CEQA-Level Drainage Study

for

Rosemary's Mountain Mining and Processing Facility

PDS2013-MUP-87-021W2 and PDS2013-RC-87-001W2

Log No: 87-2-13

April 3, 2014

Wayne W. Chang, MS, PE 46548

ChangConsultants

Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

P.O. Box 9496
Rancho Santa Fe, CA 92067
(858) 692-0760

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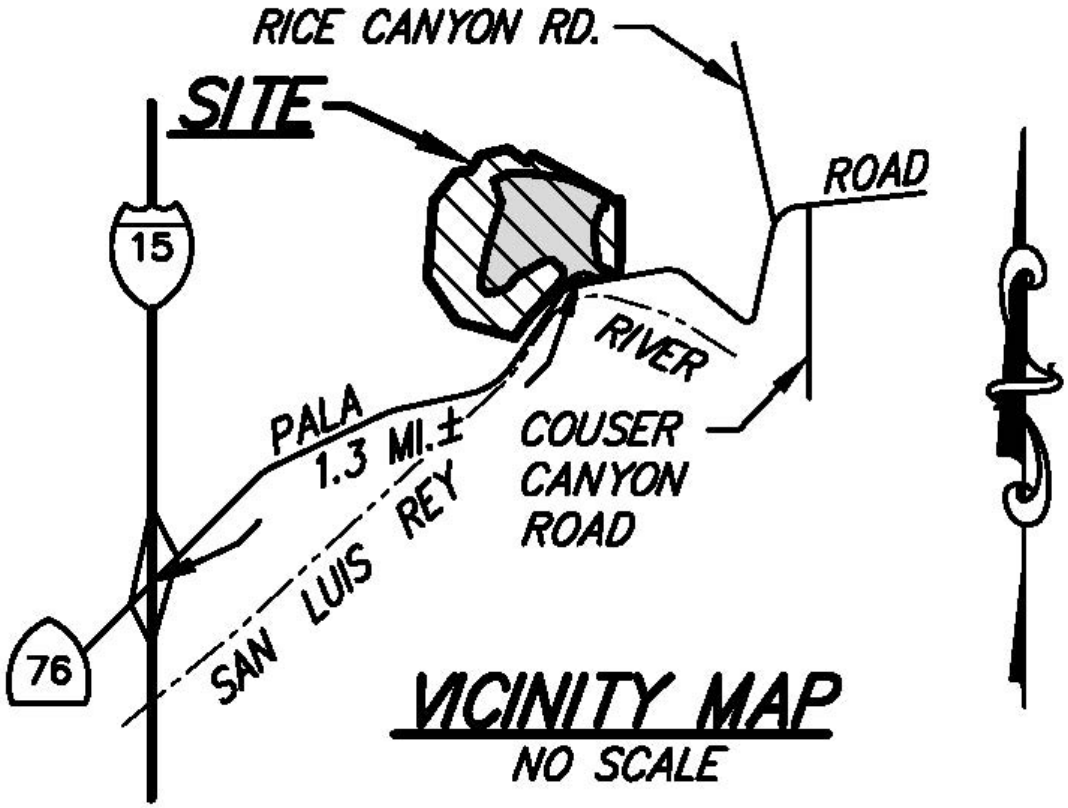
INTRODUCTION

The Rosemary's Mountain Mining and Processing Facility is located immediately north of Pala Road (State Route 76) along the east face of Rosemary's Mountain. The San Luis Rey River flows in a westerly direction along the south side of Pala Road near the site. In 2011, the project proposed a Major Use Permit Modification and Reclamation Plan Amendment to revise/clarify a number of conditions in the approved MUP and revise the Plot Plan to incorporate new areas outside the mining footprint into the mining footprint, change some phase boundaries, revise slope/bench configurations, redesign access road alignments, and change some final pad elevations. The project contained an initial site preparation phase followed by three mining phases (Phases 1, 2, and 3).



Currently, the project proposes to expand the site preparation area as well as Phases 1, 2, and 3. The expansion will primarily be towards the north. This CEQA-level drainage report contains hydrologic analyses to determine the 100-year flow rates from the expanded site preparation phase as well as from expanded mining Phases 1, 2, and 3. An existing storm drain system currently serves the site. The system conveys the site runoff south under Pala Road and outlets into the San Luis Rey River. This report also contains hydraulic analyses to confirm that the storm drain can continue to convey the project runoff during all phases.

HYDROLOGIC ANALYSES

Hydrologic analyses were performed to determine the 100-year flow rates under current conditions as well as in each of the project phases. The County of San Diego's 2003 *Hydrology Manual* rational method procedure was used for the 100-year hydrologic analyses. The rational method input parameters are summarized below and the supporting data is included in Appendix A:

- Precipitation: The 100-year, 6- and 24-hour precipitation values are 3.5 and 5.9 inches, respectively.

- Drainage areas: The drainage basins were delineated from the base topography and plans by Cherry Engineering. See the Rational Method Work Map exhibits in the map pocket for the basin boundaries, rational method node numbers, and basin areas. For current conditions, the most recent topographic mapping was used, which is from May 2013.

- Hydrologic soil groups: The hydrologic soil groups were determined from the Natural Resources Conservation Service's (NRCS) *Web Soil Survey*. The soil group in the study area is primarily type B along with some areas of soil groups A and D. The soil group boundaries have been added to the Rational Method Work Maps.

- Runoff coefficients: The site and portions of the off-site watershed will be mostly undeveloped and support natural ground cover. Land uses for the undeveloped and natural areas were based on the undisturbed natural terrain category. A portion of the project will construct paving for the access roads and a processing area. The drainage subbasins containing paving were assigned a land use based on the percentage of impervious area within the subbasin.

- Flow lengths and elevations: The flow lengths and elevations were obtained from the base topography and engineering plans

The rational method results are included in Appendix A and summarized in Table 1 for the overall runoff within the project footprint under current conditions (based on May 2013 topographic mapping) as well as the post-development phases.

All of the storm runoff from the current conditions, site preparation phase, and Phases 1 and 2 will be conveyed by the existing on-site storm drain to the San Luis Rey River. On the other hand, Phase 3 will both create a pit within the site. The runoff captured in the pit will either evaporate or infiltrate. Under Phase 3, only 92 cubic feet per second (cfs) of the total runoff will be conveyed into the river. Table 2 summarizes the overall runoff to the San Luis Rey River. All of the results except the Phase 3 results are the same under Tables 1 and 2.

Table 1 and 2 identify 100-year runoff mitigation measures needed for each phase. The baseline for comparison is current conditions with a flow of 136 cfs. The tables show that the site preparation phase, Phase 2, and Phase 3 will not increase the flow rate from the site to the San Luis Rey River over current conditions. Therefore, mitigation is not needed for these phases.

Phase 1 will increase the flow by 5 cfs. However, according to the rational method results, this flow rate can be conveyed by the existing 42-inch RCP from the site to the river. This flow rate is also negligible compared to the 100-year flow rate in the river of 33,000 cfs. A HEC-RAS analysis was performed to confirm this. The most up-to-date HEC-RAS of the San Luis Rey River from URS Corporation (adopted by FEMA) was used for the analysis. Appendix B contains the HEC-RAS results based on the 100-year flow rate and the 100-year flow rate plus 5 cfs. The analysis extends from Interstate 15 to the site, and the work map is in the map pocket. The results show there is no increase in water surface elevations. A no-rise certification is provided after the conclusion. Therefore, mitigation is not proposed for Phase 1.

Phase	C	Total Area, ac	100-Year Flow, cfs	Mitigation
Current	0.27	67.81	136	---
Site Preparation	0.34	68.51	130	N/A, does not increase flow
1	0.30	68.11	141	N/A, existing 42” RCP can convey flow
2	0.32	72.43	128	N/A, does not increase flow
3	0.23	71.72	124	N/A, does not increase flow

Table 1. Summary of Overall Rational Method Results within Project Footprint

Phase	C	Total Area, ac	100-Year Flow, cfs	Mitigation
Current	0.27	67.81	136	---
Site Preparation	0.34	68.51	130	N/A, does not increase flow
1	0.30	68.11	141	N/A, existing 42” RCP can convey flow
2	0.32	72.43	128	N/A, does not increase flow
3	0.34	41.94	93	N/A, does not increase flow

Table 2. Summary of Rational Method Results Discharging from Project to San Luis Rey River

CONCLUSION

Hydrologic analyses have been performed for the current proposal to expand the project, which in 2011 included a Major Use Permit Modification and Reclamation Plan Amendment for the Rosemary’s Mountain Mining and Processing. The analyses provide the 100-year runoff generated by the expanded site preparation and three expanded mining phases. The maximum 100-year runoff under these phases will be 141 cfs, which occurs under Phase 1. The rational method results for these results contain a normal depth pipe analysis. The results indicate that a 39 inch diameter pipe is needed to convey the flow. The existing storm drain is a 42 inch reinforced concrete pipe so it has capacity for the project runoff.

The project will not significant alter the existing drainage patterns of the site or area. A mining operation has already been approved for the site by the County of San Diego, and the mining

operations area currently ongoing. The County approval permits a site preparation phase followed by three mining phases. The currently proposed project maintains the site preparation phase and three mining phases and does not change the land use. The proposed runoff will generally be conveyed in a southerly direction through the site and into the San Luis Rey River similar to the approved project. The existing 42 inch storm drain discharging to the river has capacity for the proposed runoff. There are no known planned drainage facilities that will be impacted by the project. At the completion of mining, the runoff into the river will be less than under current conditions (93 versus 130 cfs). The project will not alter the river or major streams nor will it unacceptably increase flooding on- or off-site. Since the project will ultimately create a pit that provides on-site retention, the off-site flooding will be minimally reduced. Since the project is similar to pre-development conditions, it will not result in substantial erosion or siltation on- or off-site beyond County approvals. The project does not propose housing, so it will not place housing in a 100-year flood hazard area.

There are two existing 24-inch RCP storm drains on either side of the project entrance from Pala Road. These storm drains convey surface runoff along a portion of Pala Road southerly to the San Luis Rey River.

DECLARATION OF RESPONSIBLE CHARGE AND NO-RISE CERTIFICATION

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

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

It further certify that the attached technical data supports the fact that proposed development (as defined in County of San Diego Ordinance Section 811.201(i)) associated with County of San Diego PDS2013-3301-87-021-04 (MUP Modification W2) and PDS2013-3311-87-001-02 (RP Modification W2) will not result in increase in flood levels or the volume or velocity of flood flows during the occurrence of the base flood discharge within the San Luis Rey River in compliance with County of San Diego Ordinance Section 811.506.

April 3, 2014

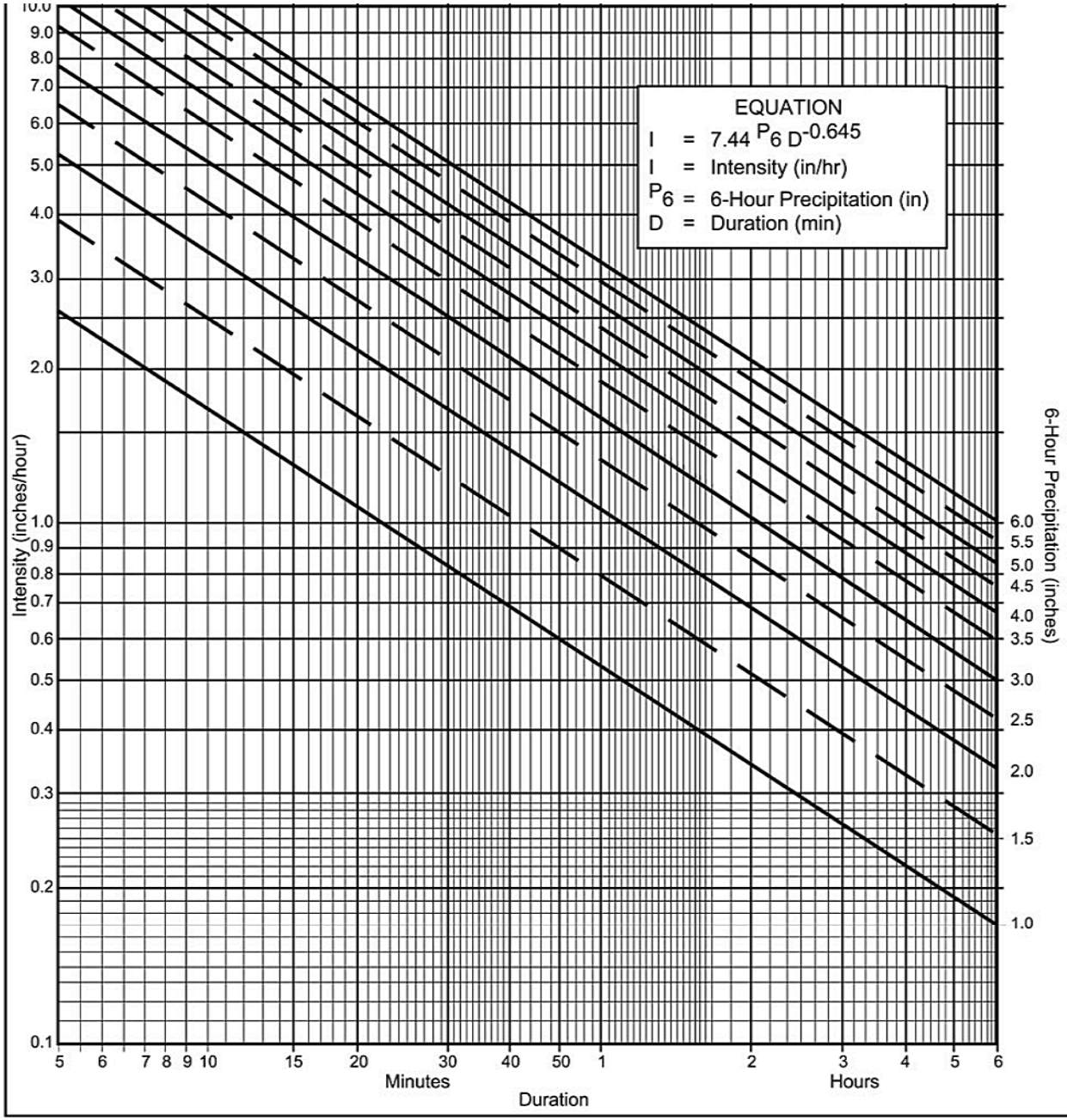
Wayne W. Chang
RCE 46548
Exp. June 30, 2015

Date

APPENDIX A

RATIONAL METHOD ANALYSES

RATIONAL METHOD
SUPPORT MATERIAL



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency **100** year

(b) P_6 = **3.5** in., P_{24} = **5.9**, $\frac{P_6}{P_{24}}$ = **59** %(2)

(c) Adjusted P_6(2) = **3.5** in.

(d) t_x = _____ min.

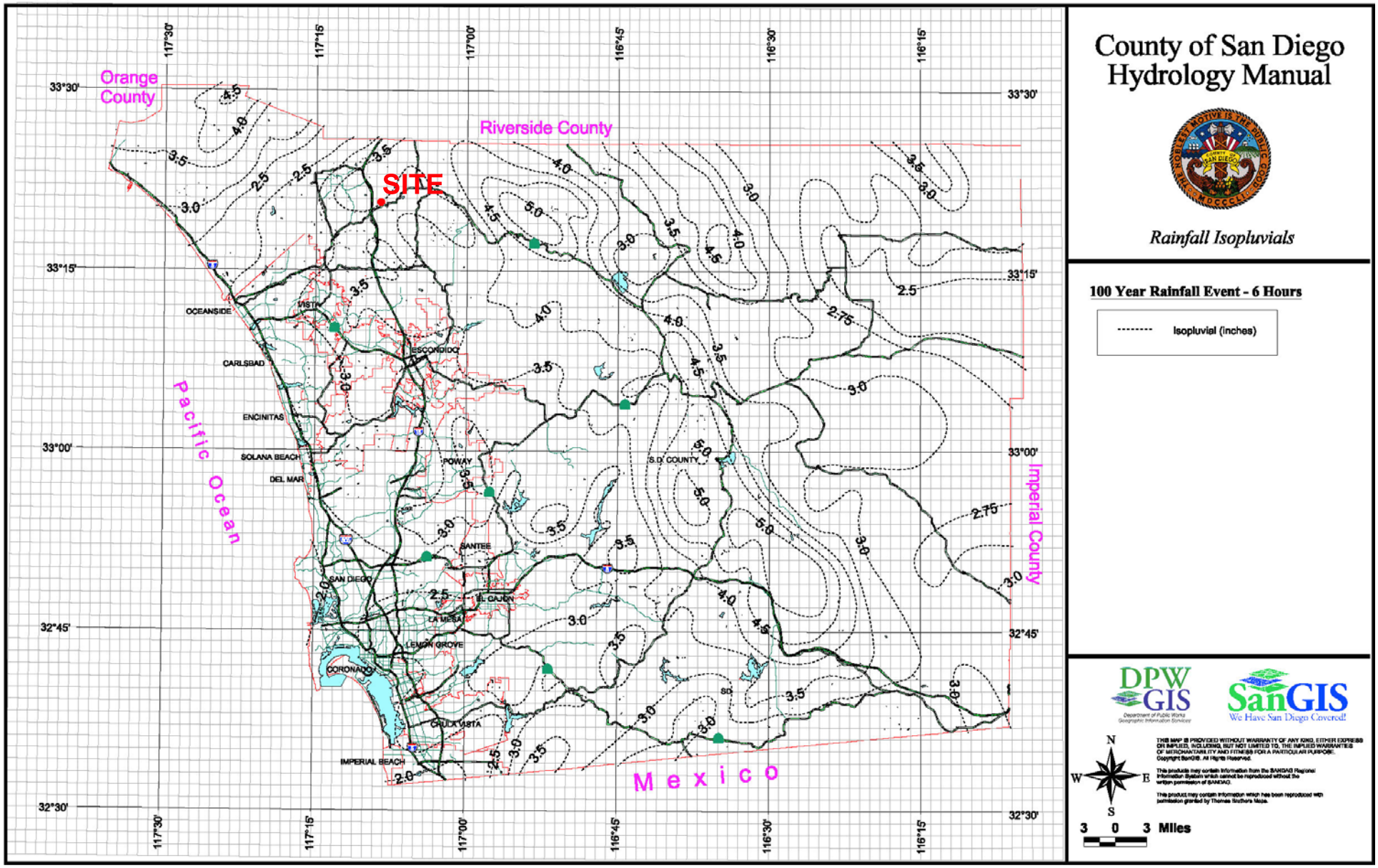
(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

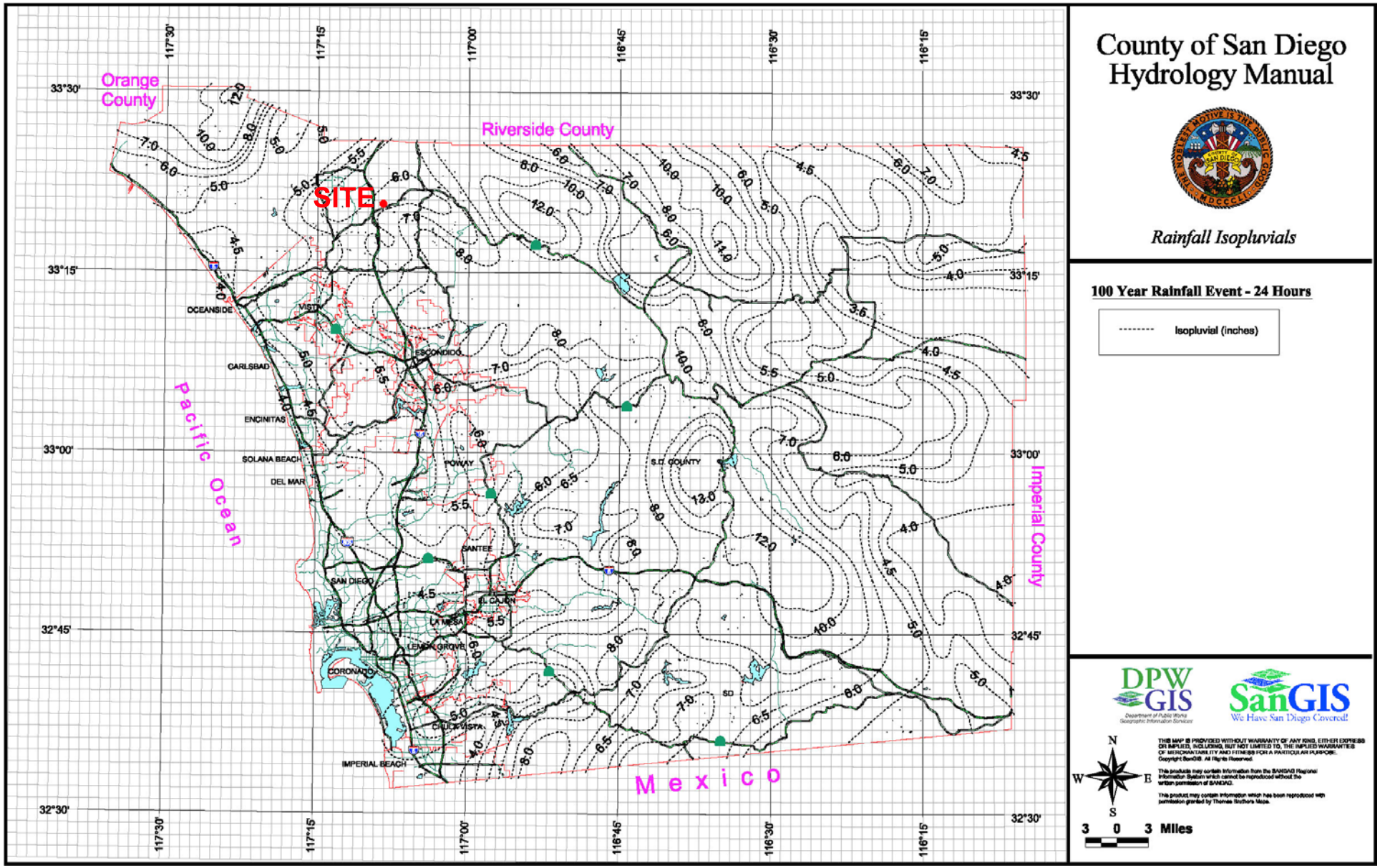
P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity Duration Design Chart - Template

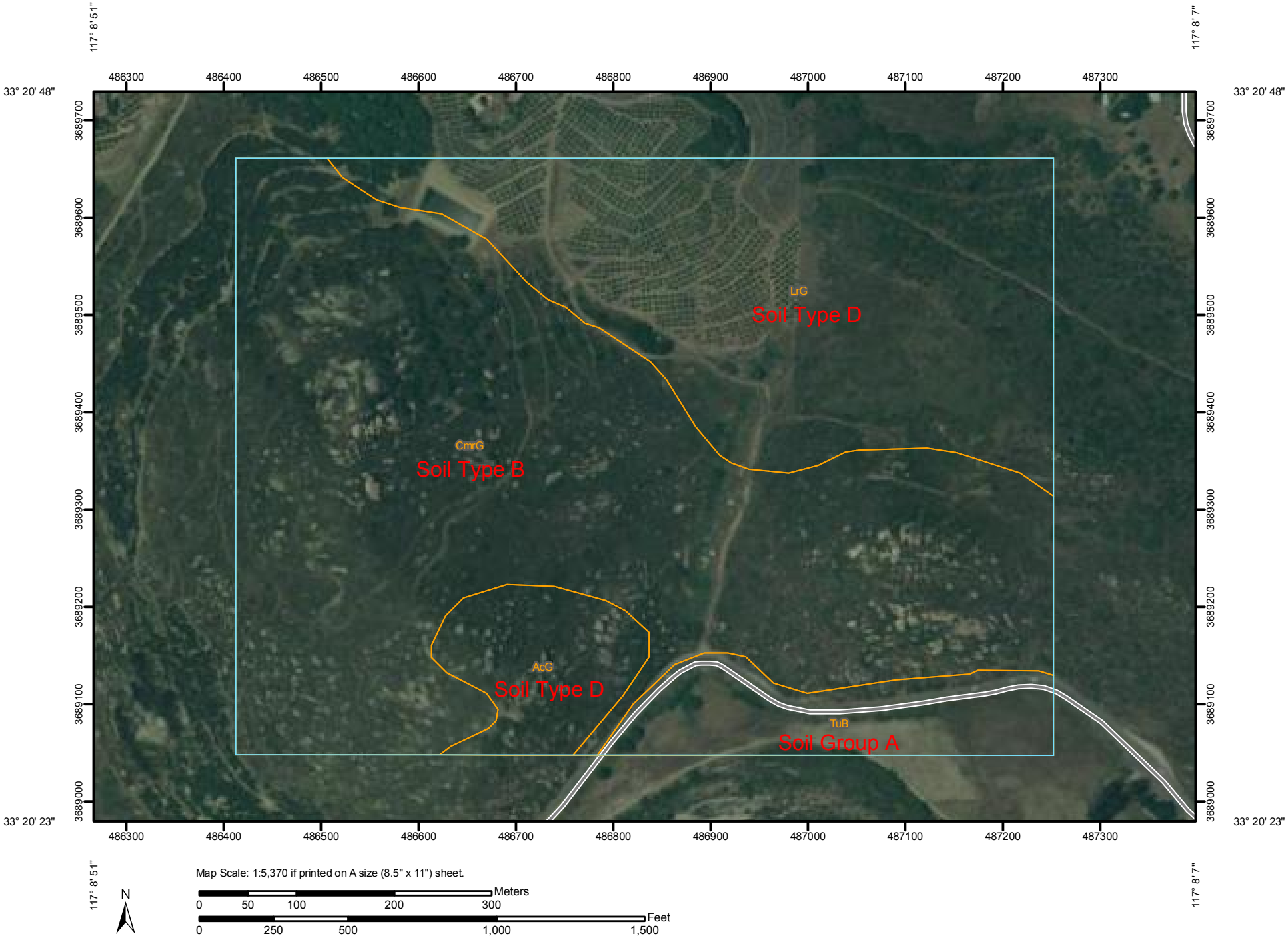
FIGURE



100-YEAR, 6-HOUR PRECIPITATION = 3.5"



100-YEAR, 24-HR PRECIPITATION=5.9"


117° 8' 51"
117° 8' 7"
33° 20' 48"
33° 20' 23"
486300
486400
486500
486600
486700
486800
486900
487000
487100
487200
487300
3689700
3689600
3689500
3689400
3689300
3689200
3689100
3689000
LrG
Soil Type D
CmrG
Soil Type B
AcG
Soil Type D
TuB
Soil Group A
Map Scale: 1:5,370 if printed on A size (8.5" x 11") sheet.
N
Meters
0
50
100
200
300
Feet
0
250
500
1,000
1,500

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Gully

Short Steep Slope

Other

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:5,370 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 6, Dec 17, 2007

Date(s) aerial images were photographed: 6/7/2005

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

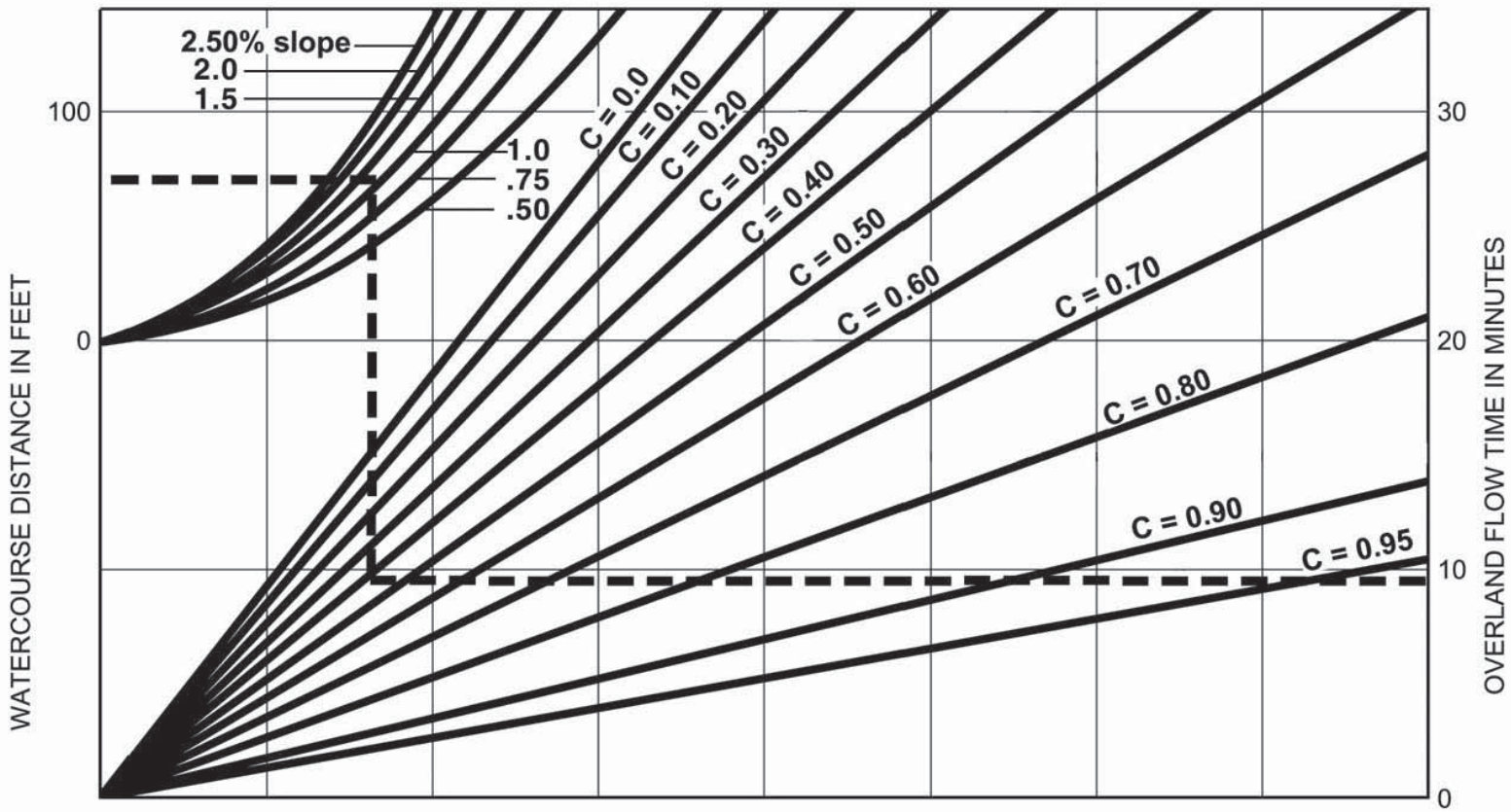
Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AcG	Acid igneous rock land	6.9	5.5%
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes	72.0	56.6%
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slope s	39.3	30.9%
TuB	Tujunga sand, 0 to 5 percent slopes	9.0	7.1%
Totals for Area of Interest		**127.2**	**100.0%**

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

Rational Formula - Overland Time of Flow Nomograph

3-3

100-YEAR ANALYSES

```
           San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 02/26/14
----------------------------------------------------------------------
Rosemary's Mountain
Existing Conditions
100-Year Storm Event

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

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


Program License Serial Number 4028

----------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  5.900
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =  626.000(Ft.)
Highest elevation =  985.000(Ft.)
Lowest elevation =  629.000(Ft.)
Elevation difference =  356.000(Ft.) Slope = 56.869 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  56.87 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
```

```
Initial Area Time of Concentration =   3.98 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(  56.869^(1/3)]=   3.98
The initial area total distance of  626.00 (Ft.) entered leaves a
remaining distance of  526.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.21 minutes
for a distance of 526.00 (Ft.) and a slope of 56.87 %
with an elevation difference of 299.13(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.208 Minutes
Tt=[(11.9*0.0996^3)/(299.13)]^.385=  1.21
Total initial area Ti =   3.98 minutes from Figure 3-3 formula plus
  1.21 minutes from the Figure 3-4 formula =   5.19 minutes
Rainfall intensity (I) =      9.006(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =     24.766(CFS)
Total initial stream area =       11.000(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       14.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   629.000(Ft.)
Downstream point elevation =   305.000(Ft.)
Channel length thru subarea  =  2195.000(Ft.)
Channel base width    =    2.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     24.766(CFS)
Depth of flow =   0.540(Ft.), Average velocity =  14.890(Ft/s)
Channel flow top width =    4.160(Ft.)
Flow Velocity =   14.89(Ft/s)
Travel time  =    2.46 min.
Time of concentration =    7.64 min.
Critical depth =      1.156(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   300.000(Ft.)
Downstream point/station elevation =   298.000(Ft.)
Pipe length  =    60.00(Ft.) Slope =   0.0333  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.766(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    24.766(CFS)
Normal flow depth in pipe =   14.95(In.)
Flow top width inside pipe =   19.02(In.)
```

```
Critical depth could not be calculated.
Pipe flow velocity =     13.52(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     7.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      6.970(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.030
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.470
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.295
Time of concentration =     7.72 min.
Rainfall intensity =      6.970(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.286  CA =     14.470
Subarea runoff =     76.081(CFS) for     39.660(Ac.)
Total runoff =    100.848(CFS)   Total area =      50.660(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   298.000(Ft.)
Downstream point/station elevation =   296.000(Ft.)
Pipe length  =    85.00(Ft.) Slope =   0.0235  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   100.848(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =   100.848(CFS)
Normal flow depth in pipe =   29.06(In.)
Flow top width inside pipe =   28.40(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.50(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     7.80 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     50.660(Ac.)
Runoff from this stream =    100.848(CFS)
```

```
Time of concentration =    7.80 min.
Rainfall intensity =     6.920(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.330
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.670
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.317
Initial subarea total flow distance  =  857.000(Ft.)
Highest elevation =  687.400(Ft.)
Lowest elevation =  443.300(Ft.)
Elevation difference =  244.100(Ft.) Slope = 28.483 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  28.48 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.62 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3170)*( 100.000^.5)/(  28.483^(1/3)]=   4.62
The initial area total distance of  857.00 (Ft.) entered leaves a
remaining distance of  757.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.09 minutes
for a distance of 757.00 (Ft.) and a slope of 28.48 %
with an elevation difference of 215.62(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.087 Minutes
Tt=[(11.9*0.1434^3)/(215.62)]^.385=  2.09
Total initial area Ti =   4.62 minutes from Figure 3-3 formula plus
  2.09 minutes from the Figure 3-4 formula =   6.70 minutes
Rainfall intensity (I) =      7.634(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.317
Subarea runoff =     24.103(CFS)
Total initial stream area =        9.960(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   443.300(Ft.)
Downstream point elevation =   318.000(Ft.)
Channel length thru subarea  =   911.000(Ft.)
Channel base width    =    1.000(Ft.)
```

```
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     29.772(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     29.772(CFS)
Depth of flow =   0.754(Ft.), Average velocity =  15.756(Ft/s)
Channel flow top width =    4.015(Ft.)
Flow Velocity =   15.76(Ft/s)
Travel time  =    0.96 min.
Time of concentration =    7.67 min.
Critical depth =      1.461(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      7.000(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.020
Decimal fraction soil group B = 0.830
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.150
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.264
Rainfall intensity =      7.000(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.295  CA =      5.055
Subarea runoff =     11.287(CFS) for      7.190(Ac.)
Total runoff =     35.390(CFS)   Total area =      17.150(Ac.)
Depth of flow =   0.816(Ft.), Average velocity =  16.469(Ft/s)
Critical depth =      1.578(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   318.000(Ft.)
Downstream point/station elevation =   300.000(Ft.)
Pipe length  =   174.00(Ft.) Slope =   0.1034  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    35.390(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    35.390(CFS)
Normal flow depth in pipe =   12.88(In.)
Flow top width inside pipe =   20.45(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.89(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     7.79 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
```

```
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     17.150(Ac.)
Runoff from this stream =     35.390(CFS)
Time of concentration =    7.79 min.
Rainfall intensity =     6.927(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      100.848      7.80            6.920
2       35.390      7.79            6.927
Qmax(1) =
        1.000 *    1.000 *   100.848) +
        0.999 *    1.000 *    35.390) + =     136.204
Qmax(2) =
        1.000 *    0.999 *   100.848) +
        1.000 *    1.000 *    35.390) + =     136.091

Total of 2 streams to confluence:
Flow rates before confluence point:
     100.848      35.390
Maximum flow rates at confluence using above data:
      136.204      136.091
Area of streams before confluence:
       50.660       17.150
Results of confluence:
Total flow rate =    136.204(CFS)
Time of concentration =     7.804 min.
Effective stream area after confluence =     67.810(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   287.180(Ft.)
Downstream point/station elevation =   279.860(Ft.)
Pipe length  =   242.00(Ft.) Slope =   0.0302  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   136.204(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =   136.204(CFS)
Normal flow depth in pipe =   30.28(In.)
Flow top width inside pipe =   32.50(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.70(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     8.01 min.
End of computations, total study area =          67.810 (Ac.)
```

```
            San Diego County Rational Hydrology Program
CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 07/12/13
----------------------------------------------------------------------
Rosemary's Mountain
Site Preparation Phase
Proposed Conditions
100-Year Storm Event
----------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 4028

----------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  5.900
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.750
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.250
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.275
Initial subarea total flow distance  =  935.000(Ft.)
Highest elevation =  981.000(Ft.)
Lowest elevation =  592.000(Ft.)
Elevation difference =  389.000(Ft.) Slope = 41.604 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  41.60 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.29 minutes
```

```
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2750)*( 100.000^.5)/(  41.604^(1/3)]=   4.29
The initial area total distance of  935.00 (Ft.) entered leaves a
remaining distance of  835.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.95 minutes
for a distance of 835.00 (Ft.) and a slope of 41.60 %
with an elevation difference of 347.39(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.945 Minutes
Tt=[(11.9*0.1581^3)/(347.39)]^.385=  1.95
Total initial area Ti =   4.29 minutes from Figure 3-3 formula plus
  1.95 minutes from the Figure 3-4 formula =   6.23 minutes
Rainfall intensity (I) =      8.001(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.275
Subarea runoff =     14.831(CFS)
Total initial stream area =        6.740(Ac.)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Process from Point/Station       12.000 to Point/Station       14.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   583.000(Ft.)
Downstream point elevation =   492.000(Ft.)
Channel length thru subarea  =   707.000(Ft.)
Channel base width    =   20.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     22.438(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     22.438(CFS)
Depth of flow =   0.191(Ft.), Average velocity =   5.806(Ft/s)
Channel flow top width =   20.572(Ft.)
Flow Velocity =    5.81(Ft/s)
Travel time  =    2.03 min.
Time of concentration =    8.26 min.
Critical depth =      0.336(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.671(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.950
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.050
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.255
Rainfall intensity =      6.671(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.263  CA =      4.493
Subarea runoff =     15.140(CFS) for     10.350(Ac.)
```

```
Total runoff =     29.970(CFS)   Total area =      17.090(Ac.)
Depth of flow =   0.227(Ft.), Average velocity =   6.502(Ft/s)
Critical depth =      0.406(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   492.000(Ft.)
Downstream point elevation =   488.000(Ft.)
Channel length thru subarea  =   415.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     38.905(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     38.905(CFS)
Depth of flow =   1.451(Ft.), Average velocity =   4.542(Ft/s)
Channel flow top width =    8.805(Ft.)
Flow Velocity =    4.54(Ft/s)
Travel time  =    1.52 min.
Time of concentration =    9.78 min.
Critical depth =      1.297(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.981(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.350
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.650
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.315
Rainfall intensity =      5.981(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.283  CA =      7.989
Subarea runoff =     17.814(CFS) for     11.100(Ac.)
Total runoff =     47.785(CFS)   Total area =      28.190(Ac.)
Depth of flow =   1.605(Ft.), Average velocity =   4.795(Ft/s)
Critical depth =      1.453(Ft.)


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Process from Point/Station       16.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   483.000(Ft.)
Downstream point/station elevation =   443.000(Ft.)
Pipe length  =   220.00(Ft.) Slope =   0.1818  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    47.785(CFS)
```

```
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    47.785(CFS)
Normal flow depth in pipe =   13.03(In.)
Flow top width inside pipe =   20.38(In.)
Critical depth could not be calculated.
Pipe flow velocity =     30.46(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     9.90 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     28.190(Ac.)
Runoff from this stream =     47.785(CFS)
Time of concentration =    9.90 min.
Rainfall intensity =     5.934(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  875.000(Ft.)
Highest elevation =  687.400(Ft.)
Lowest elevation =  443.000(Ft.)
Elevation difference =  244.400(Ft.) Slope = 27.931 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.93 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(  27.931^(1/3)]=   4.63
The initial area total distance of  875.00 (Ft.) entered leaves a
remaining distance of  775.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.14 minutes
for a distance of 775.00 (Ft.) and a slope of 27.93 %
with an elevation difference of 216.47(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.141 Minutes
```

```
Tt=[(11.9*0.1468^3)/(216.47)]^.385=  2.14
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  2.14 minutes from the Figure 3-4 formula =   6.77 minutes
Rainfall intensity (I) =      7.585(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =     29.007(CFS)
Total initial stream area =       11.950(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     11.950(Ac.)
Runoff from this stream =     29.007(CFS)
Time of concentration =    6.77 min.
Rainfall intensity =     7.585(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       47.785      9.90            5.934
2       29.007      6.77            7.585
Qmax(1) =
        1.000 *    1.000 *    47.785) +
        0.782 *    1.000 *    29.007) + =      70.477
Qmax(2) =
        1.000 *    0.683 *    47.785) +
        1.000 *    1.000 *    29.007) + =      61.664

Total of 2 streams to confluence:
Flow rates before confluence point:
      47.785      29.007
Maximum flow rates at confluence using above data:
       70.477       61.664
Area of streams before confluence:
       28.190       11.950
Results of confluence:
Total flow rate =     70.477(CFS)
Time of concentration =     9.903 min.
Effective stream area after confluence =     40.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   443.000(Ft.)
Downstream point elevation =   318.000(Ft.)
```

```
Channel length thru subarea  =   911.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     73.959(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     73.959(CFS)
Depth of flow =   1.138(Ft.), Average velocity =  19.843(Ft/s)
Channel flow top width =    5.551(Ft.)
Flow Velocity =   19.84(Ft/s)
Travel time  =    0.77 min.
Time of concentration =   10.67 min.
Critical depth =      2.188(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.656(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.020
Decimal fraction soil group B = 0.880
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.100
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.259
Rainfall intensity =      5.656(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.289  CA =     13.675
Subarea runoff =      6.872(CFS) for      7.190(Ac.)
Total runoff =     77.349(CFS)   Total area =      47.330(Ac.)
Depth of flow =   1.161(Ft.), Average velocity =  20.068(Ft/s)
Critical depth =      2.250(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   318.000(Ft.)
Downstream point/station elevation =   300.000(Ft.)
Pipe length  =   174.00(Ft.) Slope =   0.1034  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    77.349(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    77.349(CFS)
Normal flow depth in pipe =   17.88(In.)
Flow top width inside pipe =   25.54(In.)
Critical depth could not be calculated.
Pipe flow velocity =     27.68(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    10.77 min.


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Process from Point/Station       22.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     47.330(Ac.)
Runoff from this stream =     77.349(CFS)
Time of concentration =   10.77 min.
Rainfall intensity =     5.620(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  492.000(Ft.)
Highest elevation =  681.000(Ft.)
Lowest elevation =  590.000(Ft.)
Elevation difference =   91.000(Ft.) Slope = 18.496 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  18.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.10 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  18.496^(1/3)]=   5.10
The initial area total distance of  492.00 (Ft.) entered leaves a
remaining distance of  392.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.48 minutes
for a distance of 392.00 (Ft.) and a slope of 18.50 %
with an elevation difference of  72.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.485 Minutes
Tt=[(11.9*0.0742^3)/( 72.50)]^.385=  1.48
Total initial area Ti =   5.10 minutes from Figure 3-3 formula plus
  1.48 minutes from the Figure 3-4 formula =   6.59 minutes
Rainfall intensity (I) =      7.718(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      6.780(CFS)
Total initial stream area =        2.510(Ac.)


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Process from Point/Station       32.000 to Point/Station       34.000
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**** IMPROVED CHANNEL TRAVEL TIME ****
_____________________________________________________________________
Upstream point elevation =   590.000(Ft.)
Downstream point elevation =   305.000(Ft.)
Channel length thru subarea  =  2206.000(Ft.)
Channel base width    =    2.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     22.071(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     22.071(CFS)
Depth of flow =   0.526(Ft.), Average velocity =  13.739(Ft/s)
Channel flow top width =    4.105(Ft.)
Flow Velocity =   13.74(Ft/s)
Travel time  =    2.68 min.
Time of concentration =    9.27 min.
Critical depth =      1.094(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.195(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.010
Decimal fraction soil group B = 0.400
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.590
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.373
Rainfall intensity =      6.195(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.369  CA =      6.020
Subarea runoff =     30.514(CFS) for     13.800(Ac.)
Total runoff =     37.294(CFS)   Total area =      16.310(Ac.)
Depth of flow =   0.692(Ft.), Average velocity =  15.911(Ft/s)
Critical depth =      1.422(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       34.000 to Point/Station       36.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________
Upstream point/station elevation =   300.000(Ft.)
Downstream point/station elevation =   298.000(Ft.)
Pipe length  =    60.00(Ft.) Slope =   0.0333  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    37.294(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    37.294(CFS)
Normal flow depth in pipe =   17.86(In.)
Flow top width inside pipe =   20.94(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.89(Ft/s)
Travel time through pipe =    0.07 min.
```

```
Time of concentration (TC) =     9.33 min.


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Process from Point/Station       36.000 to Point/Station       36.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      6.166(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.150
Decimal fraction soil group B = 0.700
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.150
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.674
Time of concentration =     9.33 min.
Rainfall intensity =      6.166(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.439  CA =      9.305
Subarea runoff =     20.080(CFS) for      4.870(Ac.)
Total runoff =     57.374(CFS)   Total area =      21.180(Ac.)


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Process from Point/Station       36.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   298.000(Ft.)
Downstream point/station elevation =   296.000(Ft.)
Pipe length  =    85.00(Ft.) Slope =   0.0235  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    57.374(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    57.374(CFS)
Normal flow depth in pipe =   22.50(In.)
Flow top width inside pipe =   25.98(In.)
Critical Depth =   28.48(In.)
Pipe flow velocity =     14.53(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     9.43 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       36.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     21.180(Ac.)
Runoff from this stream =     57.374(CFS)
Time of concentration =    9.43 min.
Rainfall intensity =     6.125(In/Hr)
Summary of stream data:
```

```
Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       77.349     10.77            5.620
2       57.374      9.43            6.125
Qmax(1) =
        1.000 *    1.000 *    77.349) +
        0.918 *    1.000 *    57.374) + =     130.000
Qmax(2) =
        1.000 *    0.875 *    77.349) +
        1.000 *    1.000 *    57.374) + =     125.078

Total of 2 streams to confluence:
Flow rates before confluence point:
      77.349      57.374
Maximum flow rates at confluence using above data:
      130.000      125.078
Area of streams before confluence:
       47.330       21.180
Results of confluence:
Total flow rate =    130.000(CFS)
Time of concentration =    10.773 min.
Effective stream area after confluence =     68.510(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   287.180(Ft.)
Downstream point/station elevation =   279.860(Ft.)
Pipe length  =   242.00(Ft.) Slope =   0.0302  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   130.000(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =   130.000(CFS)
Normal flow depth in pipe =   29.06(In.)
Flow top width inside pipe =   33.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.60(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =    10.98 min.
End of computations, total study area =          68.510 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/12/13

Rosemary's Mountain
Phase 1
Proposed Conditions
100-Year Storm Event

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

Program License Serial Number 4028

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 5.900
P6/P24 = 59.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 11.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance = 430.000(Ft.)
Highest elevation = 829.500(Ft.)
Lowest elevation = 825.000(Ft.)
Elevation difference = 4.500(Ft.) Slope = 1.047 %
Top of Initial Area Slope adjusted by User to 1.000 %
Bottom of Initial Area Slope adjusted by User to 1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.00 %, in a development type of

```
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =  12.80 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*(  70.000^.5)/(   1.000^(1/3)]=  12.80
The initial area total distance of  430.00 (Ft.) entered leaves a
remaining distance of  360.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   4.28 minutes
for a distance of 360.00 (Ft.) and a slope of  1.00 %
with an elevation difference of   3.60(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    4.275 Minutes
Tt=[(11.9*0.0682^3)/(  3.60)]^.385=  4.28
Total initial area Ti =  12.80 minutes from Figure 3-3 formula plus
  4.28 minutes from the Figure 3-4 formula =  17.08 minutes
Rainfall intensity (I) =      4.176(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      1.295(CFS)
Total initial stream area =        1.240(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   825.000(Ft.)
Downstream point elevation =   583.000(Ft.)
Channel length thru subarea  =  2103.000(Ft.)
Channel base width    =   30.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      6.658(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      6.658(CFS)
Depth of flow =   0.075(Ft.), Average velocity =   2.968(Ft/s)
Channel flow top width =   30.149(Ft.)
Flow Velocity =    2.97(Ft/s)
Travel time  =   11.81 min.
Time of concentration =   28.88 min.
Critical depth =      0.115(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      2.975(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.850
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.150
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.265
Rainfall intensity =      2.975(In/Hr) for a   100.0 year storm
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Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.264  CA =      4.009
Subarea runoff =     10.634(CFS) for     13.960(Ac.)
Total runoff =     11.929(CFS)   Total area =      15.200(Ac.)
Depth of flow =   0.106(Ft.), Average velocity =   3.744(Ft/s)
Critical depth =      0.170(Ft.)


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Process from Point/Station       12.000 to Point/Station       14.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   583.000(Ft.)
Downstream point elevation =   492.000(Ft.)
Channel length thru subarea  =   592.000(Ft.)
Channel base width    =   20.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     13.080(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     13.080(CFS)
Depth of flow =   0.131(Ft.), Average velocity =   4.955(Ft/s)
Channel flow top width =   20.392(Ft.)
Flow Velocity =    4.96(Ft/s)
Travel time  =    1.99 min.
Time of concentration =   30.88 min.
Critical depth =      0.234(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      2.850(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.980
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.020
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.252
Rainfall intensity =      2.850(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.261  CA =      4.959
Subarea runoff =      2.206(CFS) for      3.770(Ac.)
Total runoff =     14.134(CFS)   Total area =      18.970(Ac.)
Depth of flow =   0.137(Ft.), Average velocity =   5.109(Ft/s)
Critical depth =      0.248(Ft.)


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Process from Point/Station       14.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   492.000(Ft.)
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Downstream point elevation =   488.000(Ft.)
Channel length thru subarea  =   415.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     18.646(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     18.646(CFS)
Depth of flow =   1.001(Ft.), Average velocity =   3.723(Ft/s)
Channel flow top width =    7.005(Ft.)
Flow Velocity =    3.72(Ft/s)
Travel time  =    1.86 min.
Time of concentration =   32.73 min.
Critical depth =      0.867(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      2.745(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.350
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.650
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.315
Rainfall intensity =      2.745(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.281  CA =      8.456
Subarea runoff =      9.074(CFS) for     11.100(Ac.)
Total runoff =     23.208(CFS)   Total area =      30.070(Ac.)
Depth of flow =   1.120(Ft.), Average velocity =   3.953(Ft/s)
Critical depth =      0.984(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   483.000(Ft.)
Downstream point/station elevation =   443.000(Ft.)
Pipe length  =   220.00(Ft.) Slope =   0.1818  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.208(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    23.208(CFS)
Normal flow depth in pipe =   10.55(In.)
Flow top width inside pipe =   13.71(In.)
Critical depth could not be calculated.
Pipe flow velocity =     25.16(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    32.88 min.
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Process from Point/Station       16.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     30.070(Ac.)
Runoff from this stream =     23.208(CFS)
Time of concentration =   32.88 min.
Rainfall intensity =     2.737(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  875.000(Ft.)
Highest elevation =  687.400(Ft.)
Lowest elevation =  443.000(Ft.)
Elevation difference =  244.400(Ft.) Slope = 27.931 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.93 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(  27.931^(1/3)]=   4.63
The initial area total distance of  875.00 (Ft.) entered leaves a
remaining distance of  775.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.14 minutes
for a distance of 775.00 (Ft.) and a slope of 27.93 %
with an elevation difference of 216.47(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.141 Minutes
Tt=[(11.9*0.1468^3)/(216.47)]^.385=  2.14
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  2.14 minutes from the Figure 3-4 formula =   6.77 minutes
Rainfall intensity (I) =      7.585(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =     29.007(CFS)
Total initial stream area =       11.950(Ac.)


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Process from Point/Station       20.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     11.950(Ac.)
Runoff from this stream =     29.007(CFS)
Time of concentration =    6.77 min.
Rainfall intensity =     7.585(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       23.208     32.88            2.737
2       29.007      6.77            7.585
Qmax(1) =
        1.000 *    1.000 *    23.208) +
        0.361 *    1.000 *    29.007) + =      33.673
Qmax(2) =
        1.000 *    0.206 *    23.208) +
        1.000 *    1.000 *    29.007) + =      33.784

Total of 2 streams to confluence:
Flow rates before confluence point:
      23.208      29.007
Maximum flow rates at confluence using above data:
       33.673       33.784
Area of streams before confluence:
       30.070       11.950
Results of confluence:
Total flow rate =     33.784(CFS)
Time of concentration =     6.768 min.
Effective stream area after confluence =     42.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****
____________________________________________________________________
Upstream point elevation =   443.000(Ft.)
Downstream point elevation =   318.000(Ft.)
Channel length thru subarea  =   911.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     66.830(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     66.830(CFS)
Depth of flow =   1.088(Ft.), Average velocity =  19.341(Ft/s)
Channel flow top width =    5.352(Ft.)
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```
Flow Velocity =   19.34(Ft/s)
Travel time  =    0.79 min.
Time of concentration =    7.55 min.
Critical depth =      2.094(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      7.067(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.020
Decimal fraction soil group B = 0.880
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.100
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.259
Rainfall intensity =      7.067(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.287  CA =     14.142
Subarea runoff =     66.159(CFS) for      7.190(Ac.)
Total runoff =     99.943(CFS)   Total area =      49.210(Ac.)
Depth of flow =   1.298(Ft.), Average velocity =  21.408(Ft/s)
Critical depth =      2.500(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   318.000(Ft.)
Downstream point/station elevation =   300.000(Ft.)
Pipe length  =   174.00(Ft.) Slope =   0.1034  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    99.943(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    99.943(CFS)
Normal flow depth in pipe =   19.52(In.)
Flow top width inside pipe =   28.60(In.)
Critical depth could not be calculated.
Pipe flow velocity =     29.55(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     7.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     49.210(Ac.)
Runoff from this stream =     99.943(CFS)
Time of concentration =    7.65 min.
Rainfall intensity =     7.008(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  492.000(Ft.)
Highest elevation =  681.000(Ft.)
Lowest elevation =  590.000(Ft.)
Elevation difference =   91.000(Ft.) Slope = 18.496 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  18.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.10 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  18.496^(1/3)]=   5.10
The initial area total distance of  492.00 (Ft.) entered leaves a
remaining distance of  392.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.48 minutes
for a distance of 392.00 (Ft.) and a slope of 18.50 %
with an elevation difference of  72.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.485 Minutes
Tt=[(11.9*0.0742^3)/( 72.50)]^.385=  1.48
Total initial area Ti =   5.10 minutes from Figure 3-3 formula plus
  1.48 minutes from the Figure 3-4 formula =   6.59 minutes
Rainfall intensity (I) =      7.718(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      6.780(CFS)
Total initial stream area =        2.510(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       34.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   590.000(Ft.)
Downstream point elevation =   305.000(Ft.)
Channel length thru subarea  =  2206.000(Ft.)
Channel base width    =    2.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     18.991(CFS)
Manning's 'N'    = 0.020
```

```
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     18.991(CFS)
Depth of flow =   0.486(Ft.), Average velocity =  13.160(Ft/s)
Channel flow top width =    3.943(Ft.)
Flow Velocity =   13.16(Ft/s)
Travel time  =    2.79 min.
Time of concentration =    9.38 min.
Critical depth =      1.016(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.144(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.010
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.490
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.364
Rainfall intensity =      6.144(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.361  CA =      5.067
Subarea runoff =     24.354(CFS) for     11.520(Ac.)
Total runoff =     31.134(CFS)   Total area =      14.030(Ac.)
Depth of flow =   0.631(Ft.), Average velocity =  15.136(Ft/s)
Critical depth =      1.305(Ft.)


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Process from Point/Station       34.000 to Point/Station       36.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   300.000(Ft.)
Downstream point/station elevation =   298.000(Ft.)
Pipe length  =    60.00(Ft.) Slope =   0.0333  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    31.134(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    31.134(CFS)
Normal flow depth in pipe =   15.56(In.)
Flow top width inside pipe =   22.92(In.)
Critical Depth =   22.55(In.)
Pipe flow velocity =     14.44(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     9.45 min.


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Process from Point/Station       36.000 to Point/Station       36.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      6.115(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.150
Decimal fraction soil group B = 0.700
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.150
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.674
Time of concentration =     9.45 min.
Rainfall intensity =      6.115(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.442  CA =      8.352
Subarea runoff =     19.940(CFS) for      4.870(Ac.)
Total runoff =     51.075(CFS)   Total area =      18.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       36.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   298.000(Ft.)
Downstream point/station elevation =   296.000(Ft.)
Pipe length  =    85.00(Ft.) Slope =   0.0235  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    51.075(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    51.075(CFS)
Normal flow depth in pipe =   20.53(In.)
Flow top width inside pipe =   27.89(In.)
Critical Depth =   27.75(In.)
Pipe flow velocity =     14.28(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     9.55 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       36.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     18.900(Ac.)
Runoff from this stream =     51.075(CFS)
Time of concentration =    9.55 min.
Rainfall intensity =     6.074(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       99.943      7.65            7.008
2       51.075      9.55            6.074
Qmax(1) =
        1.000 *    1.000 *    99.943) +
        1.000 *    0.801 *    51.075) + =     140.858
```

```
Qmax(2) =
        0.867 *    1.000 *    99.943) +
        1.000 *    1.000 *    51.075) + =     137.695

Total of 2 streams to confluence:
Flow rates before confluence point:
      99.943      51.075
Maximum flow rates at confluence using above data:
      140.858      137.695
Area of streams before confluence:
       49.210       18.900
Results of confluence:
Total flow rate =    140.858(CFS)
Time of concentration =     7.652 min.
Effective stream area after confluence =     68.110(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   287.180(Ft.)
Downstream point/station elevation =   279.860(Ft.)
Pipe length  =   242.00(Ft.) Slope =   0.0302  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   140.858(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =   140.858(CFS)
Normal flow depth in pipe =   31.31(In.)
Flow top width inside pipe =   31.03(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.73(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     7.86 min.
End of computations, total study area =          68.110 (Ac.)
```

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           San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 07/12/13
----------------------------------------------------------------------
Rosemary's Mountain
Phase 2
Proposed Conditions
100-Year Storm Event
----------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 4028

----------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  5.900
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.700
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.300
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.280
Initial subarea total flow distance  =  916.000(Ft.)
Highest elevation =  981.000(Ft.)
Lowest elevation =  592.000(Ft.)
Elevation difference =  389.000(Ft.) Slope = 42.467 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  42.47 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
```

```
Initial Area Time of Concentration =   4.23 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2800)*( 100.000^.5)/(  42.470^(1/3)]=   4.23
The initial area total distance of  916.00 (Ft.) entered leaves a
remaining distance of  816.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.90 minutes
for a distance of 816.00 (Ft.) and a slope of 42.47 %
with an elevation difference of 346.56(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.896 Minutes
Tt=[(11.9*0.1545^3)/(346.56)]^.385=  1.90
Total initial area Ti =   4.23 minutes from Figure 3-3 formula plus
  1.90 minutes from the Figure 3-4 formula =   6.13 minutes
Rainfall intensity (I) =      8.089(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.280
Subarea runoff =     12.299(CFS)
Total initial stream area =        5.430(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       14.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   583.000(Ft.)
Downstream point elevation =   507.000(Ft.)
Channel length thru subarea  =   308.000(Ft.)
Channel base width    =   20.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   2.000
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     12.299(CFS)
Depth of flow =   0.109(Ft.), Average velocity =   5.581(Ft/s)
Channel flow top width =   20.328(Ft.)
Flow Velocity =    5.58(Ft/s)
Travel time  =    0.92 min.
Time of concentration =    7.05 min.
Critical depth =      0.227(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   507.000(Ft.)
Downstream point elevation =   488.000(Ft.)
Channel length thru subarea  =   943.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     21.163(CFS)
Manning's 'N'    = 0.030
```

```
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     21.163(CFS)
Depth of flow =   0.883(Ft.), Average velocity =   5.032(Ft/s)
Channel flow top width =    6.530(Ft.)
Flow Velocity =    5.03(Ft/s)
Travel time  =    3.12 min.
Time of concentration =   10.17 min.
Critical depth =      0.938(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.834(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.350
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.650
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.315
Rainfall intensity =      5.834(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.304  CA =      5.133
Subarea runoff =     17.647(CFS) for     11.470(Ac.)
Total runoff =     29.946(CFS)   Total area =      16.900(Ac.)
Depth of flow =   1.057(Ft.), Average velocity =   5.541(Ft/s)
Critical depth =      1.125(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   483.000(Ft.)
Downstream point/station elevation =   443.000(Ft.)
Pipe length  =   220.00(Ft.) Slope =   0.1818  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    29.946(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    29.946(CFS)
Normal flow depth in pipe =   10.77(In.)
Flow top width inside pipe =   17.65(In.)
Critical depth could not be calculated.
Pipe flow velocity =     27.16(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    10.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     16.900(Ac.)
Runoff from this stream =     29.946(CFS)
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Time of concentration =   10.30 min.
Rainfall intensity =     5.784(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  875.000(Ft.)
Highest elevation =  687.400(Ft.)
Lowest elevation =  443.000(Ft.)
Elevation difference =  244.400(Ft.) Slope = 27.931 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.93 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(  27.931^(1/3)]=   4.63
The initial area total distance of  875.00 (Ft.) entered leaves a
remaining distance of  775.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.14 minutes
for a distance of 775.00 (Ft.) and a slope of 27.93 %
with an elevation difference of 216.47(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.141 Minutes
Tt=[(11.9*0.1468^3)/(216.47)]^.385=  2.14
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  2.14 minutes from the Figure 3-4 formula =   6.77 minutes
Rainfall intensity (I) =      7.585(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =     29.007(CFS)
Total initial stream area =       11.950(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     11.950(Ac.)
Runoff from this stream =     29.007(CFS)
Time of concentration =    6.77 min.
```

```
Rainfall intensity =     7.585(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       29.946     10.30            5.784
2       29.007      6.77            7.585
Qmax(1) =
        1.000 *    1.000 *    29.946) +
        0.763 *    1.000 *    29.007) + =      52.065
Qmax(2) =
        1.000 *    0.657 *    29.946) +
        1.000 *    1.000 *    29.007) + =      48.676

Total of 2 streams to confluence:
Flow rates before confluence point:
      29.946      29.007
Maximum flow rates at confluence using above data:
       52.065       48.676
Area of streams before confluence:
       16.900       11.950
Results of confluence:
Total flow rate =     52.065(CFS)
Time of concentration =    10.305 min.
Effective stream area after confluence =     28.850(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   443.000(Ft.)
Downstream point elevation =   318.000(Ft.)
Channel length thru subarea  =   911.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     55.857(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     55.857(CFS)
Depth of flow =   1.004(Ft.), Average velocity =  18.482(Ft/s)
Channel flow top width =    5.018(Ft.)
Flow Velocity =   18.48(Ft/s)
Travel time  =    0.82 min.
Time of concentration =   11.13 min.
Critical depth =      1.938(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.505(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.020
```

```
Decimal fraction soil group B = 0.880
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.100
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.259
Rainfall intensity =      5.505(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =     10.820
Subarea runoff =      7.497(CFS) for      7.190(Ac.)
Total runoff =     59.561(CFS)   Total area =      36.040(Ac.)
Depth of flow =   1.034(Ft.), Average velocity =  18.785(Ft/s)
Critical depth =      2.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   318.000(Ft.)
Downstream point/station elevation =   300.000(Ft.)
Pipe length  =   174.00(Ft.) Slope =   0.1034  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    59.561(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    59.561(CFS)
Normal flow depth in pipe =   16.52(In.)
Flow top width inside pipe =   22.23(In.)
Critical depth could not be calculated.
Pipe flow velocity =     25.84(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =    11.24 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     36.040(Ac.)
Runoff from this stream =     59.561(CFS)
Time of concentration =   11.24 min.
Rainfall intensity =     5.469(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
```

```
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  492.000(Ft.)
Highest elevation =  681.000(Ft.)
Lowest elevation =  590.000(Ft.)
Elevation difference =   91.000(Ft.) Slope = 18.496 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  18.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.10 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  18.496^(1/3)]=   5.10
The initial area total distance of  492.00 (Ft.) entered leaves a
remaining distance of  392.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.48 minutes
for a distance of 392.00 (Ft.) and a slope of 18.50 %
with an elevation difference of  72.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.485 Minutes
Tt=[(11.9*0.0742^3)/( 72.50)]^.385=  1.48
Total initial area Ti =   5.10 minutes from Figure 3-3 formula plus
  1.48 minutes from the Figure 3-4 formula =   6.59 minutes
Rainfall intensity (I) =      7.718(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      6.780(CFS)
Total initial stream area =        2.510(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       34.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   590.000(Ft.)
Downstream point elevation =   305.000(Ft.)
Channel length thru subarea  =  2206.000(Ft.)
Channel base width    =    2.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     13.391(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     13.391(CFS)
Depth of flow =   0.402(Ft.), Average velocity =  11.882(Ft/s)
Channel flow top width =    3.608(Ft.)
Flow Velocity =   11.88(Ft/s)
Travel time  =    3.09 min.
Time of concentration =    9.68 min.
```

```
Critical depth =      0.844(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.021(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.010
Decimal fraction soil group B = 0.400
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.590
[LOW DENSITY RESIDENTIAL                      ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.373
Rainfall intensity =      6.021(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.366  CA =      3.308
Subarea runoff =     13.136(CFS) for      6.520(Ac.)
Total runoff =     19.916(CFS)   Total area =       9.030(Ac.)
Depth of flow =   0.498(Ft.), Average velocity =  13.341(Ft/s)
Critical depth =      1.039(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       34.000 to Point/Station       36.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   300.000(Ft.)
Downstream point/station elevation =   298.000(Ft.)
Pipe length  =    60.00(Ft.) Slope =   0.0333  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.916(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    19.916(CFS)
Normal flow depth in pipe =   12.80(In.)
Flow top width inside pipe =   20.49(In.)
Critical Depth =   19.15(In.)
Pipe flow velocity =     12.96(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =     9.76 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       36.000 to Point/Station       36.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      5.990(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.030
Decimal fraction soil group B = 0.800
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.170
[LOW DENSITY RESIDENTIAL                      ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.334
Time of concentration =     9.76 min.
```

```
Rainfall intensity =      5.990(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.342  CA =     12.441
Subarea runoff =     54.603(CFS) for     27.360(Ac.)
Total runoff =     74.519(CFS)   Total area =      36.390(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       36.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   298.000(Ft.)
Downstream point/station elevation =   296.000(Ft.)
Pipe length  =    85.00(Ft.) Slope =   0.0235  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    74.519(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    74.519(CFS)
Normal flow depth in pipe =   24.89(In.)
Flow top width inside pipe =   28.41(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.49(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     9.85 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       36.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     36.390(Ac.)
Runoff from this stream =     74.519(CFS)
Time of concentration =    9.85 min.
Rainfall intensity =     5.954(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       59.561     11.24            5.469
2       74.519      9.85            5.954
Qmax(1) =
        1.000 *    1.000 *    59.561) +
        0.919 *    1.000 *    74.519) + =     128.014
Qmax(2) =
        1.000 *    0.877 *    59.561) +
        1.000 *    1.000 *    74.519) + =     126.734

Total of 2 streams to confluence:
Flow rates before confluence point:
      59.561      74.519
```

```
Maximum flow rates at confluence using above data:
      128.014      126.734
Area of streams before confluence:
       36.040       36.390
Results of confluence:
Total flow rate =    128.014(CFS)
Time of concentration =    11.238 min.
Effective stream area after confluence =     72.430(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   287.180(Ft.)
Downstream point/station elevation =   279.860(Ft.)
Pipe length  =   242.00(Ft.) Slope =   0.0302  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   128.014(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =   128.014(CFS)
Normal flow depth in pipe =   28.69(In.)
Flow top width inside pipe =   34.40(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.56(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =    11.44 min.
End of computations, total study area =          72.430 (Ac.)
```

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           San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 04/03/14
----------------------------------------------------------------------
Rosemary's Mountain
Phase 3
Proposed Conditions
100-Year Storm Event
----------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 4028

----------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  5.900
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  916.000(Ft.)
Highest elevation =  981.000(Ft.)
Lowest elevation =  592.000(Ft.)
Elevation difference =  389.000(Ft.) Slope = 42.467 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  42.47 %, in a development type of
 Permanent Open Space
```

```
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.13 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  42.470^(1/3)]=   4.13
The initial area total distance of  916.00 (Ft.) entered leaves a
remaining distance of  816.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.90 minutes
for a distance of 816.00 (Ft.) and a slope of 42.47 %
with an elevation difference of 346.56(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.896 Minutes
Tt=[(11.9*0.1545^3)/(346.56)]^.385=  1.90
Total initial area Ti =   4.13 minutes from Figure 3-3 formula plus
  1.90 minutes from the Figure 3-4 formula =   6.02 minutes
Rainfall intensity (I) =      8.178(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =     19.480(CFS)
Total initial stream area =        7.940(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       14.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   590.000(Ft.)
Downstream point elevation =   450.000(Ft.)
Channel length thru subarea  =  1159.000(Ft.)
Channel base width    =    2.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     30.452(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     30.452(CFS)
Depth of flow =   0.634(Ft.), Average velocity =  14.683(Ft/s)
Channel flow top width =    4.538(Ft.)
Flow Velocity =   14.68(Ft/s)
Travel time  =    1.32 min.
Time of concentration =    7.34 min.
Critical depth =      1.289(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      7.200(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.030
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.970
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.347
Rainfall intensity =      7.200(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
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(Q=KCIA) is C = 0.326  CA =      5.744
Subarea runoff =     21.878(CFS) for      9.690(Ac.)
Total runoff =     41.358(CFS)   Total area =      17.630(Ac.)
Depth of flow =   0.743(Ft.), Average velocity =  15.974(Ft/s)
Critical depth =      1.500(Ft.)


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Process from Point/Station       14.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   450.000(Ft.)
Downstream point elevation =   305.000(Ft.)
Channel length thru subarea  =  1056.000(Ft.)
Channel base width    =    2.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     42.244(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     42.244(CFS)
Depth of flow =   0.727(Ft.), Average velocity =  16.832(Ft/s)
Channel flow top width =    4.907(Ft.)
Flow Velocity =   16.83(Ft/s)
Travel time  =    1.05 min.
Time of concentration =    8.38 min.
Critical depth =      1.516(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.607(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.030
Decimal fraction soil group B = 0.800
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.170
[LOW DENSITY RESIDENTIAL                      ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.392
Rainfall intensity =      6.607(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.332  CA =      6.514
Subarea runoff =      1.677(CFS) for      1.960(Ac.)
Total runoff =     43.035(CFS)   Total area =      19.590(Ac.)
Depth of flow =   0.734(Ft.), Average velocity =  16.918(Ft/s)
Critical depth =      1.531(Ft.)


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Process from Point/Station       16.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   300.000(Ft.)
Downstream point/station elevation =   298.000(Ft.)
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Pipe length  =    60.00(Ft.) Slope =   0.0333  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    43.035(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    43.035(CFS)
Normal flow depth in pipe =   17.63(In.)
Flow top width inside pipe =   25.71(In.)
Critical Depth =   25.50(In.)
Pipe flow velocity =     15.65(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =     8.45 min.


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Process from Point/Station       18.000 to Point/Station       18.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      6.575(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.200
Decimal fraction soil group B = 0.600
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.200
[MEDIUM DENSITY RESIDENTIAL                  ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.516
Time of concentration =     8.45 min.
Rainfall intensity =      6.575(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.365  CA =      8.691
Subarea runoff =     14.106(CFS) for      4.220(Ac.)
Total runoff =     57.141(CFS)   Total area =      23.810(Ac.)


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Process from Point/Station       18.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   298.000(Ft.)
Downstream point/station elevation =   296.000(Ft.)
Pipe length  =    85.00(Ft.) Slope =   0.0235  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    57.141(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    57.141(CFS)
Normal flow depth in pipe =   22.41(In.)
Flow top width inside pipe =   26.09(In.)
Critical Depth =   28.46(In.)
Pipe flow velocity =     14.52(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     8.55 min.


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Process from Point/Station       18.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     23.810(Ac.)
Runoff from this stream =     57.141(CFS)
Time of concentration =    8.55 min.
Rainfall intensity =     6.526(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.250
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.750
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.325
Initial subarea total flow distance  =  875.000(Ft.)
Highest elevation =  687.400(Ft.)
Lowest elevation =  443.000(Ft.)
Elevation difference =  244.400(Ft.) Slope = 27.931 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.93 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.60 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3250)*( 100.000^.5)/(  27.931^(1/3)]=   4.60
The initial area total distance of  875.00 (Ft.) entered leaves a
remaining distance of  775.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.14 minutes
for a distance of 775.00 (Ft.) and a slope of 27.93 %
with an elevation difference of 216.47(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.141 Minutes
Tt=[(11.9*0.1468^3)/(216.47)]^.385=  2.14
Total initial area Ti =   4.60 minutes from Figure 3-3 formula plus
  2.14 minutes from the Figure 3-4 formula =   6.74 minutes
Rainfall intensity (I) =      7.607(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.325
Subarea runoff =     27.121(CFS)
Total initial stream area =       10.970(Ac.)


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Process from Point/Station       21.000 to Point/Station       22.000
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**** IMPROVED CHANNEL TRAVEL TIME ****
_____________________________________________________________________
Upstream point elevation =   443.000(Ft.)
Downstream point elevation =   318.000(Ft.)
Channel length thru subarea  =   911.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     32.561(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     32.561(CFS)
Depth of flow =   0.786(Ft.), Average velocity =  16.107(Ft/s)
Channel flow top width =    4.144(Ft.)
Flow Velocity =   16.11(Ft/s)
Travel time  =    0.94 min.
Time of concentration =    7.68 min.
Critical depth =      1.516(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.991(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.020
Decimal fraction soil group B = 0.880
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.100
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.259
Rainfall intensity =      6.991(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.299  CA =      5.427
Subarea runoff =     10.822(CFS) for      7.190(Ac.)
Total runoff =     37.943(CFS)   Total area =      18.160(Ac.)
Depth of flow =   0.843(Ft.), Average velocity =  16.750(Ft/s)
Critical depth =      1.625(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________
Upstream point/station elevation =   318.000(Ft.)
Downstream point/station elevation =   300.000(Ft.)
Pipe length  =   174.00(Ft.) Slope =   0.1034  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    37.943(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    37.943(CFS)
Normal flow depth in pipe =   13.50(In.)
Flow top width inside pipe =   20.12(In.)
Critical depth could not be calculated.
Pipe flow velocity =     23.22(Ft/s)
Travel time through pipe =    0.12 min.
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```
Time of concentration (TC) =     7.81 min.


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Process from Point/Station       22.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     18.160(Ac.)
Runoff from this stream =     37.943(CFS)
Time of concentration =    7.81 min.
Rainfall intensity =     6.919(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       57.141      8.55            6.526
2       37.943      7.81            6.919
Qmax(1) =
        1.000 *    1.000 *    57.141) +
        0.943 *    1.000 *    37.943) + =      92.933
Qmax(2) =
        1.000 *    0.913 *    57.141) +
        1.000 *    1.000 *    37.943) + =      90.140

Total of 2 streams to confluence:
Flow rates before confluence point:
      57.141      37.943
Maximum flow rates at confluence using above data:
       92.933       90.140
Area of streams before confluence:
       23.810       18.160
Results of confluence:
Total flow rate =     92.933(CFS)
Time of concentration =     8.546 min.
Effective stream area after confluence =     41.970(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   287.180(Ft.)
Downstream point/station elevation =   279.860(Ft.)
Pipe length  =   242.00(Ft.) Slope =   0.0302  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    92.933(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    92.933(CFS)
Normal flow depth in pipe =   24.38(In.)
Flow top width inside pipe =   33.67(In.)
```

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Critical depth could not be calculated.
Pipe flow velocity =     18.24(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     8.77 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       26.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     41.970(Ac.)
Runoff from this stream =     92.933(CFS)
Time of concentration =    8.77 min.
Rainfall intensity =     6.420(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =   83.000(Ft.)
Highest elevation =  760.000(Ft.)
Lowest elevation =  402.000(Ft.)
Elevation difference =  358.000(Ft.) Slope = 431.325 %
Top of Initial Area Slope adjusted by User to 89.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  89.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.43 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(  89.000^(1/3)]=   3.43
Calculated TC of    3.427 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      9.222(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      0.369(CFS)
Total initial stream area =        0.160(Ac.)
```

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Process from Point/Station       32.000 to Point/Station       34.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   402.000(Ft.)
Downstream point elevation =   304.000(Ft.)
Channel length thru subarea  =  1509.000(Ft.)
Channel base width    =   10.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     10.173(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     10.173(CFS)
Depth of flow =   0.221(Ft.), Average velocity =   4.499(Ft/s)
Channel flow top width =   10.442(Ft.)
Flow Velocity =    4.50(Ft/s)
Travel time  =    5.59 min.
Time of concentration =    9.02 min.
Critical depth =      0.316(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.304(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.600
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.400
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.290
Rainfall intensity =      6.304(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.289  CA =      3.155
Subarea runoff =     19.519(CFS) for     10.740(Ac.)
Total runoff =     19.888(CFS)   Total area =      10.900(Ac.)
Depth of flow =   0.331(Ft.), Average velocity =   5.815(Ft/s)
Critical depth =      0.488(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       34.000 to Point/Station       36.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   304.000(Ft.)
Downstream point elevation =   301.000(Ft.)
Channel length thru subarea  =   537.000(Ft.)
Channel base width    =   10.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     31.398(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.500(Ft.)
```

```
Flow(q) thru subarea =     31.398(CFS)
Depth of flow =   0.880(Ft.), Average velocity =   3.035(Ft/s)
Channel flow top width =   13.519(Ft.)
Flow Velocity =    3.04(Ft/s)
Travel time  =    2.95 min.
Time of concentration =   11.97 min.
Critical depth =      0.641(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.253(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.850
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.150
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.265
Rainfall intensity =      5.253(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.274  CA =      8.158
Subarea runoff =     22.963(CFS) for     18.880(Ac.)
Total runoff =     42.850(CFS)   Total area =      29.780(Ac.)
Depth of flow =   1.052(Ft.), Average velocity =   3.364(Ft/s)
Critical depth =      0.781(Ft.)


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Process from Point/Station       34.000 to Point/Station       36.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     29.780(Ac.)
Runoff from this stream =     42.850(CFS)
Time of concentration =   11.97 min.
Rainfall intensity =     5.253(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       92.933      8.77            6.420
2       42.850     11.97            5.253
Qmax(1) =
        1.000 *    1.000 *    92.933) +
        1.000 *    0.733 *    42.850) + =     124.329
Qmax(2) =
        0.818 *    1.000 *    92.933) +
        1.000 *    1.000 *    42.850) + =     118.891

Total of 2 main streams to confluence:
```

```
Flow rates before confluence point:
      92.933      42.850
Maximum flow rates at confluence using above data:
      124.329      118.891
Area of streams before confluence:
       41.970       29.780


Results of confluence:
Total flow rate =    124.329(CFS)
Time of concentration =     8.767 min.
Effective stream area after confluence  =     71.750(Ac.)
End of computations, total study area =          71.750 (Ac.)
```

APPENDIX B

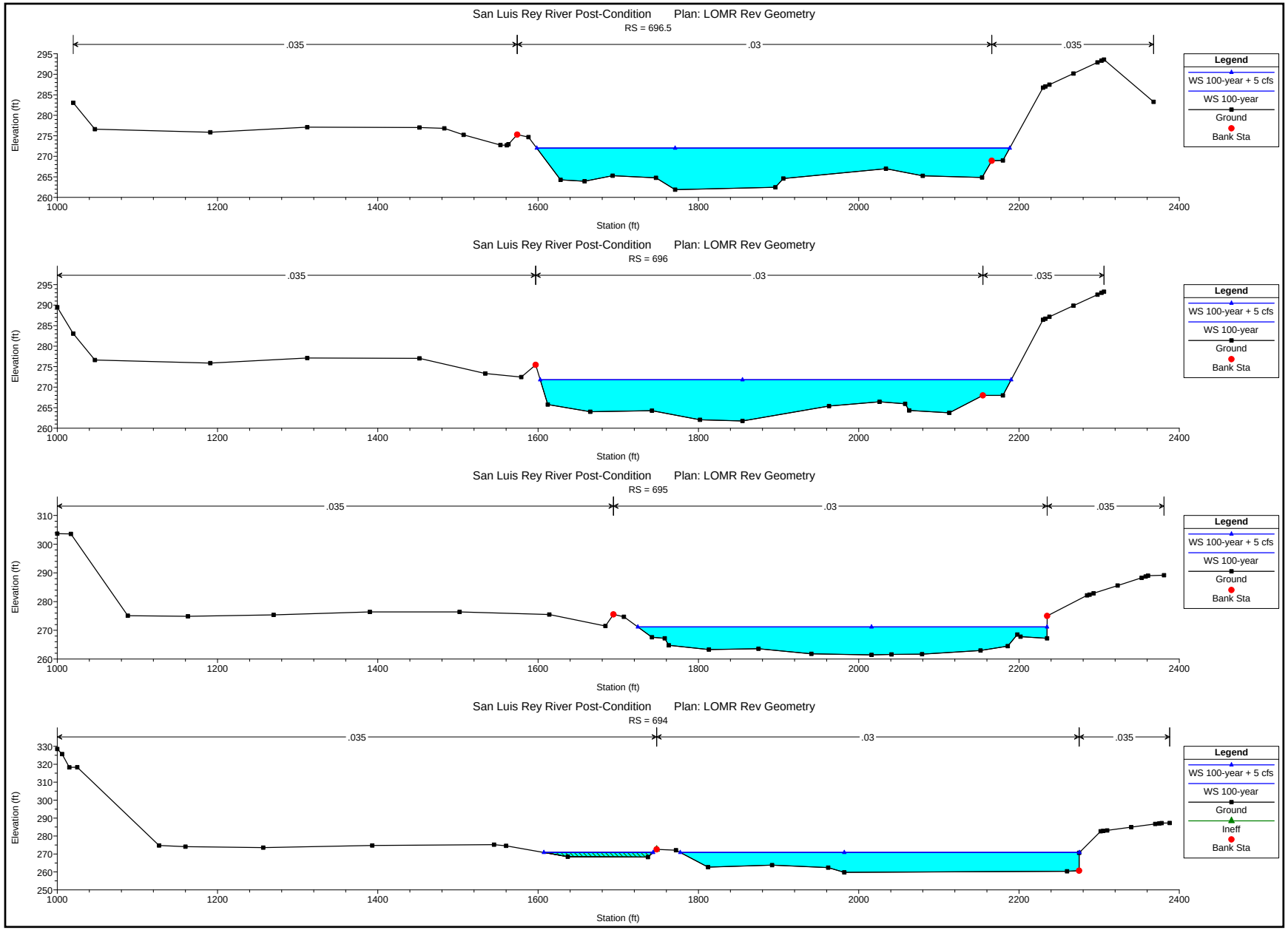
HEC-RAS ANALYSES

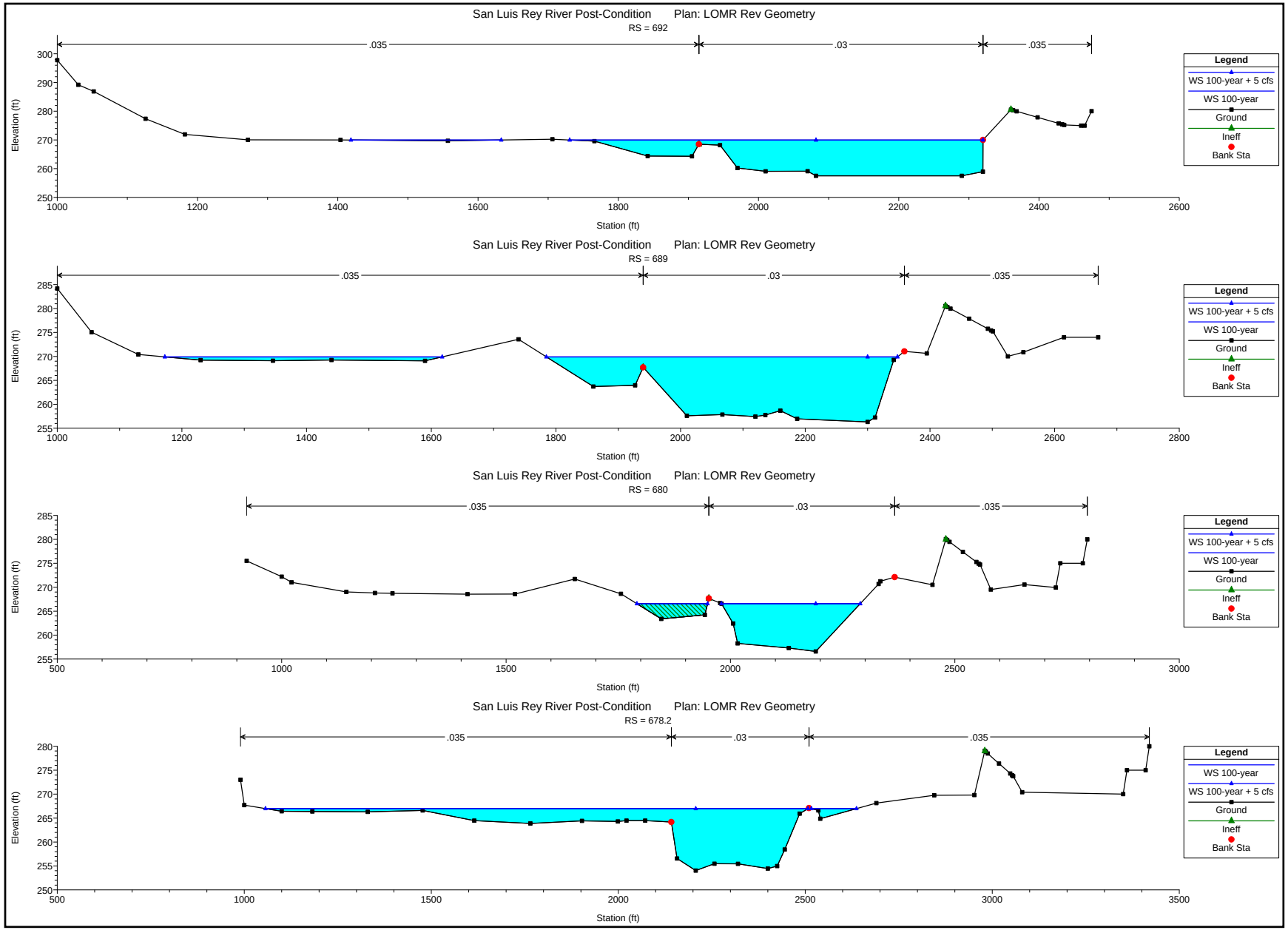
HEC-RAS Plan: Rev River: San Luis Reach: 1

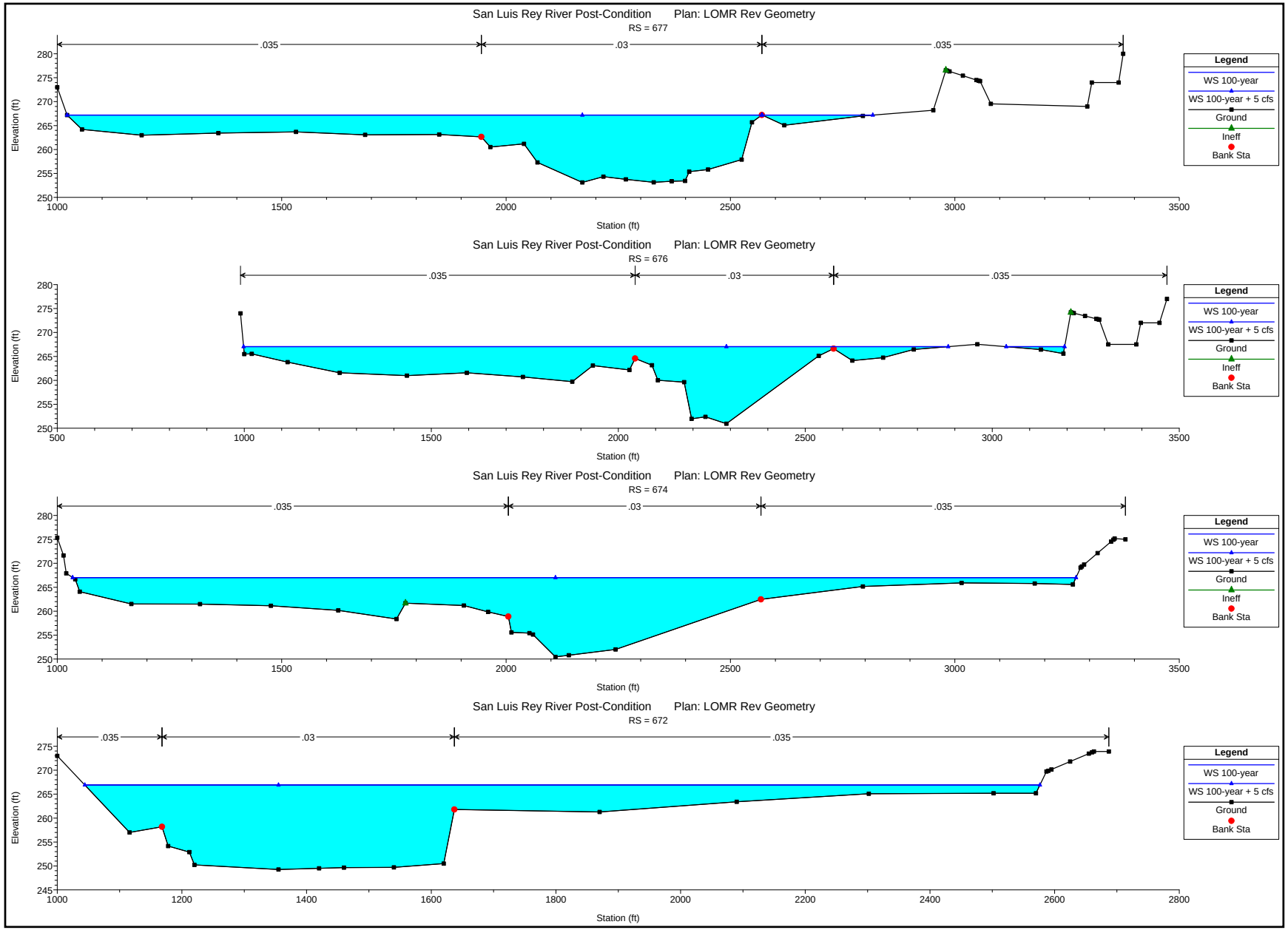
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	696.5	100-year	33000.00	261.87	272.02		272.98	0.0018	7.88	4220	590	0.51
1	696.5	100-year + 5 cfs	33005.00	261.87	272.02		272.98	0.0018	7.88	4220	590	0.51
1	696	100-year	33000.00	261.77	271.80		272.75	0.0017	7.87	4251	588	0.51
1	696	100-year + 5 cfs	33005.00	261.77	271.80		272.75	0.0017	7.87	4251	588	0.51
1	695	100-year	33000.00	261.45	271.16		272.26	0.0019	8.43	3913	511	0.54
1	695	100-year + 5 cfs	33005.00	261.45	271.16		272.26	0.0019	8.43	3914	511	0.54
1	694	100-year	33000.00	259.78	270.81	266.54	271.60	0.0011	7.14	4621	634	0.41
1	694	100-year + 5 cfs	33005.00	259.78	270.81	266.53	271.60	0.0011	7.14	4621	634	0.41
1	692	100-year	33000.00	257.49	269.97	264.61	270.73	0.0009	7.18	4998	804	0.39
1	692	100-year + 5 cfs	33005.00	257.49	269.97	264.61	270.73	0.0009	7.18	4998	804	0.39
1	689	100-year	33000.00	256.31	269.90	264.24	270.56	0.0008	6.76	5504	1008	0.36
1	689	100-year + 5 cfs	33005.00	256.31	269.90	264.24	270.56	0.0008	6.77	5504	1008	0.36
1	680	100-year	33000.00	256.58	266.55	266.55	270.09	0.0069	15.10	2186	466	1.00
1	680	100-year + 5 cfs	33005.00	256.58	266.55	266.55	270.09	0.0069	15.08	2188	467	1.00
1	678.2	100-year	33000.00	254.02	266.97		267.82	0.0012	7.84	5676	1571	0.43
1	678.2	100-year + 5 cfs	33005.00	254.02	266.97		267.82	0.0012	7.84	5674	1571	0.43
1	677	100-year	33000.00	253.12	267.19		267.40	0.0003	4.02	10412	1794	0.22
1	677	100-year + 5 cfs	33005.00	253.12	267.19		267.40	0.0003	4.02	10411	1794	0.22
1	676	100-year	33000.00	250.95	267.03		267.22	0.0004	4.11	10571	2040	0.24
1	676	100-year + 5 cfs	33005.00	250.95	267.03		267.22	0.0004	4.11	10570	2040	0.25
1	674	100-year	33000.00	250.45	267.02	259.50	267.15	0.0002	3.26	13779	2236	0.17
1	674	100-year + 5 cfs	33005.00	250.45	267.02	259.51	267.15	0.0002	3.26	13778	2236	0.17
1	672	100-year	33000.00	249.25	266.91		267.08	0.0001	3.60	11887	1532	0.16
1	672	100-year + 5 cfs	33005.00	249.25	266.91		267.08	0.0001	3.60	11886	1532	0.16
1	670	100-year	33000.00	248.00	265.97	263.18	266.84	0.0009	8.77	6344	1385	0.39
1	670	100-year + 5 cfs	33005.00	248.00	265.96	263.18	266.84	0.0009	8.77	6342	1385	0.39

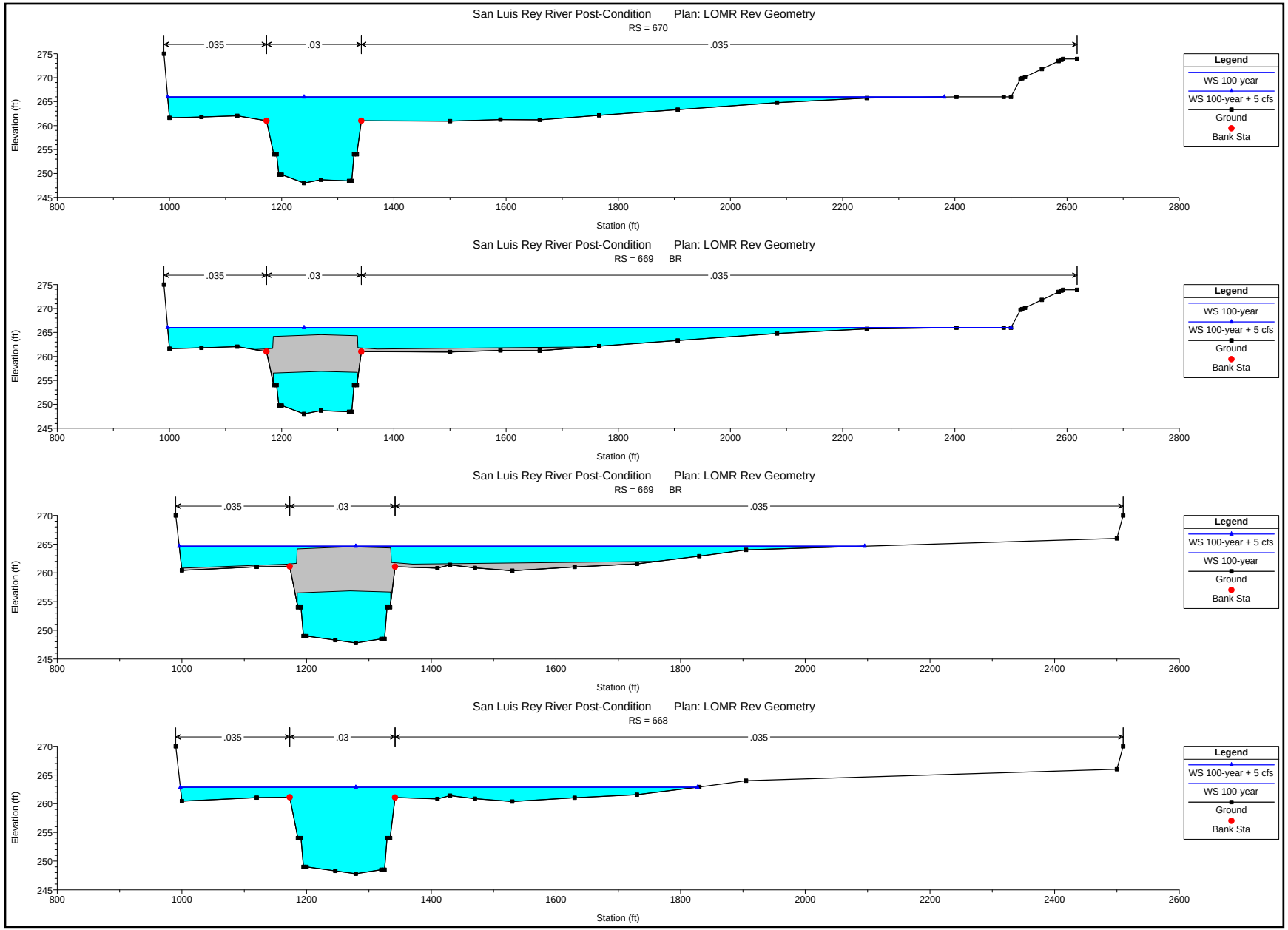
HEC-RAS Plan: Rev River: San Luis Reach: 1 (Continued)

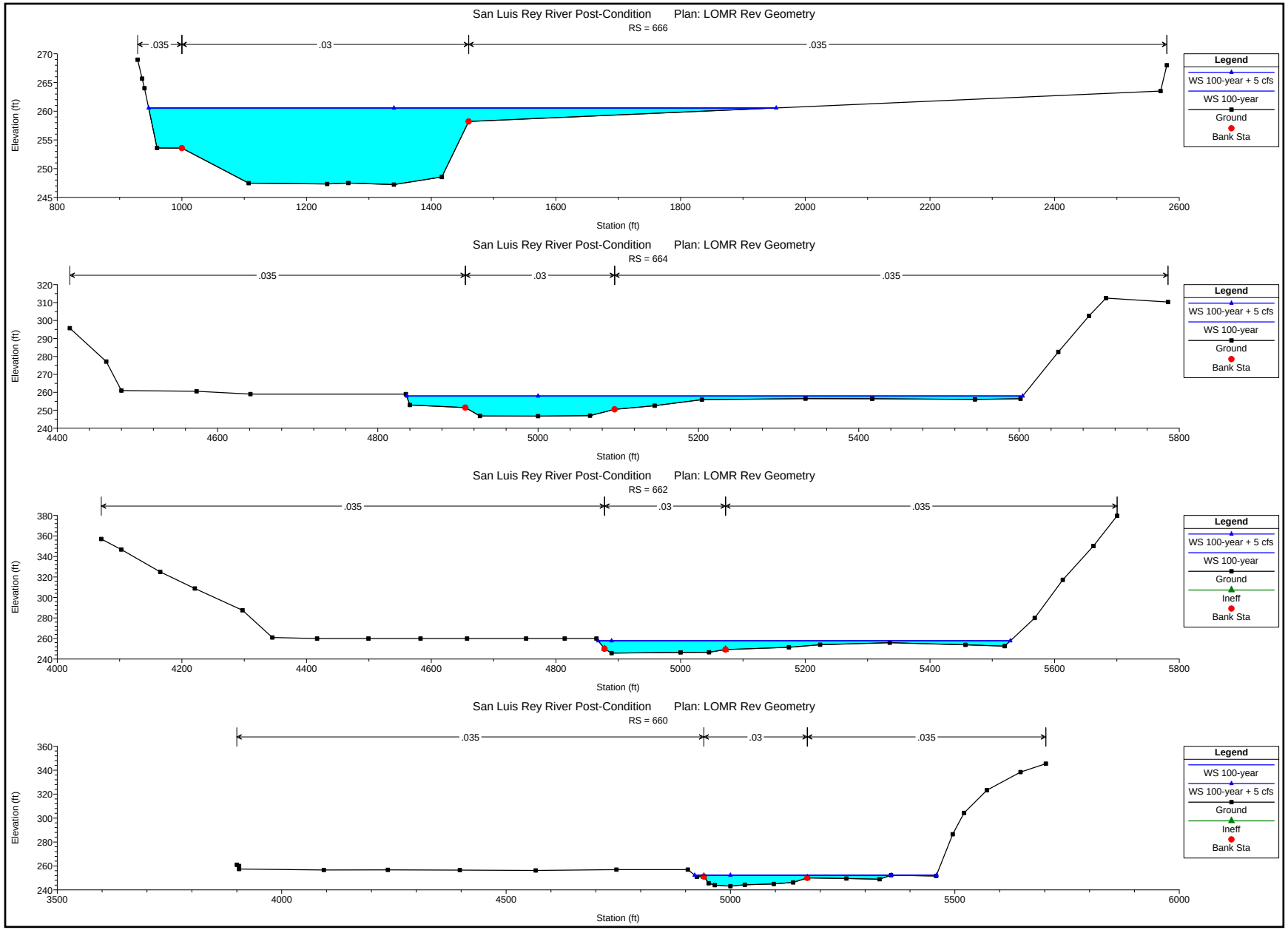
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	669		Bridge									
1	668	100-year	33000.00	247.80	262.87	262.87	265.38	0.0026	13.45	3339	829	0.66
1	668	100-year + 5 cfs	33005.00	247.80	262.87	262.87	265.38	0.0026	13.45	3340	830	0.66
1	666	100-year	33000.00	247.22	260.57		261.06	0.0005	5.77	6336	1007	0.30
1	666	100-year + 5 cfs	33005.00	247.22	260.57		261.06	0.0005	5.78	6336	1007	0.30
1	664	100-year	33000.00	246.70	257.94	257.74	259.98	0.0029	12.78	3595	769	0.69
1	664	100-year + 5 cfs	33005.00	246.70	257.94	255.89	259.98	0.0029	12.78	3596	769	0.69
1	662	100-year	33000.00	245.80	257.77	256.38	259.12	0.0019	10.67	4195	661	0.56
1	662	100-year + 5 cfs	33005.00	245.80	257.77	256.38	259.12	0.0019	10.67	4196	661	0.56
1	660	100-year	33000.00	243.10	252.30	252.30	256.61	0.0093	17.59	2200	538	1.16
1	660	100-year + 5 cfs	33005.00	243.10	252.30	252.30	256.62	0.0093	17.59	2200	538	1.16
1	658	100-year	33000.00	237.60	252.64	247.83	252.98	0.0005	5.79	10257	2585	0.28
1	658	100-year + 5 cfs	33005.00	237.60	252.64	247.83	252.98	0.0005	5.79	10258	2585	0.28
1	656	100-year	33000.00	236.60	252.40	248.41	252.76	0.0006	6.37	9564	2256	0.32
1	656	100-year + 5 cfs	33005.00	236.60	252.40	248.41	252.76	0.0006	6.37	9565	2256	0.32
1	654	100-year	33000.00	236.30	252.35	246.45	252.58	0.0003	4.70	10990	2498	0.23
1	654	100-year + 5 cfs	33005.00	236.30	252.35	246.45	252.58	0.0003	4.70	10990	2498	0.23

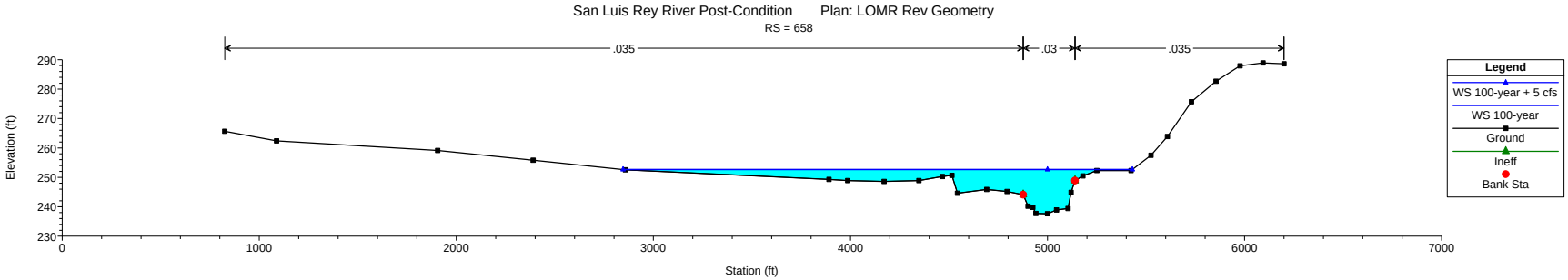

San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 696.5
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 696
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 695
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 694
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Ineff
Bank Sta

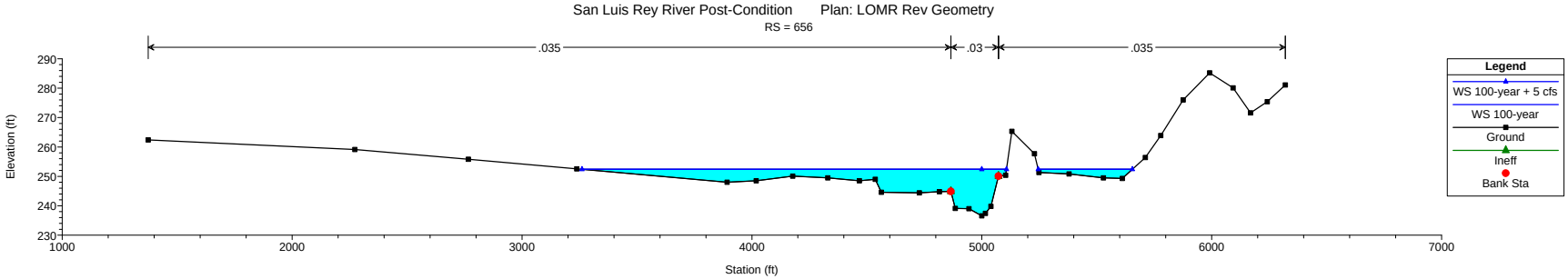

San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 692
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Ineff
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 689
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Ineff
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 680
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Ineff
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 678.2
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Ineff
Bank Sta

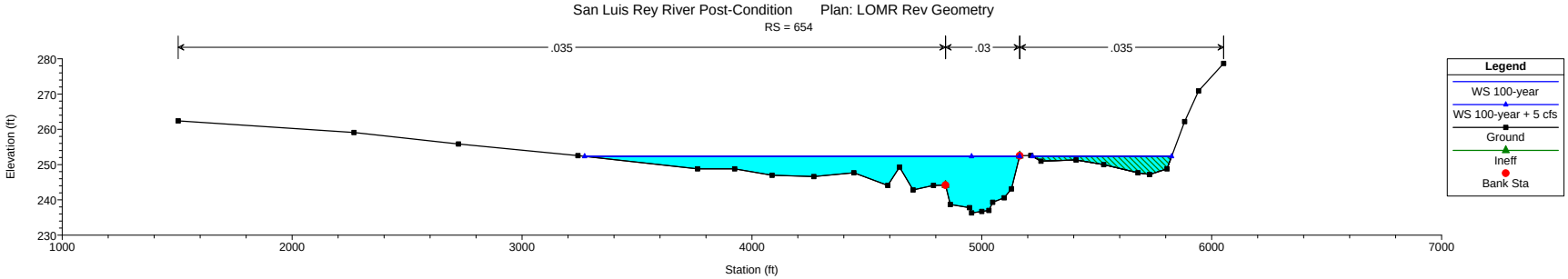

San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 677
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Ineff
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 676
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Ineff
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 674
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Ineff
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 672
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Bank Sta


San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 670
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 669 BR
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 669 BR
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 668
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Bank Sta


San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 666
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 664
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 662
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Ineff
Bank Sta
San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 660
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Ineff
Bank Sta


San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 658
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Ineff
Bank Sta

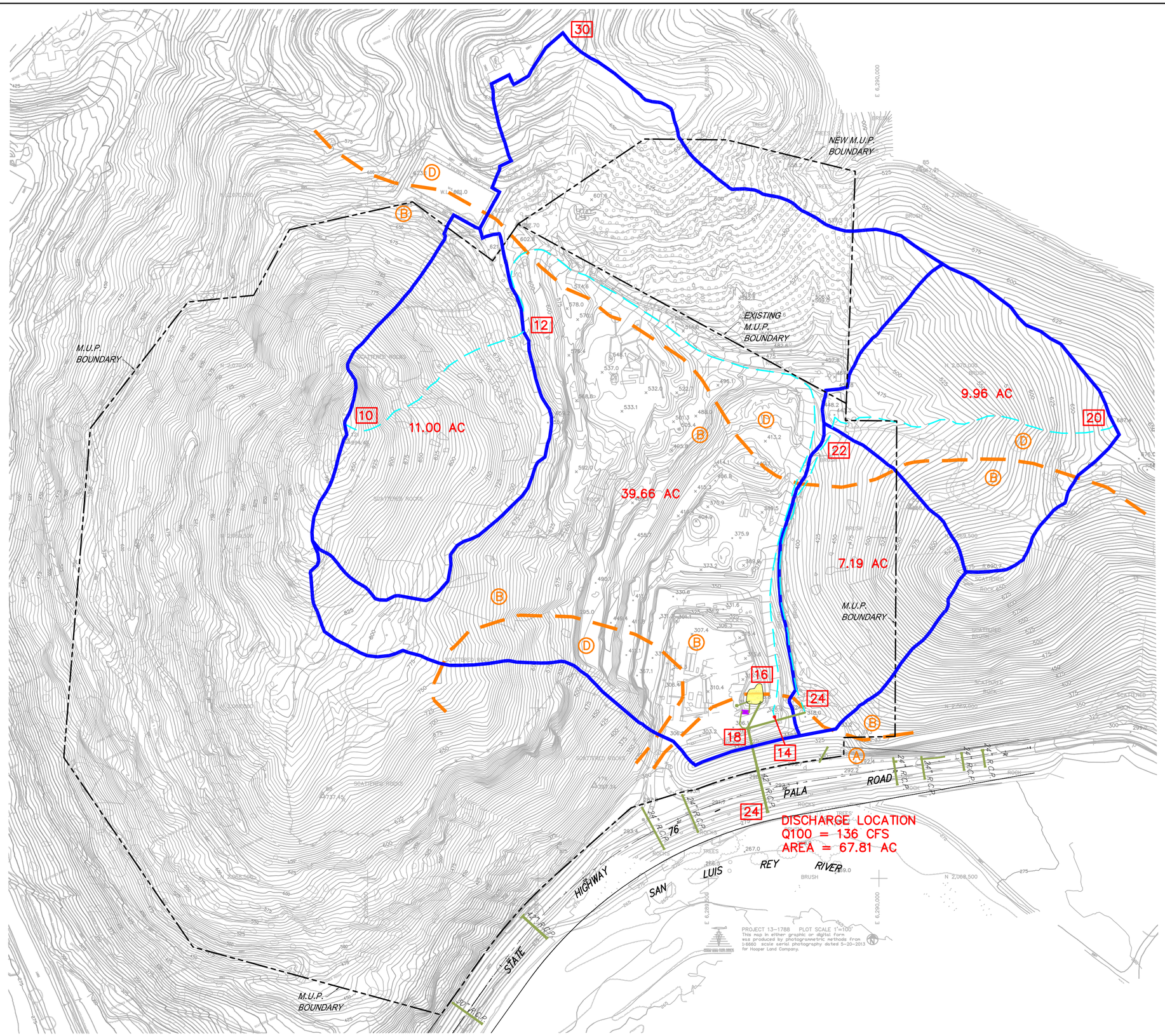

San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 656
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year + 5 cfs
WS 100-year
Ground
Ineff
Bank Sta


San Luis Rey River Post-Condition Plan: LOMR Rev Geometry
RS = 654
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 100-year + 5 cfs
Ground
Ineff
Bank Sta

GRAPHIC SCALE

200 0 100 200 400

1 INCH = 200 FEET



LEGEND:

- M.U.P. BOUNDARY
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- D HYDROLOGIC SOIL GROUP
- EXISTING STORM DRAIN (SIZE PER PLAN)
- EXISTING WATER QUALITY BASIN
- EXISTING STORMWATER FILTER

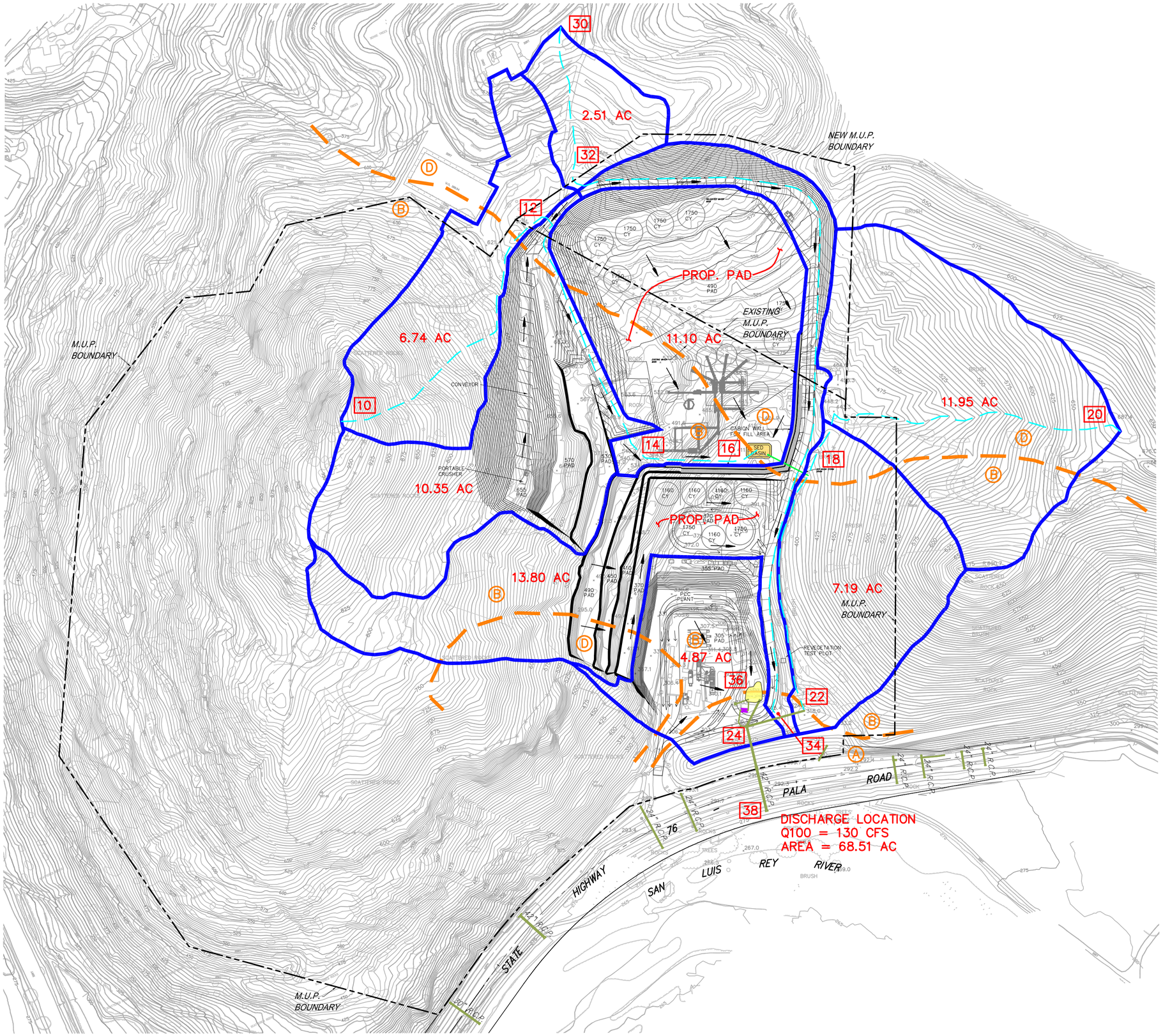
ROSEMARY'S MOUNTAIN CURRENT CONDITIONS

RATIONAL METHOD WORK MAP

GRAPHIC SCALE

200 0 100 200 400

1 INCH = 200 FEET



LEGEND:

- M.U.P. BOUNDARY
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- D HYDROLOGIC SOIL GROUP
- PROPOSED FLOW DIRECTION
- EXISTING STORM DRAIN (SIZE PER PLAN)
- PROPOSED STORM DRAIN (24" HDPE)
- EXISTING WATER QUALITY BASIN
- PROPOSED WATER QUALITY BASIN
- EXISTING STORMWATER FILTER

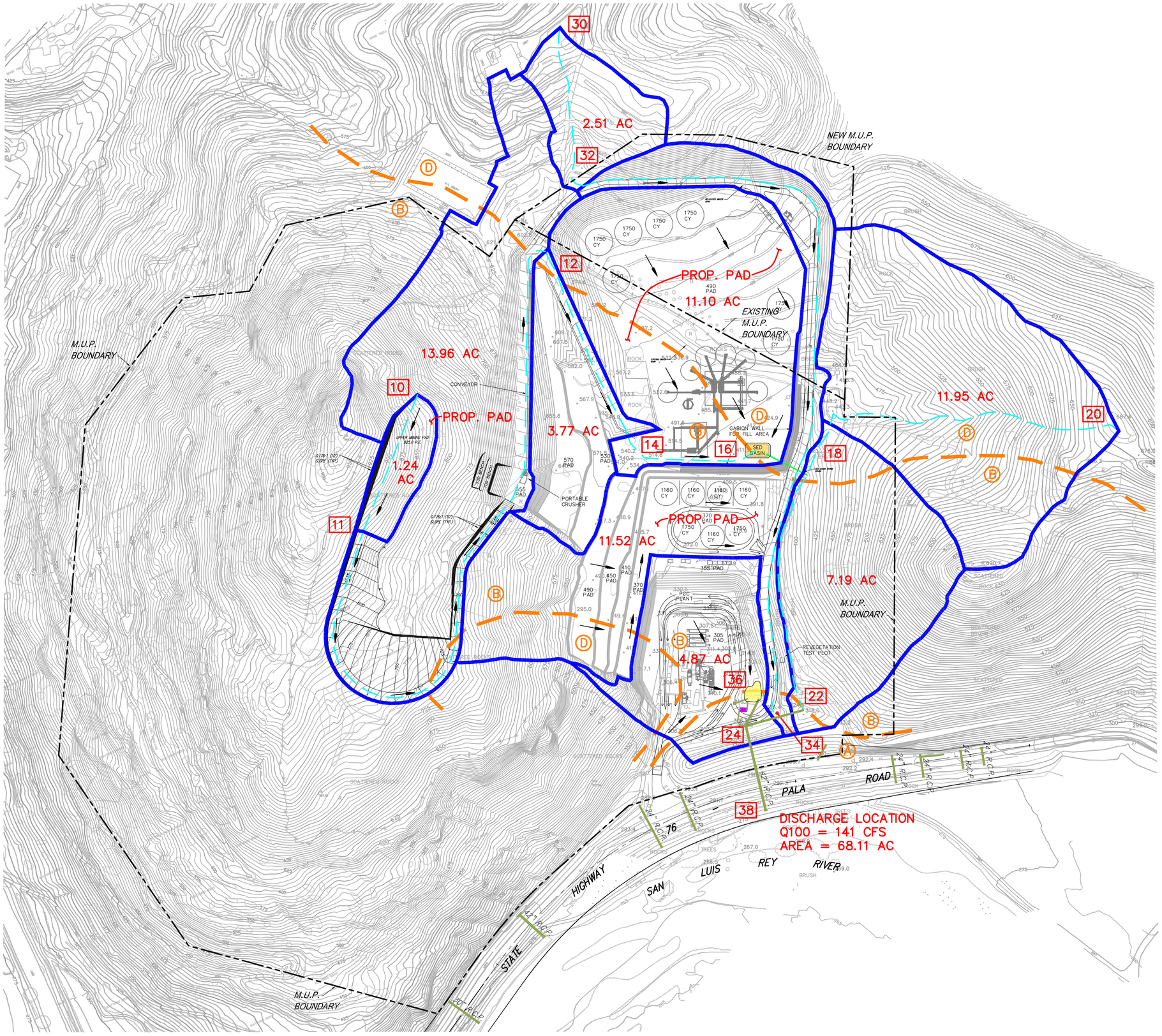
ROSEMARY'S MOUNTAIN SITE PREPARATION PHASE

RATIONAL METHOD WORK MAP

GRAPHIC SCALE

200 0 100 200 400

1 INCH = 200 FEET



LEGEND:

- M.U.P. BOUNDARY
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- (D) HYDROLOGIC SOIL GROUP
- PROPOSED FLOW DIRECTION
- EXISTING STORM DRAIN (SIZE PER PLAN)
- PROPOSED STORM DRAIN (24" HDPE)
- EXISTING WATER QUALITY BASIN
- PROPOSED WATER QUALITY BASIN
- EXISTING STORMWATER FILTER

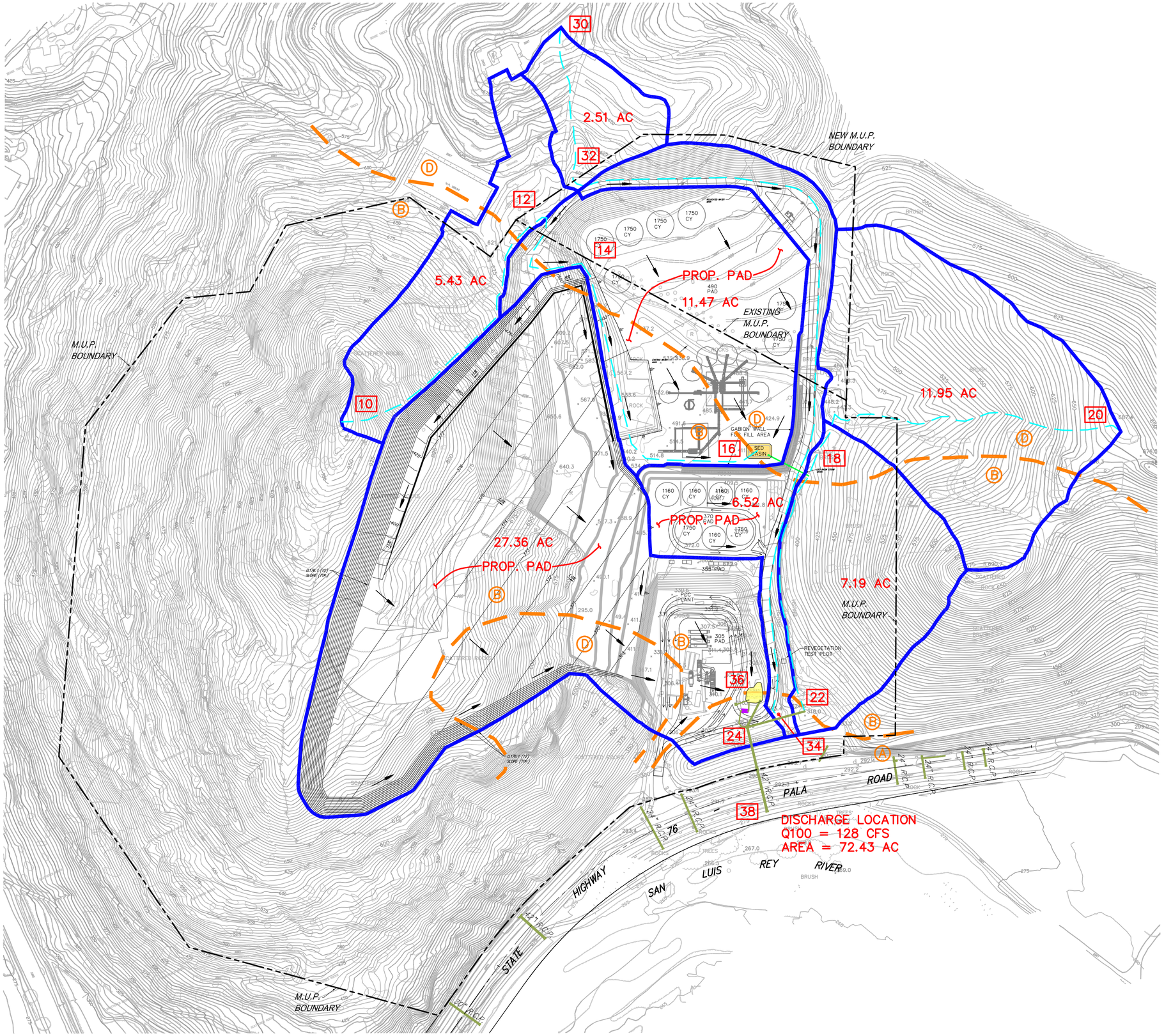
ROSEMARY'S MOUNTAIN PHASE 1

RATIONAL METHOD WORK MAP

GRAPHIC SCALE

200 0 100 200 400

1 INCH = 200 FEET



LEGEND:

- M.U.P. BOUNDARY
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- D HYDROLOGIC SOIL GROUP
- PROPOSED FLOW DIRECTION
- EXISTING STORM DRAIN (SIZE PER PLAN)
- PROPOSED STORM DRAIN (24" HDPE)
- EXISTING WATER QUALITY BASIN
- PROPOSED WATER QUALITY BASIN
- EXISTING STORMWATER FILTER

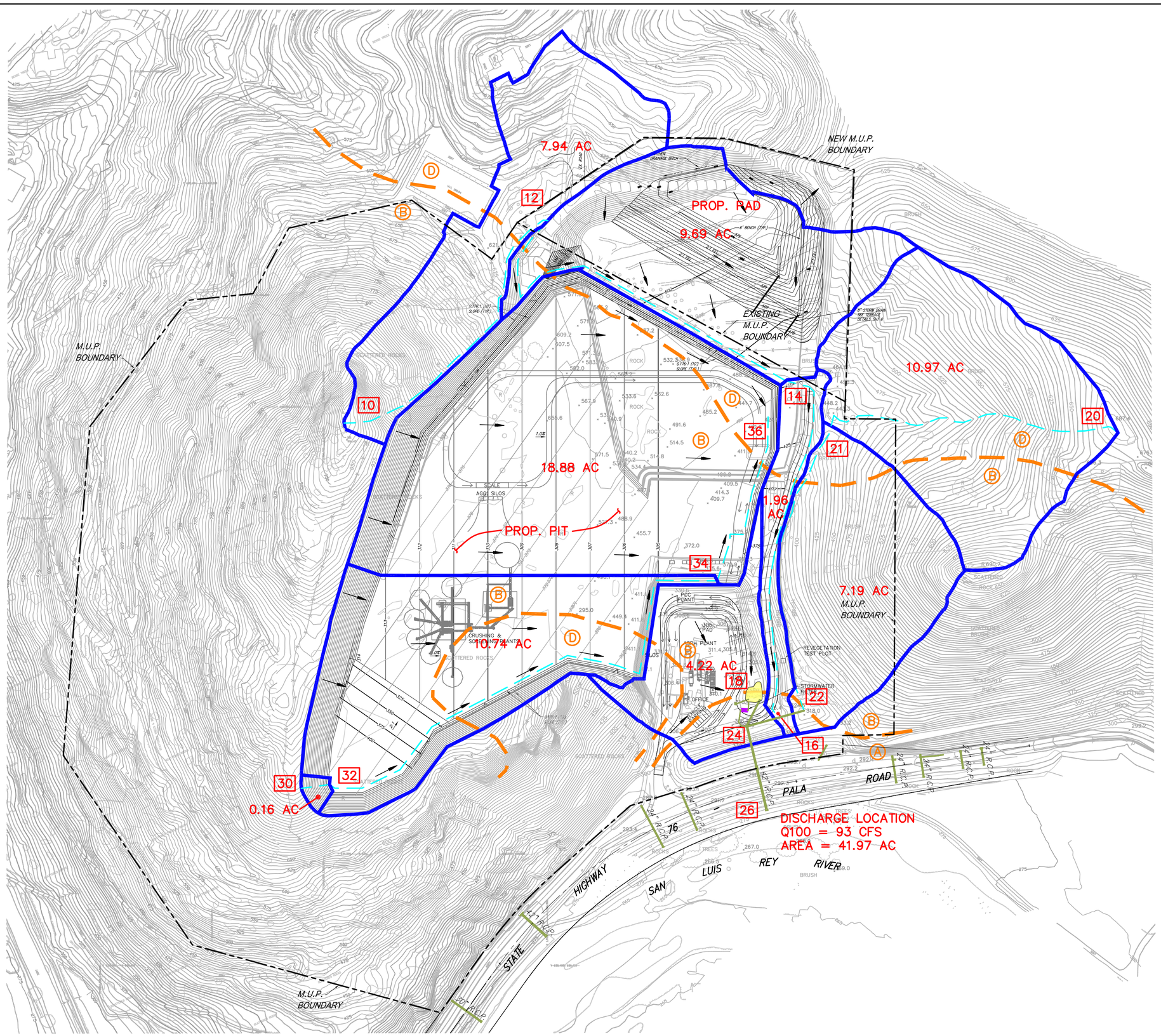
ROSEMARY'S MOUNTAIN PHASE 2

RATIONAL METHOD WORK MAP

GRAPHIC SCALE

200 0 100 200 400

1 INCH = 200 FEET

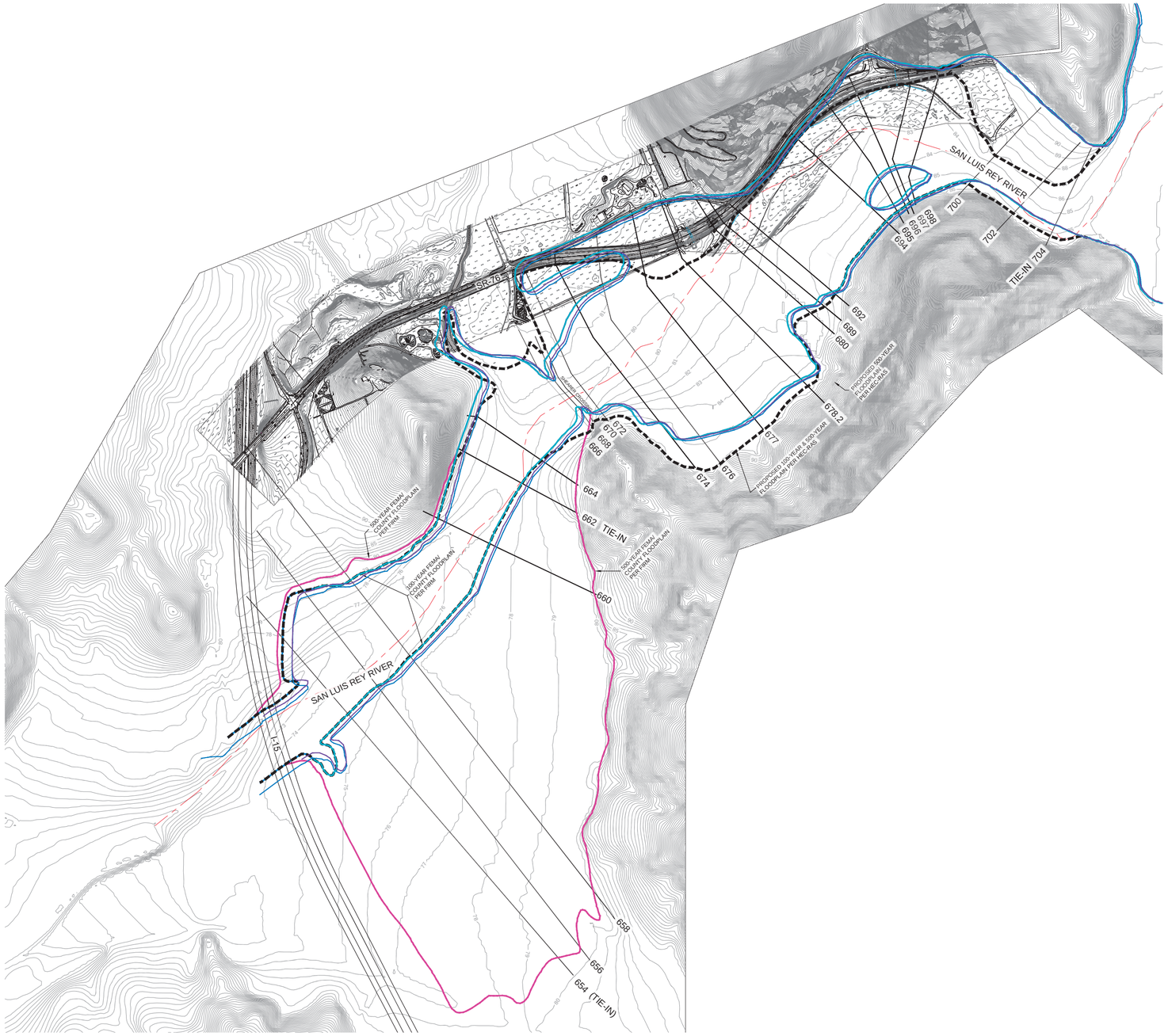


LEGEND:

- M.U.P. BOUNDARY
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- D HYDROLOGIC SOIL GROUP
- PROPOSED FLOW DIRECTION
- EXISTING STORM DRAIN (SIZE PER PLAN)
- EXISTING WATER QUALITY BASIN
- EXISTING STORMWATER FILTER

ROSEMARY'S MOUNTAIN PHASE 3

RATIONAL METHOD WORK MAP



LEGEND

RIVER CENTERLINE	
100-YR FLOODPLAIN LIMITS PER HEC-RAS	
100-YR FLOODPLAIN LIMITS (EFFECTIVE)	
500-YR FLOODPLAIN LIMITS PER HEC-RAS	
500-YR FLOODPLAIN LIMITS (EFFECTIVE)	
100-YR PROPOSED FLOODPLAIN LIMITS	
HEC-RAS CROSS-SECTION	
HEC-RAS CROSS-SECTION I.D.	704

NOTE: FLOODPLAIN DELINEATIONS DO NOT REFLECT THE GROUND DATA FROM THE SAN DIEGO COUNTY TOPOGRAPHY MAPS. THE HEC-RAS FLOODPLAIN RESULTS REFLECT THE GEOMETRY FROM THE DETAILED CROSS-SECTION SURVEY CONDUCTED IN APRIL 2004 AND THE AS-BUILT SURVEY DATA FOR STATE ROUTE 76.

FEMA LETTER OF MAP REVISION
SR-76 WIDENING AND REALIGNMENT
FROM I-15 TO 3.9 KM EAST, SAN DIEGO COUNTY

URS

250 0 250 500 FEET
SCALE: 1"= 500' (NGVD 1929)

CHECKED BY:
DATE: 03-08-12
PM: MM
PROJ. NO: 27683001.04300
FIG. NO: A