3543 ft/s

Top Width: 30.0866 ft

Froude Number: 1.4846

Critical Depth: 0.4861 ft

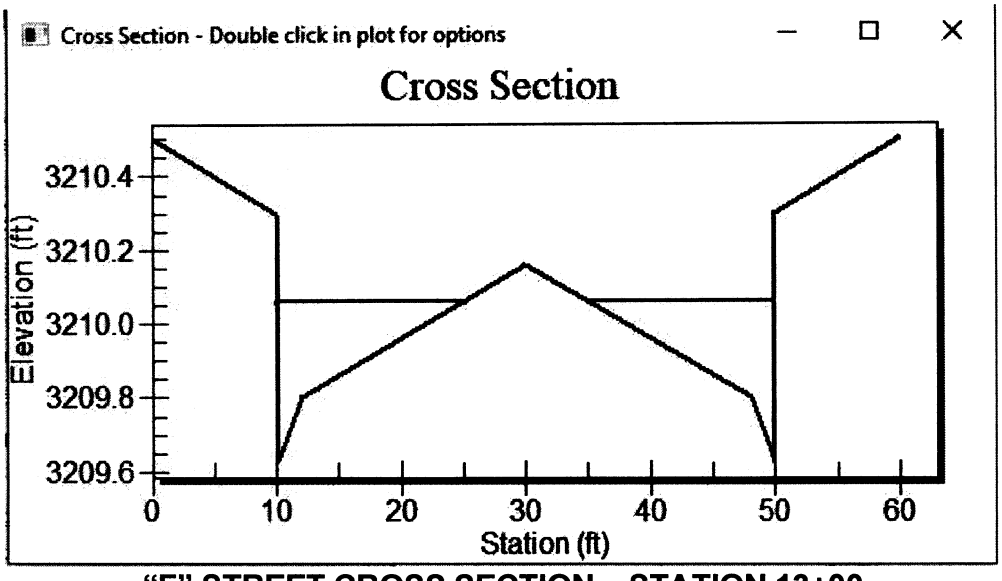
Critical Velocity: 2.4378 ft/s

Critical Slope: 0.0054 ft/ft

Critical Top Width: 35.56 ft

Composite Manning's n Equation: Lotter method

Manning's n: 0.0143



"F" STREET CROSS SECTION – STATION 13+00

The flows that originate directly south of the site are carried from west to east past the site and have no direct impact on the site. These flows are then interrupted by "G" Avenue and Sultana High School. See included offsite drainage flow map. (See Drawing 4)

CONCLUSION

Off-site flows will not impact the development of the site as shown in this report. Provisions are to be made to carry 16 cfs northerly in "F" Avenue.

The on-site flows were determined for the site as it exists now and as a fully developed site. The total storm flows for the fully developed site are 26 cfs. The runoff volume at the end of the peak for the developed site is 2.6092 acre feet (113,657 cubic feet). The total storm flows for the site in the existing native condition are 22.1 cfs. The runoff volume at the end of the peak for the existing site is 2.3618 acre feet (102,880 cubic feet). Based upon this information, the following calculations would apply:

Developed Runoff	=	113,657 cu. ft.
Existing Runoff	=	-102,880 cu. ft.
Detention Volume	=	10,777 cu. Ft.

Retention would be accomplished by two subsurface retention systems. Each subsurface retention systems will have a capacity of approximately 5,000 cubic feet of storage. Overflows from the retention areas will exit near the northeast corner of the site and onto "G" Avenue, essentially the historical low point.

U n i t H y d r o g r a p h A n a l y s i s

Study date 04/24/06

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Altec Engineering Corporation, Apple Valley, CA - S/N 869

Tract 17690
100 Year Storm Event
Developed Offsite Runoff
Tr17690offdev.out

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
10.00	1	1.25
Rainfall data for year 100		
10.00	6	2.00
Rainfall data for year 100		
10.00	24	3.70

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	86.2	10.00	1.000	0.262	0.350	0.092

Area-averaged adjusted loss rate Fm (In/Hr) = 0.092

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
3.50	0.350	69.0	86.2	1.60	0.620
6.50	0.650	98.0	98.0	0.20	0.937

Area-averaged catchment yield fraction, Y = 0.826
Area-averaged low loss fraction, Yb = 0.174
User entry of time of concentration = 0.187 (hours)
++
Watershed area = 10.00(Ac.)
Catchment Lag time = 0.150 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 55.7041
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.092(In/Hr)
Average low loss rate fraction (Yb) = 0.174 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.593(In)
Computed peak 30-minute rainfall = 1.015(In)
Specified peak 1-hour rainfall = 1.250(In)
Computed peak 3-hour rainfall = 1.667(In)
Specified peak 6-hour rainfall = 2.000(In)
Specified peak 24-hour rainfall = 3.700(In)

Rainfall depth area reduction factors:
Using a total area of 10.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.593(In)
30-minute factor = 1.000 Adjusted rainfall = 1.015(In)
1-hour factor = 1.000 Adjusted rainfall = 1.249(In)
3-hour factor = 1.000 Adjusted rainfall = 1.667(In)
6-hour factor = 1.000 Adjusted rainfall = 2.000(In)
24-hour factor = 1.000 Adjusted rainfall = 3.700(In)

Unit Hydrograph

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 120.94 (CFS))		
1	4.819	5.828
2	36.973	38.887
3	65.180	34.112
4	77.243	14.588
5	84.282	8.513
6	88.996	5.702
7	92.154	3.818
8	94.495	2.832
9	96.209	2.072
10	97.422	1.467
11	98.152	0.883
12	98.787	0.768
13	99.426	0.772
14	99.825	0.483
15	100.000	0.212

Total soil rain loss = 0.51(In)
Total effective rainfall = 3.19(In)
Peak flow rate in flood hydrograph = 29.94(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
14+ 0	0.9088	1.10	Q	V			
14+ 5	0.9166	1.13	Q	V			
14+10	0.9246	1.17	Q	V			
14+15	0.9329	1.20	Q	V			
14+20	0.9414	1.24	Q	V			
14+25	0.9503	1.28	Q	V			
14+30	0.9594	1.33	Q	V			
14+35	0.9689	1.37	Q	V			
14+40	0.9787	1.43	Q	V			
14+45	0.9889	1.48	Q	V			
14+50	0.9996	1.55	Q	V			
14+55	1.0108	1.62	Q	V			
15+ 0	1.0225	1.70	Q	V			
15+ 5	1.0348	1.79	Q	V			
15+10	1.0478	1.89	Q	V			
15+15	1.0616	2.00	Q	V			
15+20	1.0763	2.14	Q	V			
15+25	1.0922	2.31	Q	V			
15+30	1.1103	2.63	Q	V			
15+35	1.1308	2.97	Q	V			
15+40	1.1538	3.34	Q	V			
15+45	1.1798	3.77	Q	V			
15+50	1.2105	4.46	Q	V			
15+55	1.2481	5.45	Q	V			
16+ 0	1.2995	7.47	Q	V			
16+ 5	1.3901	13.15	Q	V			
16+10	**1.5963**	**29.94**			V		Q
16+15	1.7766	26.18			V	Q	
16+20	1.8778	14.69		Q	V		
16+25	1.9474	10.10	Q		V		
16+30	1.9991	7.51	Q		V		
16+35	2.0384	5.71	Q		V		
16+40	2.0702	4.61	Q		V		
16+45	2.0961	3.77	Q		V		
16+50	2.1175	3.10	Q		V		
16+55	2.1349	2.53	Q		V		
17+ 0	2.1504	2.25	Q		V		
17+ 5	2.1646	2.06	Q		V		
17+10	2.1766	1.74	Q		V		
17+15	2.1866	1.46	Q		V		
17+20	2.1952	1.24	Q		V		
17+25	2.2031	1.16	Q		V		
17+30	2.2106	1.09	Q		V		
17+35	2.2177	1.03	Q		V		
17+40	2.2244	0.98	Q		V		
17+45	2.2309	0.93	Q		V		
17+50	2.2370	0.89	Q		V		
17+55	2.2430	0.86	Q		V		

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2001 Version 6.4
Rational Hydrology Study Date: 04/24/06

Tract 17690 Offsite
100 Year Storm Event
Developed Time of Concentration
tr17690offdevtc.out

Altec Engineering Corporation, Apple Valley, CA - S/N 869

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

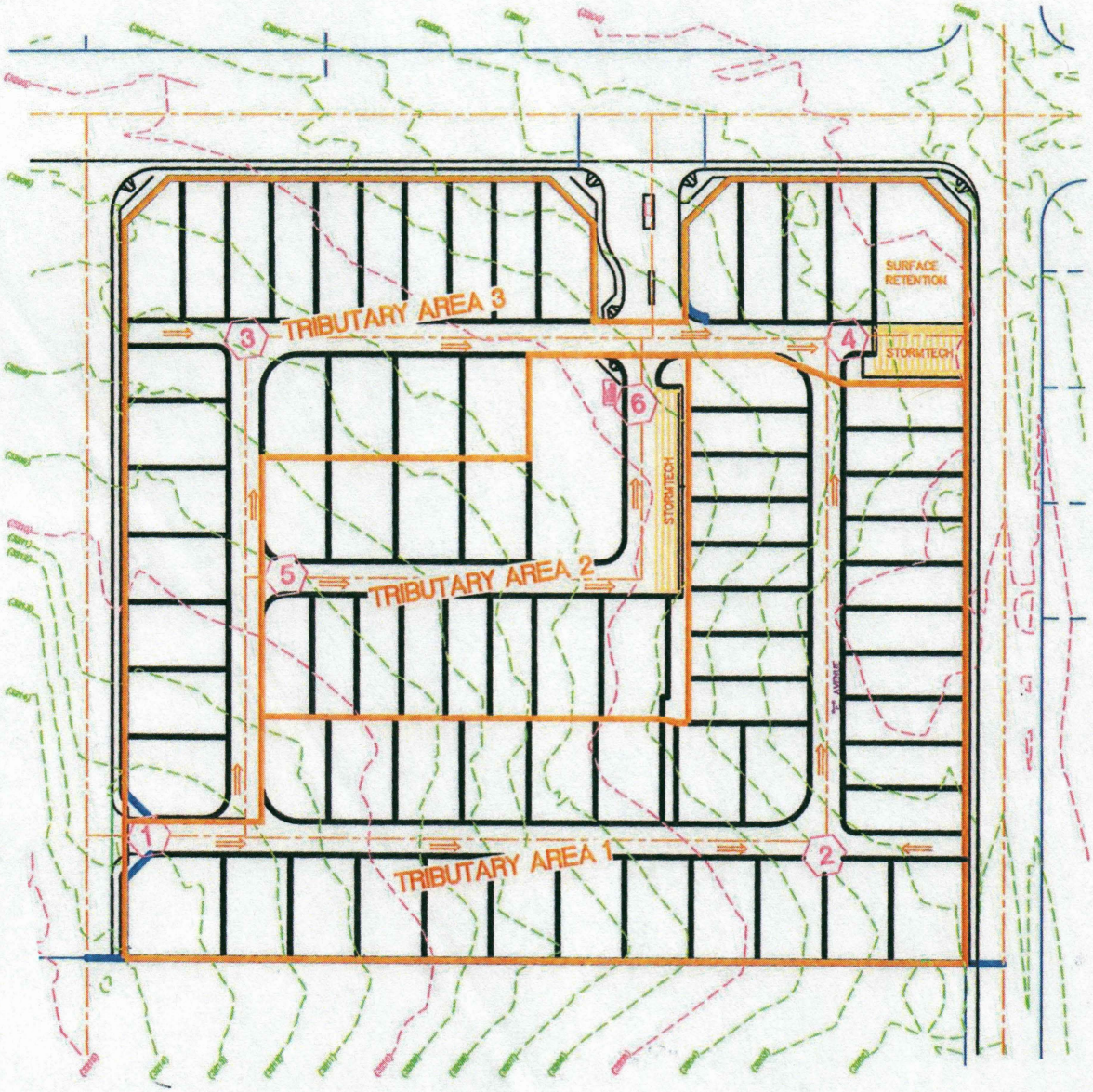
```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
-------------------------------------------------------------------------------
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.052(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  3225.000(Ft.)
Bottom (of initial area) elevation =  3205.000(Ft.)
Difference in elevation =    20.000(Ft.)
Slope =    0.02000  s(%)=       2.00
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.229 min.
Rainfall intensity =      4.040(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
Subarea runoff =     35.889(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.052(In/Hr)
End of computations, Total Study Area =           10.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number =  69.0
```

AERIAL PHOTOGRAPH OF SITE

DRAWING 1

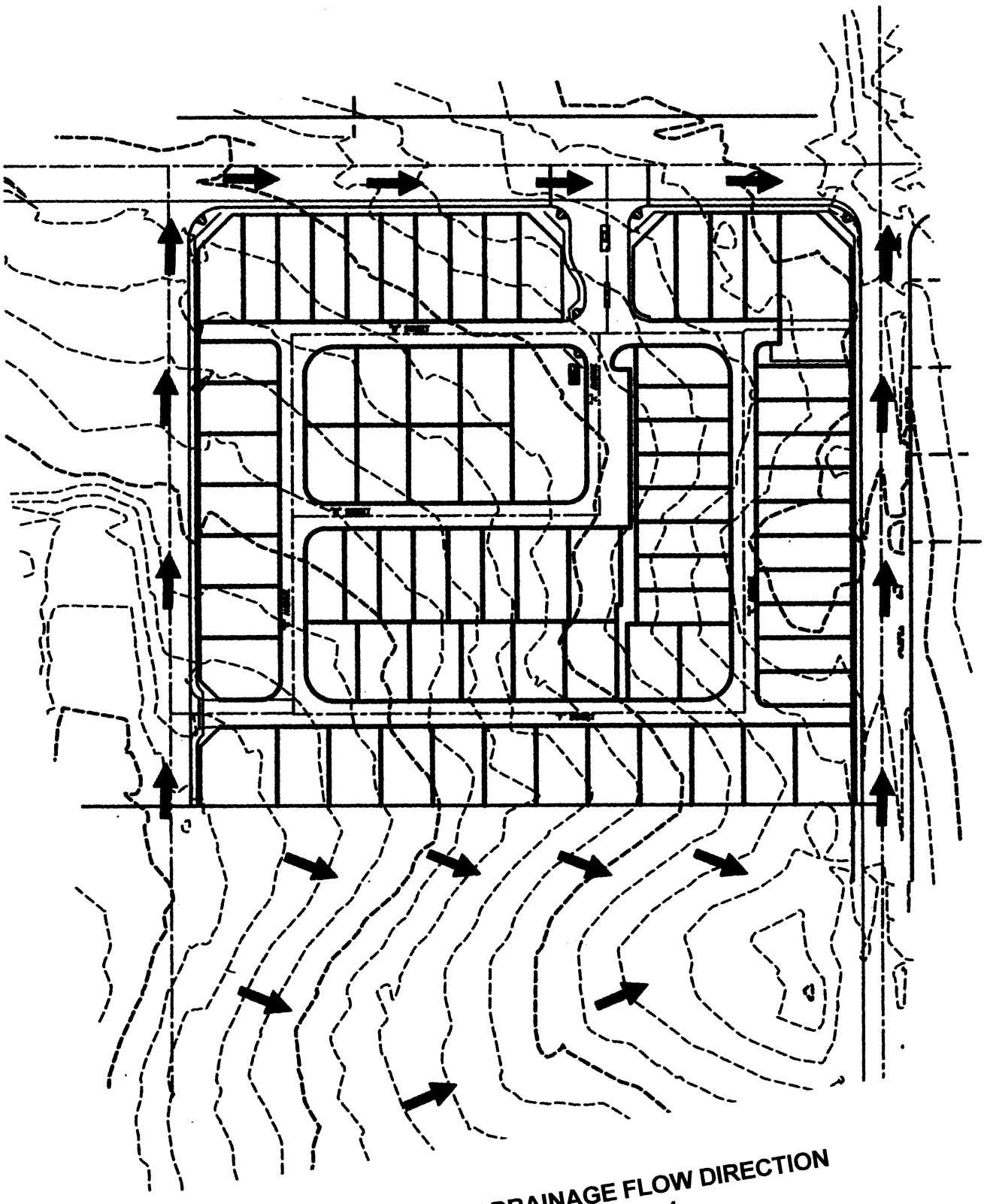
USGS QUAD SHEET

DRAWING 2



ONSITE DRAINAGE NODES/TRIBUTARY AREAS

DRAWING 3



OFFSITE DRAINAGE FLOW DIRECTION
DRAWING 4

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****

----------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.052(In/Hr)
Initial subarea data:
Initial area flow distance =   900.000(Ft.)
Top (of initial area) elevation =  3210.000(Ft.)
Bottom (of initial area) elevation =  3195.000(Ft.)
Difference in elevation =    15.000(Ft.)
Slope =    0.01667  s(%)=       1.67
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.159 min.
Rainfall intensity =      4.058(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
Subarea runoff =     36.048(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.052(In/Hr)
End of computations, Total Study Area =           10.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number =  69.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2001 Version 6.4
Rational Hydrology Study Date: 04/25/06

Tract 17690 Onsite
100 Year Storm Event
Developed Runoff
tr17690ondevtc.out

Altec Engineering Corporation, Apple Valley, CA - S/N 869

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****

-------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.052(In/Hr)
Initial subarea data:
Initial area flow distance =   900.000(Ft.)
Top (of initial area) elevation =  3210.000(Ft.)
Bottom (of initial area) elevation =  3195.000(Ft.)
Difference in elevation =    15.000(Ft.)
Slope =    0.01667  s(%)=       1.67
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.159 min.
Rainfall intensity =      4.058(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
Subarea runoff =     36.048(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.052(In/Hr)
End of computations, Total Study Area =           10.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number =  69.0
```

U n i t H y d r o g r a p h A n a l y s i s

Study date 02/14/08

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Altec Engineering Corporation, Apple Valley, CA - S/N 869

Tract 17690
100 Year Storm Event
Existing Onsite Runoff
Tr17690onexist.out

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
10.00	1	1.25
Rainfall data for year 100		
10.00	6	2.00
Rainfall data for year 100		
10.00	24	3.70

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
78.0	92.8	10.00	1.000	0.140	1.000	0.140

Area-averaged adjusted loss rate Fm (In/Hr) = 0.140

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
10.00	1.000	78.0	92.8	0.78	0.786

Area-averaged catchment yield fraction, Y = 0.786
Area-averaged low loss fraction, Yb = 0.214
User entry of time of concentration = 0.353 (hours)
++
Watershed area = 10.00(Ac.)
Catchment Lag time = 0.283 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 29.4923
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.140(In/Hr)
Average low loss rate fraction (Yb) = 0.214 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.593(In)
Computed peak 30-minute rainfall = 1.015(In)
Specified peak 1-hour rainfall = 1.250(In)
Computed peak 3-hour rainfall = 1.667(In)
Specified peak 6-hour rainfall = 2.000(In)
Specified peak 24-hour rainfall = 3.700(In)

Rainfall depth area reduction factors:
Using a total area of 10.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.593(In)
30-minute factor = 1.000 Adjusted rainfall = 1.015(In)
1-hour factor = 1.000 Adjusted rainfall = 1.249(In)
3-hour factor = 1.000 Adjusted rainfall = 1.667(In)
6-hour factor = 1.000 Adjusted rainfall = 2.000(In)
24-hour factor = 1.000 Adjusted rainfall = 3.700(In)

Unit Hydrograph

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 120.94 (CFS))		
1	1.717	2.076
2	9.076	8.900
3	29.560	24.773
4	51.337	26.337
5	63.566	14.790
6	71.284	9.334
7	76.865	6.750
8	81.049	5.059
9	84.325	3.963
10	87.089	3.342
11	89.271	2.639
12	90.991	2.080
13	92.491	1.814
14	93.790	1.572
15	94.840	1.269
16	95.778	1.134
17	96.552	0.937
18	97.190	0.772
19	97.706	0.624
20	98.051	0.417
21	98.359	0.372
22	98.709	0.424
23	99.063	0.428
24	99.411	0.421
25	99.641	0.278
26	99.825	0.223
27	100.000	0.211

Total soil rain loss = 0.64(In)
Total effective rainfall = 3.06(In)
Peak flow rate in flood hydrograph = 20.97(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
14+ 0	0.8492	1.00	Q	V			
14+ 5	0.8562	1.02	Q	V			
14+10	0.8635	1.05	Q	V			
14+15	0.8709	1.08	Q	V			
14+20	0.8785	1.11	Q	V			
14+25	0.8864	1.14	Q	V			
14+30	0.8946	1.18	Q	V			
14+35	0.9030	1.22	Q	V			
14+40	0.9117	1.26	Q	V			
14+45	0.9207	1.31	Q	V			
14+50	0.9301	1.36	Q	V			
14+55	0.9399	1.42	Q	V			
15+ 0	0.9501	1.48	Q	V			
15+ 5	0.9607	1.55	Q	V			
15+10	0.9719	1.63	Q	V			
15+15	0.9838	1.72	Q	V			
15+20	0.9963	1.82	Q	V			
15+25	1.0096	1.94	Q	V			
15+30	1.0241	2.10	Q	V			
15+35	1.0403	2.35	Q	V			
15+40	1.0584	2.63	Q	V			
15+45	1.0788	2.95	Q	V			
15+50	1.1017	3.33	Q	V			
15+55	1.1285	3.89	Q	V			
16+ 0	1.1618	4.83	Q	V			
16+ 5	1.2127	7.39	Q	V			
16+10	1.2992	12.55	Q	V			
16+15	**1.4436**	**20.97**	Q	V			
16+20	1.5881	20.97	Q	V			
16+25	1.6850	14.08	Q	V			
16+30	1.7556	10.25	Q	V			
16+35	1.8113	8.08	Q	V			
16+40	1.8564	6.55	Q	V			
16+45	1.8943	5.49	Q	V			
16+50	1.9271	4.77	Q	V			
16+55	1.9552	4.08	Q	V			
17+ 0	1.9795	3.53	Q	V			
17+ 5	2.0013	3.16	Q	V			
17+10	**2.0208**	2.84	Q	V			
17+15	2.0382	2.52	Q	V			
17+20	2.0540	2.30	Q	V			
17+25	2.0682	2.06	Q	V			
17+30	2.0809	1.85	Q	V			
17+35	2.0924	1.67	Q	V			
17+40	2.1026	1.48	Q	V			
17+45	2.1121	1.38	Q	V			
17+50	2.1214	1.35	Q	V			
17+55	2.1303	1.29	Q	V			

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2001 Version 6.4
Rational Hydrology Study Date: 02/14/08

Tract 17690
100 Year Storm Event
Existing Time of Concentration
tr17690onexisttc.out

Altec Engineering Corporation, Apple Valley, CA - S/N 869

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Initial subarea data:
Initial area flow distance =   900.000(Ft.)
Top (of initial area) elevation =  3210.000(Ft.)
Bottom (of initial area) elevation =  3195.000(Ft.)
Difference in elevation =    15.000(Ft.)
Slope =    0.01667  s(%)=       1.67
TC = k(0.615)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   21.194 min.
Rainfall intensity =      2.590(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.851
Subarea runoff =     22.048(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.140(In/Hr)
End of computations, Total Study Area =           10.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/06/09

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Altec Engineering Corporation, Apple Valley, CA - S/N 869

Tract 17690
10 Year Storm Event
Developed Site Runoff
Tr1769010Yr.out

Storm Event Year = 10

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
10.00	1	0.80
Rainfall data for year 10		
10.00	6	1.40
Rainfall data for year 10		
10.00	24	2.10

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	86.2	10.00	1.000	0.262	0.200	0.052

Area-averaged adjusted loss rate Fm (In/Hr) = 0.052

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
2.00	0.200	69.0	86.2	1.60	0.446
8.00	0.800	98.0	98.0	0.20	0.892

Area-averaged catchment yield fraction, Y = 0.803
Area-averaged low loss fraction, Yb = 0.197
User entry of time of concentration = 0.208 (hours)
++
Watershed area = 10.00(Ac.)
Catchment Lag time = 0.166 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 50.1525
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.052(In/Hr)
Average low loss rate fraction (Yb) = 0.197 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.380(In)
Computed peak 30-minute rainfall = 0.650(In)
Specified peak 1-hour rainfall = 0.800(In)
Computed peak 3-hour rainfall = 1.127(In)
Specified peak 6-hour rainfall = 1.400(In)
Specified peak 24-hour rainfall = 2.100(In)

Rainfall depth area reduction factors:
Using a total area of 10.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.379(In)
30-minute factor = 1.000 Adjusted rainfall = 0.649(In)
1-hour factor = 1.000 Adjusted rainfall = 0.800(In)
3-hour factor = 1.000 Adjusted rainfall = 1.127(In)
6-hour factor = 1.000 Adjusted rainfall = 1.400(In)
24-hour factor = 1.000 Adjusted rainfall = 2.100(In)

U n i t H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 120.94 (CFS))	
1	3.983	4.816
2	30.692	32.302
3	60.699	36.290
4	73.878	15.938
5	81.532	9.256
6	86.673	6.218
7	90.232	4.304
8	92.827	3.138
9	94.794	2.378
10	96.287	1.806
11	97.379	1.320
12	98.068	0.833
13	98.623	0.672
14	99.224	0.728
15	99.670	0.539
16	100.000	0.399

Total soil rain loss = 0.31(In)
Total effective rainfall = 1.79(In)
Peak flow rate in flood hydrograph = 17.55(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
14+ 0	0.4141	0.86	Q	V			
14+ 5	0.4202	0.89	Q	V			
14+10	0.4264	0.91	Q	V			
14+15	0.4329	0.93	Q	V			
14+20	0.4395	0.96	Q	V			
14+25	0.4463	0.99	Q	V			
14+30	0.4534	1.02	Q	V			
14+35	0.4607	1.06	Q	V			
14+40	0.4682	1.10	Q	V			
14+45	0.4760	1.14	Q	V			
14+50	0.4842	1.18	Q	V			
14+55	0.4926	1.23	Q	V			
15+ 0	0.5015	1.29	Q	V			
15+ 5	0.5108	1.35	Q	V			
15+10	0.5205	1.42	Q	V			
15+15	0.5308	1.49	Q	V			
15+20	0.5417	1.59	Q	V			
15+25	0.5533	1.69	Q	V			
15+30	0.5657	1.79	Q	V			
15+35	0.5789	1.92	Q	V			
15+40	0.5936	2.13	Q	V			
15+45	0.6101	2.40	Q	V			
15+50	0.6295	2.82	Q	V			
15+55	0.6531	3.42	Q	V			
16+ 0	0.6846	4.58	Q	V			
16+ 5	0.7383	7.80	Q	V			
16+10	0.8558	17.06	Q	V			
16+15	**0.9767**	**17.55**	Q	V			
16+20	1.0457	10.02	Q	V			
16+25	1.0931	6.88	Q	V			
16+30	1.1289	5.20	Q	V			
16+35	1.1571	4.10	Q	V			
16+40	1.1802	3.35	Q	V			
16+45	1.1995	2.81	Q	V			
16+50	1.2159	2.38	Q	V			
16+55	1.2298	2.03	Q	V			
17+ 0	1.2417	1.71	Q	V			
17+ 5	1.2522	1.54	Q	V			
17+10	1.2622	1.44	Q	V			
17+15	1.2710	1.28	Q	V			
17+20	1.2789	1.14	Q	V			
17+25	1.2853	0.94	Q	V			
17+30	1.2914	0.88	Q	V			
17+35	1.2971	0.83	Q	V			
17+40	1.3026	0.79	Q	V			
17+45	1.3078	0.76	Q	V			
17+50	1.3128	0.73	Q	V			
17+55	1.3176	0.70	Q	V			

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2001 Version 6.4
Rational Hydrology Study Date: 03/06/09

Tract 17690
Time of Concentration
10 Year Storm Event
tr1769010yrtc.out

Altec Engineering Corporation, Apple Valley, CA - S/N 869

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.800 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****

----------------------------------------------------------------------------
CONDOMINIUM subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.3500     Max loss rate(Fm)=     0.092(In/Hr)
Initial subarea data:
Initial area flow distance =   900.000(Ft.)
Top (of initial area) elevation =  3210.000(Ft.)
Bottom (of initial area) elevation =  3195.000(Ft.)
Difference in elevation =    15.000(Ft.)
Slope =    0.01667  s(%)=       1.67
TC = k(0.360)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.406 min.
Rainfall intensity =      2.411(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.866
Subarea runoff =     20.878(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.350
Initial area Fm value =    0.092(In/Hr)
End of computations, Total Study Area =           10.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.350
Area averaged SCS curve number =  69.0
```

U n i t H y d r o g r a p h A n a l y s i s

Study date 04/24/06

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Altec Engineering Corporation, Apple Valley, CA - S/N 869

Tract 17690
100 Year Storm Event
Existing Offsite Runoff
tr17690offexist.out

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
10.00	1	1.25
Rainfall data for year 100		
10.00	6	2.00
Rainfall data for year 100		
10.00	24	3.70

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
86.0	97.2	10.00	1.000	0.055	1.000	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
10.00	1.000	86.0	97.2	0.29	0.912

Area-averaged catchment yield fraction, Y = 0.912
Area-averaged low loss fraction, Yb = 0.088
User entry of time of concentration = 0.303 (hours)
++
Watershed area = 10.00(Ac.)
Catchment Lag time = 0.242 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 34.3784
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.055(In/Hr)
Average low loss rate fraction (Yb) = 0.088 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.593(In)
Computed peak 30-minute rainfall = 1.015(In)
Specified peak 1-hour rainfall = 1.250(In)
Computed peak 3-hour rainfall = 1.667(In)
Specified peak 6-hour rainfall = 2.000(In)
Specified peak 24-hour rainfall = 3.700(In)

Rainfall depth area reduction factors:
Using a total area of 10.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.593(In)
30-minute factor = 1.000 Adjusted rainfall = 1.015(In)
1-hour factor = 1.000 Adjusted rainfall = 1.249(In)
3-hour factor = 1.000 Adjusted rainfall = 1.667(In)
6-hour factor = 1.000 Adjusted rainfall = 2.000(In)
24-hour factor = 1.000 Adjusted rainfall = 3.700(In)

Unit Hydrograph

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 120.94 (CFS))		
1	2.172	2.627
2	12.813	12.870
3	39.789	32.624
4	59.167	23.435
5	69.523	12.524
6	76.413	8.333
7	81.311	5.923
8	85.037	4.506
9	88.052	3.646
10	90.275	2.689
11	92.122	2.233
12	93.673	1.876
13	94.911	1.497
14	95.966	1.276
15	96.832	1.048
16	97.492	0.798
17	97.972	0.582
18	98.327	0.428
19	98.732	0.490
20	99.145	0.499
21	99.517	0.450
22	99.745	0.275
23	100.000	0.138

Total soil rain loss = 0.26(In)
Total effective rainfall = 3.44(In)
Peak flow rate in flood hydrograph = 25.84(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
14+ 0	0.9897	1.17	Q	V			
14+ 5	0.9980	1.20	Q	V			
14+10	1.0065	1.24	Q	V			
14+15	1.0153	1.27	Q	V			
14+20	1.0243	1.31	Q	V			
14+25	1.0336	1.35	Q	V			
14+30	1.0433	1.40	Q	V			
14+35	1.0532	1.44	Q	V			
14+40	1.0635	1.50	Q	V			
14+45	1.0742	1.55	Q	V			
14+50	1.0853	1.62	Q	V			
14+55	1.0969	1.69	Q	V			
15+ 0	1.1091	1.76	Q	V			
15+ 5	1.1218	1.85	Q	V			
15+10	1.1351	1.94	Q	V			
15+15	1.1493	2.05	Q	V			
15+20	1.1642	2.17	Q	V			
15+25	1.1803	2.33	Q	V			
15+30	1.1978	2.54	Q	V			
15+35	1.2176	2.88	Q	V			
15+40	1.2398	3.22	Q	V			
15+45	1.2647	3.62	Q	V			
15+50	1.2929	4.10	Q	V			
15+55	1.3261	4.83	Q	V			
16+ 0	1.3674	5.99	Q	V			
16+ 5	1.4308	9.21	Q	V			
16+10	1.5418	16.12	Q	V			
16+15	**1.7198**	**25.84**	Q	V		Q	
16+20	1.8589	20.19	Q	V			
16+25	1.9512	13.41	Q	V			
16+30	2.0209	10.13	Q	V			
16+35	2.0758	7.96	Q	V			
16+40	2.1208	6.53	Q	V			
16+45	2.1589	5.54	Q	V			
16+50	2.1908	4.63	Q	V			
16+55	2.2186	4.04	Q	V			
17+ 0	2.2432	3.56	Q	V			
17+ 5	2.2647	3.13	Q	V			
17+10	2.2839	2.79	Q	V			
17+15	2.3011	2.49	Q	V			
17+20	2.3162	2.19	Q	V			
17+25	2.3295	1.94	Q	V			
17+30	2.3416	1.76	Q	V			
17+35	2.3533	1.69	Q	V			
17+40	2.3643	1.60	Q	V			
17+45	2.3745	1.48	Q	V			
17+50	2.3835	1.30	Q	V			
17+55	2.3914	1.15	Q	V			

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2001 Version 6.4
Rational Hydrology Study Date: 04/24/06

Tract 17690 Offsite
100 Year Storm Event
Existing Time of Concentration
Tr17690offexisttc.out

Altec Engineering Corporation, Apple Valley, CA - S/N 869

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****

----------------------------------------------------------------------------
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 3 = 97.20
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  3225.000(Ft.)
Bottom (of initial area) elevation =  3205.000(Ft.)
Difference in elevation =    20.000(Ft.)
Slope =    0.02000  s(%)=       2.00
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.195 min.
Rainfall intensity =      2.882(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =     25.437(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.055(In/Hr)
End of computations, Total Study Area =          10.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  86.0
```

U n i t H y d r o g r a p h A n a l y s i s

Study date 04/25/06

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Altec Engineering Corporation, Apple Valley, CA - S/N 869

Tract 17690
100 Year Storm Event
Developed Onsite Runoff
tr17690ondev.out

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
10.00	1	1.25
Rainfall data for year 100		
10.00	6	2.00
Rainfall data for year 100		
10.00	24	3.70

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	86.2	10.00	1.000	0.262	0.200	0.052

Area-averaged adjusted loss rate Fm (In/Hr) = 0.052

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
2.00	0.200	69.0	86.2	1.60	0.620
8.00	0.800	98.0	98.0	0.20	0.937

Area-averaged catchment yield fraction, Y = 0.873
Area-averaged low loss fraction, Yb = 0.127
User entry of time of concentration = 0.186 (hours)
++
Watershed area = 10.00(Ac.)
Catchment Lag time = 0.149 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 56.0036
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.052(In/Hr)
Average low loss rate fraction (Yb) = 0.127 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.593(In)
Computed peak 30-minute rainfall = 1.015(In)
Specified peak 1-hour rainfall = 1.250(In)
Computed peak 3-hour rainfall = 1.667(In)
Specified peak 6-hour rainfall = 2.000(In)
Specified peak 24-hour rainfall = 3.700(In)

Rainfall depth area reduction factors:
Using a total area of 10.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.593(In)
30-minute factor = 1.000 Adjusted rainfall = 1.015(In)
1-hour factor = 1.000 Adjusted rainfall = 1.249(In)
3-hour factor = 1.000 Adjusted rainfall = 1.667(In)
6-hour factor = 1.000 Adjusted rainfall = 2.000(In)
24-hour factor = 1.000 Adjusted rainfall = 3.700(In)

Unit Hydrograph

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 120.94 (CFS))		
1	4.869	5.889
2	37.299	39.220
3	65.395	33.978
4	77.407	14.528
5	84.417	8.478
6	89.106	5.670
7	92.249	3.801
8	94.575	2.814
9	96.275	2.056
10	97.469	1.444
11	98.185	0.865
12	98.828	0.778
13	99.460	0.764
14	100.000	0.653

Total soil rain loss = 0.36(In)
Total effective rainfall = 3.34(In)
Peak flow rate in flood hydrograph = 30.49(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	10.0	20.0	30.0	40.0
14+ 0	0.9612	1.17	Q	V			
14+ 5	0.9695	1.20	Q	V			
14+10	0.9780	1.24	Q	V			
14+15	0.9867	1.27	Q	V			
14+20	0.9958	1.31	Q	V			
14+25	1.0051	1.36	Q	V			
14+30	1.0148	1.40	Q	V			
14+35	1.0248	1.45	Q	V			
14+40	1.0352	1.51	Q	V			
14+45	1.0460	1.57	Q	V			
14+50	1.0573	1.64	Q	V			
14+55	1.0691	1.71	Q	V			
15+ 0	1.0815	1.80	Q	V			
15+ 5	1.0945	1.89	Q	V			
15+10	1.1083	2.00	Q	V			
15+15	1.1229	2.12	Q	V			
15+20	1.1385	2.26	Q	V			
15+25	1.1553	2.44	Q	V			
15+30	1.1745	2.79	Q	V			
15+35	1.1962	3.15	Q	V			
15+40	1.2208	3.57	Q	V			
15+45	1.2488	4.07	Q	V			
15+50	1.2819	4.80	Q	V			
15+55	1.3219	5.81	Q	V			
16+ 0	1.3760	7.85	Q	V			
16+ 5	1.4695	13.58	Q	V			
16+10	**1.6795**	**30.49**			V Q		
16+15	1.8621	26.50			Q V		
16+20	1.9656	15.03		Q	V		
16+25	2.0373	10.40	Q		V		
16+30	2.0906	7.74	Q		V		
16+35	2.1312	5.90	Q		V		
16+40	2.1641	4.77	Q		V		
16+45	2.1910	3.90	Q		V		
16+50	2.2131	3.21	Q		V		
16+55	2.2312	2.63	Q		V		
17+ 0	2.2475	2.36	Q		V		
17+ 5	2.2623	2.15	Q		V		
17+10	**2.2753**	1.90	Q		V		
17+15	2.2852	1.43	Q		V		
17+20	2.2942	1.31	Q		V		
17+25	2.3026	1.22	Q		V		
17+30	2.3105	1.15	Q		V		
17+35	2.3179	1.09	Q		V		
17+40	2.3250	1.03	Q		V		
17+45	2.3318	0.99	Q		V		
17+50	2.3384	0.95	Q		V		
17+55	2.3446	0.91	Q		V		

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2001 Version 6.4
Rational Hydrology Study Date: 04/25/06

Tract 17690 Onsite
100 Year Storm Event
Developed Runoff
tr17690ondevtc.out

Altec Engineering Corporation, Apple Valley, CA - S/N 869

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3