HYDROLOGY AND HYDRAULICS REPORT

Prepared For:

Riviera Village Association

1799 South Catalina Ave Unit RVA
Redondo Beach, CA 90277
Attn: Allen Sanford
310-376-8077

Site Address:

Riviera Village Area

Redondo Beach, CA 90277

Report Prepared By:

DSC ENGINEERING
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DSC Project No. 01050-20001

Revision 3
Date: 10/15/2020

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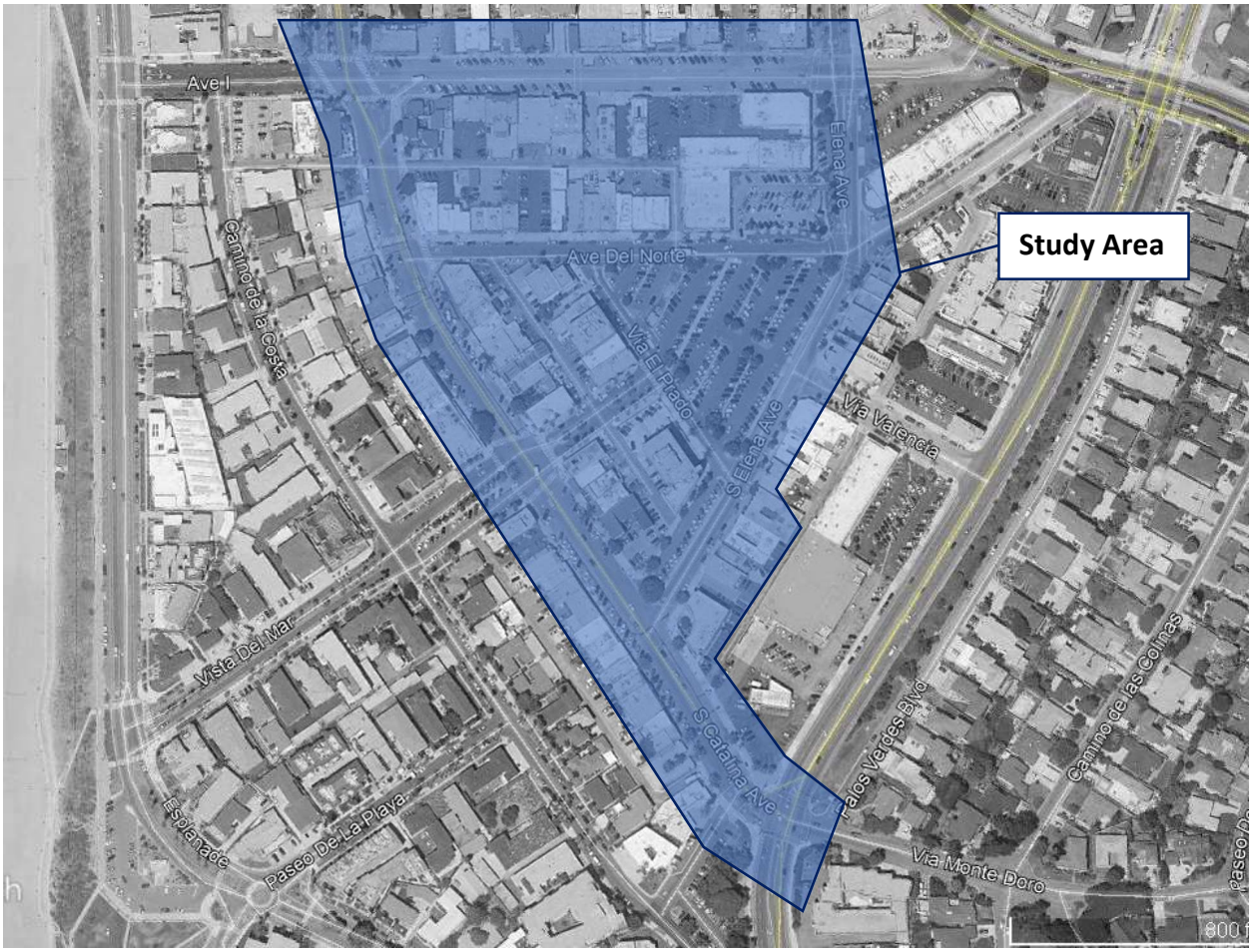
Appendices

1.0 INTRODUCTION

The purpose of this report is to provide hydrologic and hydraulic calculations for the Riviera Village area within Redondo Beach for existing and planned parklet areas. These parklet areas are used as outdoor dining and seating areas for adjacent businesses and restaurants in order to comply with COVID-19 restrictions. The City of Redondo Beach has requested a hydrology and hydraulics study be performed to analyze the impact of these parklet facilities on the hydraulic capacity of the street, curb, and gutter to carry the required storm event flows. The existing parklets are constructed of wood and steel framed decks surrounded by K-Rails for vehicle crash protection. The parklets are constructed in parking areas within the street.

2.0 LOCATION

The project location and study area is the Riviera Village area within the City of Redondo Beach. This area is bounded by Avenue I to the North, Pacific Coast Highway and Palos Verdes Boulevard to the east, and Catalina Avenue to the west and south. The study area is shown below and on the Hydrology Map in Appendix B.



Aerial Map (Google Earth)

3.0 METHODOLOGY

Runoff rates were determined based on the Los Angeles County Hydrology Manual. The City of Redondo Beach uses the 25 Year storm event as their required level of protection for permanent structures. The parklets are temporary facilities to accommodate COVID-19 restrictions and are not planned to be in place longer than one wet season. Therefore, higher frequency storm events were also analyzed to more closely reflect a storm event that would more likely happen during any single wet season. The two storms that were selected were the 85th Percentile Storm Event and the 2-Year storm event. The 85th Percentile Storm Event is used to size Low Impact Development facilities throughout Los Angeles County and represents rainfall depths that 85 percent of storms fall within. The 2-Year storm event corresponds to a storm that would occur approximately every 2 years with a 90% level of confidence.

The following table shows the corresponding isohyetal rainfall depth for each of the analyzed storm events. The values were obtained from the Los Angeles County Hydrology Manual and LA County GIS Maps and are also included in Appendix B of this report:

Storm Event	Isohyet (in.)
50 Year	5.05
25 Year	4.42
2 Year	2.28
85th Percentile	0.60

4.0 DRAINAGE AREAS

Drainage areas were defined for the Riviera Village area using several methods. First, a preliminary hydrology map was created using information obtained from available Los Angeles County GIS and Google Earth topographic data. This map was then field verified on September 2, 2020. During the field verification, existing slopes of streets, curbs and gutters were measured using a 4' digital level. Existing storm drain catch basins were inventoried along with their slopes, widths, local depressions, and other pertinent characteristics. In addition, record street and storm drain plans provided by the City of Redondo Beach and those found on the LA County Record Plan website were used to verify the watershed boundaries and flow patterns. A final hydrology map was then prepared for use in the hydrologic calculations.

The drainage area contributing to the Riviera Village area is fairly complex as numerous flow-by catch basins partially intercept flows from the Hollywood Riviera area, City of Torrance, and extending down Palos Verdes Boulevard to the south. In general, runoff is towards the west towards the Pacific Ocean. Within the Riviera Village area, flows concentrate at a sump at the intersection of Vista Del Mar and Catalina Avenue where a total of seven catch basins are located. A more detailed description of the various watersheds and their contribution to the Riviera Village area is below:

Pacific Coast Highway: Pacific Coast Highway (PCH) runs south and then towards the southeast at the northern boundary of the Riviera Village. PCH is a crowned multi-laned urban roadway. The west side of PCH contributes to the Riviera Village watershed. A high point is located approximately at Avenue G with flows on the west side of PCH flowing south from this point down Elena Avenue and onto Avenue I. PCH to the east of Palos Verdes Boulevard also slopes towards the Riviera Village area. The southern half of the street section specifically has a flow path towards Avenue I. Several large flow-by catch basins were found east of Palos Verdes Boulevard. In total, two 21 foot flow-by catch basins located east of Paseo De Las Delicias and two 14 foot flow-by catch basins west of Camino De Las Colinas intercept flow within PCH. In addition, flow from PCH is intercepted by 10' and 8' long catch basins in localized sumps at Avenue I east of Elena Avenue. These numerous catch basins were found to intercept nearly all flow that would be possible running down PCH into the Riviera Village area. These flows from the eastern portion of PCH were ignored as part of the overall contributing watershed for the study.

Palos Verdes Boulevard: A large drainage area exists along the southern portion of Palos Verdes Boulevard extending south and east through the Cities of Torrance and to Palos Verdes Estates. Numerous flow-by catch basins exist within this drainage area that partially intercept flows. Flows not intercepted by the local storm drain catch basins are routed to Palos Verdes Boulevard where they flow towards the north and Catalina Avenue. Palos Verdes Boulevard is a crowned roadway section south of Catalina Avenue. Between Catalina Avenue and PCH, Palos Verdes Boulevard is superelevated to the west, forcing all flows on the north side gutter towards the west. The large flows within Palos Verdes Boulevard south of Catalina Avenue are directed down the south half of Catalina Avenue. These flows are partially intercepted by a 14' flow-by catch basin located on the southwest corner of Catalina Avenue and Palos Verdes Boulevard. To estimate the flows and drainage area along Palos Verdes Boulevard, a watershed extending south towards Calle Miramar was used.

5.0 HYROLOGIC CALCULATIONS

Storm volumes and peak flow rates for the 25 year, 2 year and 85th percentile storm event were generated using the Los Angeles County HydroCalc v1.0.3 Calculator. The calculator was developed by the Los Angeles County Public Works Department based on the Modified Rational Method as shown in the Los Angeles County Hydrology Manual. The Calculator is available for use by the public. A copy of the HydroCalc output results are included in Appendix C of this report.

Inputs for the HydroCalc program were determined from the Los Angeles County Hydrology Manual and associated tables and figures. A copy of which has been included in Appendix B of this report. Tributary areas were determined based on Drainage Areas as described in the previous sections. Flow Lengths, elevations, and percentages of impervious surfaces were developed from available information including LA County GIS Data, Google Earth and field measured data. A summary of the HydroCalc results are included in the following table:

		Peak Flow Rate (cfs)		
Subarea	**Area (acres)**	**25-yr**	**2-yr**	**85th Percentile**
A1	1.73	2.44	0.78	0.17
A2	1.96	2.77	0.91	0.19
B1	1.9	2.58	0.84	0.18
B2	4.92	7.23	2.32	0.48
B3	0.67	1.28	0.40	0.09
C1	1.29	1.98	0.62	0.13
D1	5.12	8.23	2.66	0.56
E1	7.45	9.20	2.62	0.55
E2	5.08	8.16	2.63	0.54
E3	4.55	7.51	2.15	0.45
E4	5.71	10.24	3.22	0.67
E5	0.55	1.25	0.40	0.08
F1	28.52	30.11	8.89	1.88
F2	1.23	1.98	0.64	0.13

6.0 HYRAULIC CALCULATIONS

The existing parklets cut-off flow that would typically be contained within the curb and gutter portion of the street. Hydraulic calculations were performed to determine the required hydraulic conduit sizes to be installed adjacent to the curb face to pass the required flows under the wood framed parklet areas. Hydraulic calculations were performed in Bentley FlowMaster version 10.03.00.03 for the sizing of the hydraulic conduits and to also determine the flows intercepted at various catch basins within the watershed. Hydraulic Calculations are included in Appendix D. Hydraulic Calculations were performed for the 85th percentile and 2 year storm events to determine the required hydraulic conduits required for the parklets. Parklets should be designed to accommodate the 2 year storm event sizing at a minimum. Larger storm events require the un-impeded curb and gutter sections to be utilized to convey storm flows. A summary of the required conduit sizes are included in the table below:

	Conduit Sizes	
Location	**2 Year Storm Event**	**85th Percentile Storm Event**
Avenue I	6” Height x6” Width	6” Height x6” Width
Catalina Avenue, West Side North of Vista Del Mar	6” Height x6” Width	6” Height x6” Width
Catalina Avenue, East Side North of Vista Del Mar	6” Height x14” Width	6” Height x6” Width
Catalina Avenue, West Side South of Vista Del Mar	6” Height x16” Width	6” Height x6” Width
Catalina Avenue, East Side South of Vista Del Mar	6” Height x30” Width	6” Height x6” Width

The City of Redondo Beach provided a threshold of 3 ft/sec for the velocity for flows within the street and gutter section. In addition, the conduit sizes listed above would need to meet this velocity threshold at the outlet. Based on the hydraulic calculations, several street flow sections exceed this 3 ft/sec criteria regardless of the impact of the parklet construction. The addition of the parklet conduits further constrain flow and raise velocities approximately 1 ft/sec in some areas. Flow velocity dissipaters in the form of gravel bags near the outlet of the parklet conduits can be placed to reduce the impact of these velocities during larger storm events. However, the placement of these flow dissipaters would increase the overall flood elevations and may lead to the potential for additional flooding. Therefore, since the overall flow velocities do not significantly exceed 3 ft/sec and the flow is contained within the street section, velocity dissipaters are not recommended for outlet conditions.

7.0 CONCLUSION AND RECOMMENDATIONS

The existing parklet construction impacts the hydraulic carrying capacity of the street, curb, and gutter. The parklets are short term, temporary facilities that can be modified to provide some level of flood protection. It is recommended that each parklet be provided with, at a minimum, openings or conduits adjacent to the curb and gutter per the Table in Section 6. For larger forecasted rain events, an emergency action plan should be in place that provides increased flow capacity within the street section with the ultimate goal of flood protection for permanent structures. Gravel bags should be placed at the inlet side of the parklets to funnel and direct flow to the hydraulic conduits provided under the parklet platforms. In addition, flow should be allowed to flow from the street centerline under the K-Rails and towards the curb and hydraulic conduit section. This flow can be provided by small cut-outs on the street side of the existing plywood sheathing. The K-Rails already have integral openings at the base to allow flow to pass under them.

An emergency action plan should be developed between the Riviera Village Association and the City of Redondo Beach to closely monitor each approaching storm event and be able to respond accordingly. Response may include modifications, gravel bagging, and potentially partial removal of the parklet facilities.

8.0 DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions code, and that the design is consistent with current standards. I understand that the review of this report by the City of Redondo Beach is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

Joseph E. Dietz, PE

REGISTERED PROFESSIONAL ENGINEER
JOSEPH E. DIETZ
No. 67032
EXP: 9-30-22
CIVIL
STATE OF CALIFORNIA

10.15.2020
Date

Appendix A – Parklet Map

SANFORD VENTURES

BUILT

PROJECTED

REX STEAKHOUSE

28

27

KALAVERAS

BOTTEGA

26

26

LITTLE SISTER

24

AVENUE I

25

STUDY HUT

BARBER SHOP

BURRITO

GREEN TEMPLE

FRIENDS OF THE WINE

23

RETAIL

RETAIL

RETAIL

RETAIL

AVENIDA DEL NORTE

SANDWICH

4

5

1

2

3

HT GRILL

RETAIL

ROCKE-FELLER

JEWELERS

RIVIERA HOUSE

CREME

ROYAL REPUB

HENNESSEYS

RETAIL

RETAIL

RETAIL

RETAIL

LOCALE90

6

7

8

9

10

11

12

CATALINA AVENUE

13

14

15

16

17

18

19

RETAIL

RETAIL

GABBY JAMES

BREW CO.

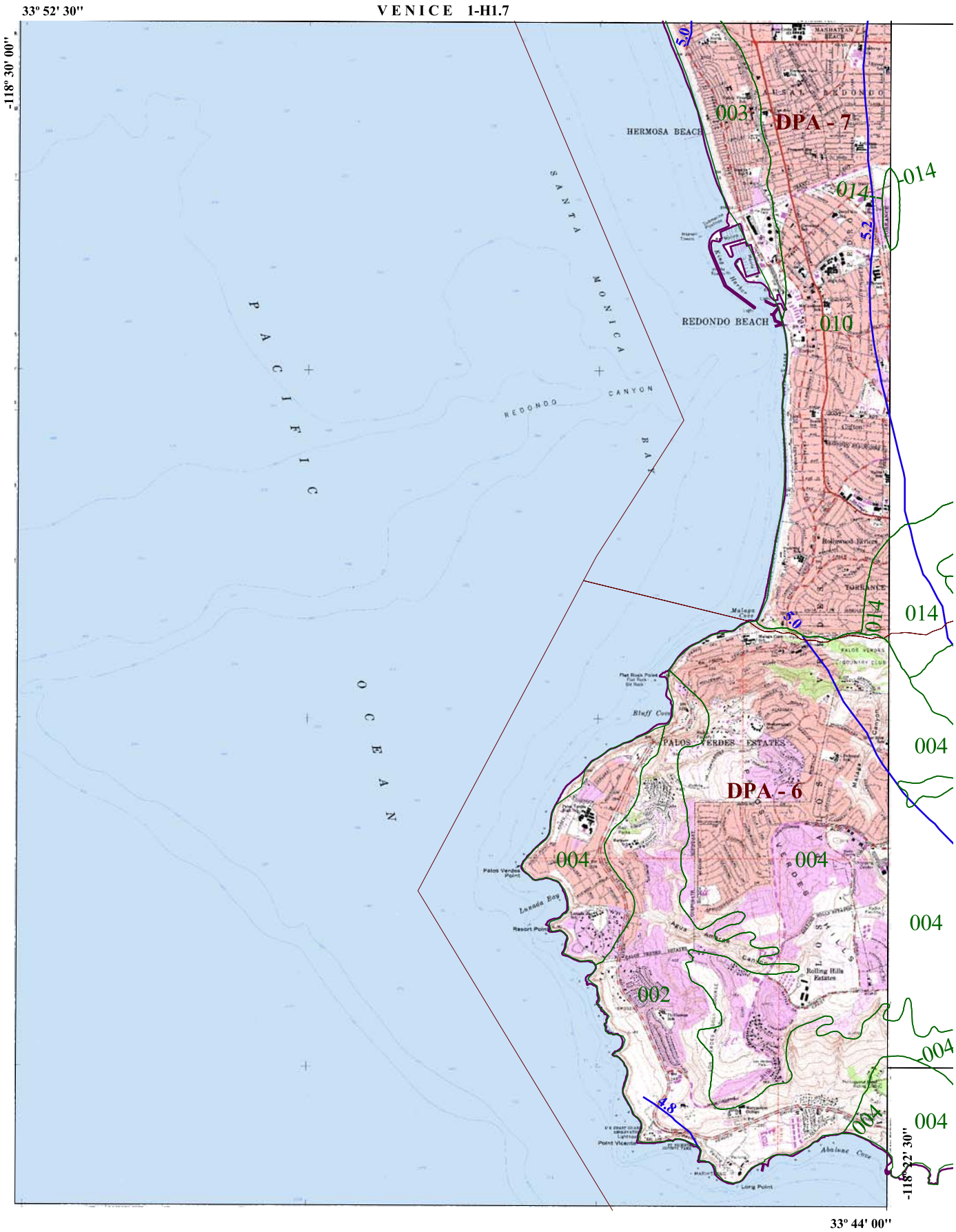
20

21

22

YELLOW VASE

Appendix B – Hydrologic Parameters and Hydrology Map



N
W E
S

016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

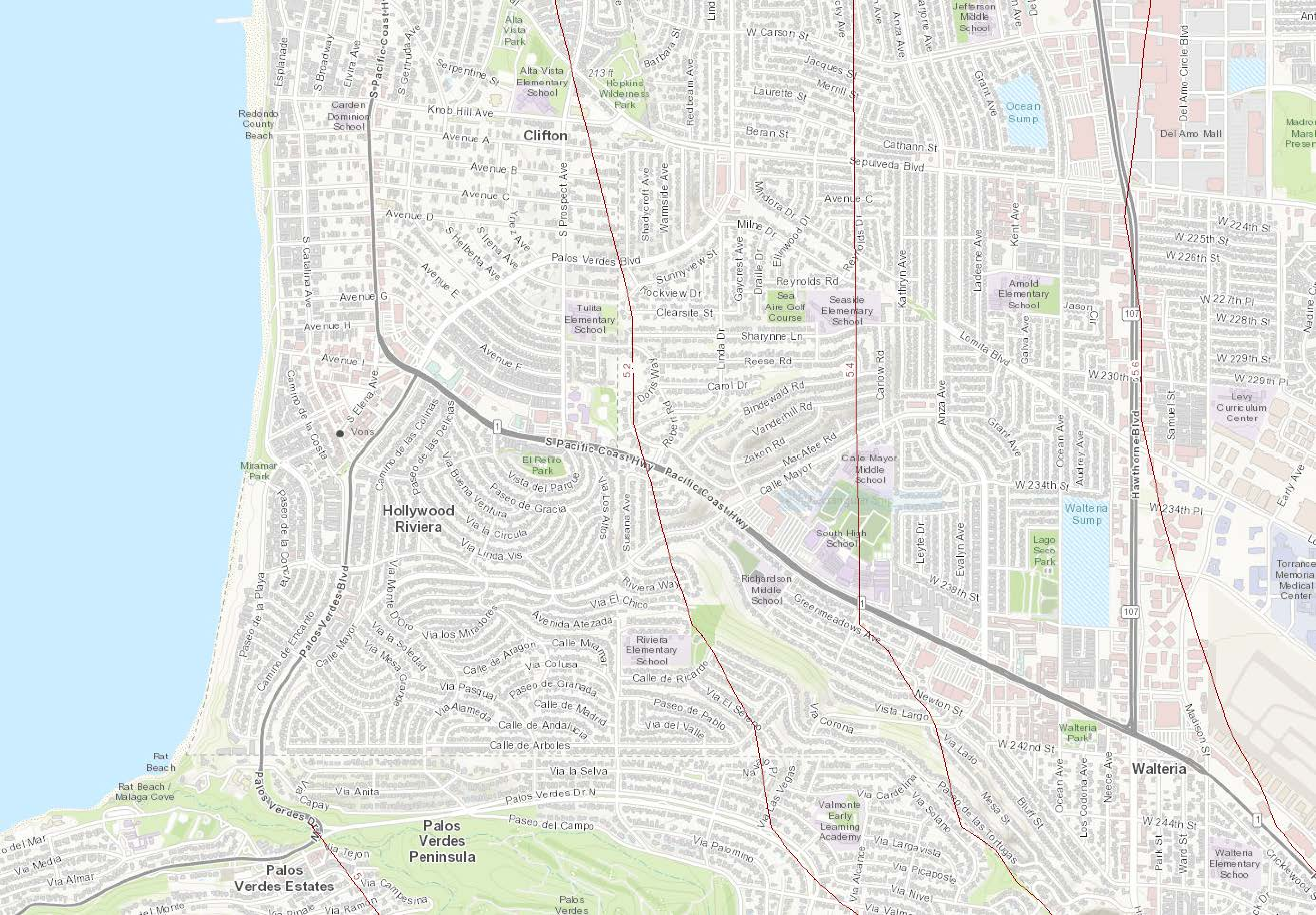
1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

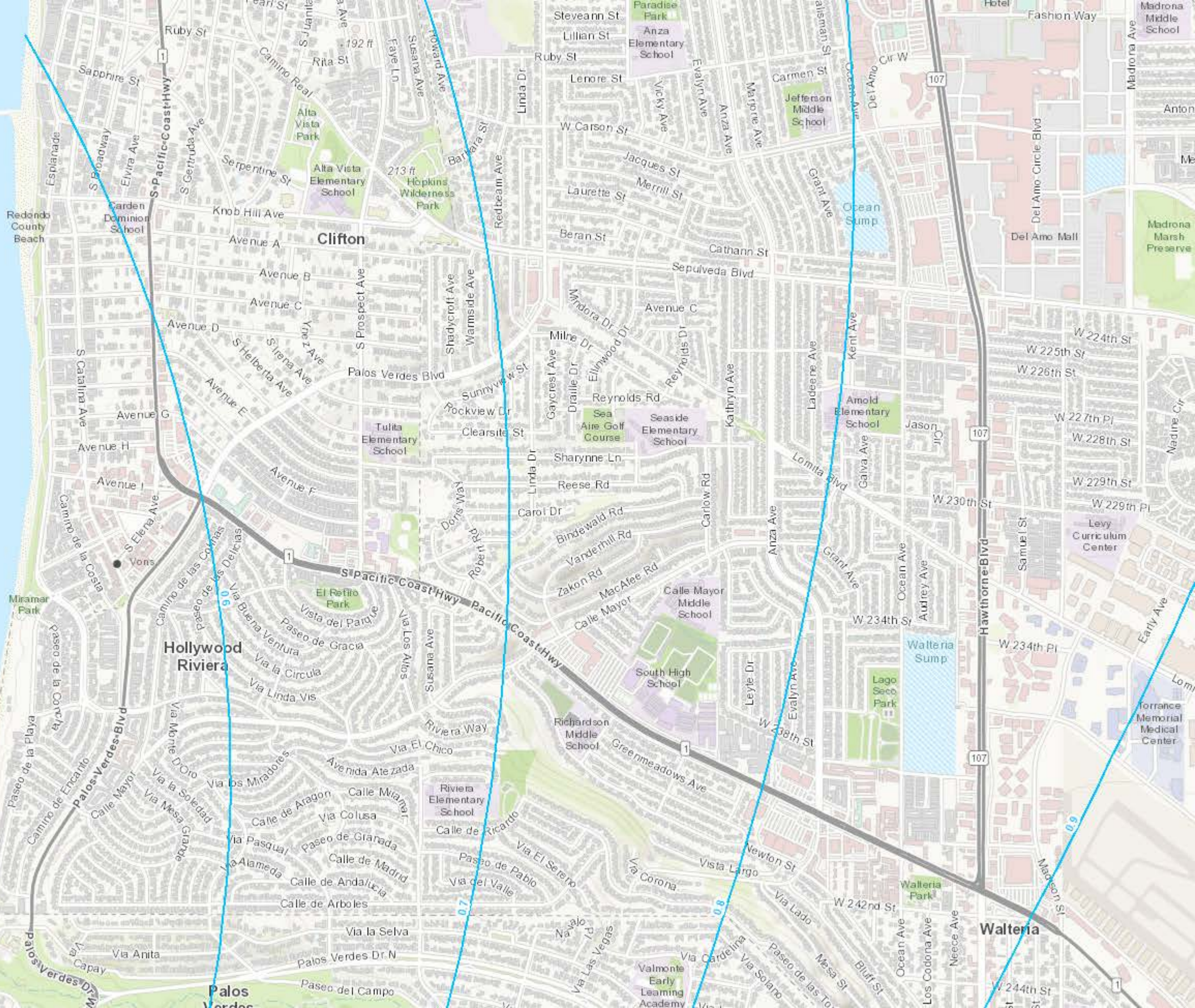
REDONDO BEACH
50-YEAR 24-HOUR ISOHYET

1-H1.3

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works



Redondo County Beach
Carden Dominion School
Alta Vista Park
Alta Vista Elementary School
Hopkins Wilderness Park
213 ft
Clifton
Jefferson Middle School
W Carson St
Ocean Sump
Del Amo Mall
Del Amo Circle Blvd
Sepulveda Blvd
Knob Hill Ave
Avenue A
Avenue B
Avenue C
Avenue D
Avenue E
Avenue F
Avenue G
Avenue H
Avenue I
Palos Verdes Blvd
S Pacific Coast Hwy
Pacific Coast Hwy
Tulita Elementary School
Sea Aire Golf Course
Seaside Elementary School
Arnold Elementary School
Levy Curriculum Center
Lomita Blvd
Hawthorne Blvd
107
1
52
54
55.6
Vons
Miramar Park
El Retiro Park
Hollywood Riviera
Calle Mayor Middle School
South High School
Richardson Middle School
Walteria Sump
Lago Seco Park
Torrance Memorial Medical Center
Riviera Elementary School
Walteria Park
Walteria
Walteria Elementary School
Rat Beach
Rat Beach / Malaga Cove
Valmonte Early Learning Academy
Palos Verdes Peninsula
Palos Verdes Estates
Palos Verdes Dr N
Paseo del Campo
Calle de Arboles
Via la Selva
Greenmeadows Ave
W 242nd St
W 244th St
W 238th St
W 234th St
W 230th St
W 224th St
W 225th St
W 226th St


Clifton
Hollywood Riviera
Walteria
Palos Verdes Estates
Redondo County Beach
Rat Beach / Malaga Cove
Miramar Park
Alta Vista Park
Alta Vista Elementary School
Hopkins Wilderness Park
Carden Dominion School
Tulita Elementary School
El Retiro Park
Riviera Elementary School
Anza Elementary School
Paradise Park
Jefferson Middle School
Seaside Elementary School
Sea Aire Golf Course
Calle Mayor Middle School
South High School
Richardson Middle School
Arnold Elementary School
Walteria Park
Walteria Sump
Ocean Sump
Lago Seco Park
Levy Curriculum Center
Torrance Memorial Medical Center
Del Amo Mall
Fashion Way
Madrona Middle School
Madrona Marsh Preserve
Valmonte Early Learning Academy
Vons
S Pacific Coast Hwy
Palos Verdes Blvd
Hawthorne Blvd
Ruby St
Sapphire St
Rita St
Lenore St
Carmen St
Lillian St
Steveann St
Ruby St
W Carson St
Jacques St
Merrill St
Laurette St
Beran St
Cathann St
Sepulveda Blvd
Avenue A
Avenue B
Avenue C
Avenue D
Avenue E
Avenue F
Avenue G
Avenue H
Avenue I
Knob Hill Ave
Serpentine St
Camino Real
Esplanade
S Broadway
Elvira Ave
S Gertruda Ave
S Juanita Ave
Faye Ln
Susana Ave
Howard Ave
Barbara St
Redbeam Ave
Linda Dr
Vicky Ave
Evalyn Ave
Anza Ave
Marjorie Ave
Grant Ave
Del Amo Cir W
Del Amo Circle Blvd
Madrona Ave
S Prospect Ave
Shadycroft Ave
Warmside Ave
Ynez Ave
S Irena Ave
S Helberta Ave
S Catalina Ave
Palos Verdes Blvd
Sunnyview St
Rockview Dr
Clearsite St
Milne Dr
Windora Dr
Ellinwood Dr
Gaycrest Ave
Draille Dr
Reynolds Dr
Reynolds Rd
Kathryn Ave
Ladeene Ave
Kent Ave
Sharynne Ln
Reese Rd
Carol Dr
Bindewald Rd
Vanderhill Rd
Zakon Rd
MacAfee Rd
Calle Mayor
Carlow Rd
Robert Rd
Doris Way
Susana Ave
Via Los Altos
Via Buena Ventura
Via la Circula
Via Linda Vis
Vista del Parque
Paseo de Gracia
Paseo de las Delicias
Camino de las Colinas
Camino de la Costa
Paseo de la Concha
Paseo de la Playa
Camino de Encanto
Via Monte D'Oro
Via la Soledad
Via Mesa Grande
Via los Miradores
Avenida Atezada
Via El Chico
Riviera Way
Calle Mayor
Calle Miramar
Via Colusa
Calle de Aragon
Paseo de Granada
Via Pasqual
Via Alameda
Calle de Madrid
Calle de Andalucia
Calle de Arboles
Calle de Ricardo
Paseo de Pablo
Via del Valle
Via El Sereno
Via Corona
Vista Largo
Newton St
Via Lado
Via la Selva
Via Anita
Via Capay
Palos Verdes Dr N
Paseo del Campo
Navajo Rd
Via Las Vegas
Via Cardelina
Via Solano
Paseo de las Tortugas
Mesa St
Bluff St
Ocean Ave
Los Codona Ave
Neece Ave
Samuel St
Early Ave
Madison St
Greenmeadows Ave
Lomita Blvd
Galva Ave
Audrey Ave
Grant Ave
Anza Ave
Evalyn Ave
Leyte Dr
W 224th St
W 225th St
W 226th St
W 227th Pl
W 228th St
W 229th St
W 229th Pl
W 230th St
W 234th St
W 234th Pl
W 238th St
W 242nd St
W 244th St
192 ft
213 ft
0.5
0.6
0.7
0.8
0.9
1
107

NOAA Atlas 14, Volume 6, Version 2
Location name: Redondo Beach, California, USA*
Latitude: 33.8164°, Longitude: -118.3877°
Elevation: 61.05 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.123** (0.104-0.149)	**0.162** (0.136-0.195)	**0.213** (0.178-0.257)	**0.254** (0.211-0.310)	**0.311** (0.248-0.393)	**0.354** (0.277-0.459)	**0.399** (0.303-0.530)	**0.444** (0.328-0.608)	**0.507** (0.357-0.725)	**0.555** (0.377-0.824)
10-min	**0.177** (0.149-0.213)	**0.232** (0.195-0.280)	**0.305** (0.255-0.369)	**0.365** (0.302-0.445)	**0.446** (0.356-0.564)	**0.508** (0.397-0.657)	**0.572** (0.435-0.759)	**0.637** (0.470-0.872)	**0.726** (0.512-1.04)	**0.795** (0.541-1.18)
15-min	**0.214** (0.180-0.258)	**0.281** (0.236-0.339)	**0.369** (0.308-0.446)	**0.441** (0.365-0.538)	**0.539** (0.431-0.682)	**0.614** (0.480-0.795)	**0.691** (0.526-0.918)	**0.770** (0.569-1.06)	**0.878** (0.620-1.26)	**0.962** (0.654-1.43)
30-min	**0.292** (0.245-0.352)	**0.384** (0.321-0.462)	**0.504** (0.421-0.609)	**0.602** (0.499-0.734)	**0.736** (0.588-0.930)	**0.839** (0.655-1.09)	**0.944** (0.718-1.25)	**1.05** (0.776-1.44)	**1.20** (0.846-1.72)	**1.31** (0.893-1.95)
60-min	**0.418** (0.351-0.503)	**0.549** (0.460-0.661)	**0.721** (0.602-0.871)	**0.861** (0.713-1.05)	**1.05** (0.841-1.33)	**1.20** (0.937-1.55)	**1.35** (1.03-1.79)	**1.50** (1.11-2.06)	**1.71** (1.21-2.45)	**1.88** (1.28-2.79)
2-hr	**0.605** (0.508-0.729)	**0.794** (0.665-0.957)	**1.04** (0.870-1.26)	**1.24** (1.03-1.52)	**1.52** (1.21-1.92)	**1.73** (1.35-2.24)	**1.95** (1.48-2.58)	**2.17** (1.60-2.97)	**2.47** (1.74-3.53)	**2.70** (1.84-4.01)
3-hr	**0.744** (0.624-0.895)	**0.975** (0.817-1.18)	**1.28** (1.07-1.55)	**1.53** (1.26-1.86)	**1.86** (1.49-2.36)	**2.12** (1.66-2.75)	**2.39** (1.82-3.17)	**2.66** (1.96-3.64)	**3.03** (2.14-4.34)	**3.32** (2.26-4.93)
6-hr	**1.04** (0.870-1.25)	**1.36** (1.14-1.64)	**1.79** (1.49-2.16)	**2.13** (1.77-2.60)	**2.61** (2.08-3.29)	**2.97** (2.32-3.84)	**3.34** (2.54-4.43)	**3.72** (2.75-5.09)	**4.24** (2.99-6.07)	**4.64** (3.16-6.89)
12-hr	**1.33** (1.12-1.61)	**1.76** (1.47-2.12)	**2.31** (1.93-2.79)	**2.76** (2.28-3.37)	**3.37** (2.69-4.26)	**3.84** (3.00-4.97)	**4.32** (3.29-5.74)	**4.81** (3.55-6.59)	**5.48** (3.87-7.85)	**6.00** (4.08-8.91)
24-hr	**1.72** (1.52-1.99)	**2.28** (2.01-2.64)	**3.01** (2.65-3.49)	**3.61** (3.16-4.22)	**4.42** (3.74-5.34)	**5.05** (4.18-6.22)	**5.69** (4.60-7.17)	**6.34** (4.99-8.22)	**7.23** (5.47-9.76)	**7.92** (5.79-11.1)
2-day	**2.07** (1.83-2.38)	**2.75** (2.43-3.18)	**3.66** (3.22-4.24)	**4.41** (3.85-5.15)	**5.43** (4.60-6.56)	**6.23** (5.17-7.68)	**7.06** (5.71-8.90)	**7.91** (6.23-10.3)	**9.08** (6.86-12.3)	**10.00** (7.31-14.0)
3-day	**2.32** (2.05-2.68)	**3.10** (2.74-3.58)	**4.14** (3.65-4.80)	**5.00** (4.37-5.85)	**6.20** (5.24-7.48)	**7.14** (5.91-8.79)	**8.10** (6.56-10.2)	**9.11** (7.18-11.8)	**10.5** (7.95-14.2)	**11.6** (8.49-16.2)
4-day	**2.54** (2.25-2.94)	**3.41** (3.01-3.94)	**4.57** (4.03-5.30)	**5.54** (4.84-6.47)	**6.87** (5.81-8.29)	**7.93** (6.57-9.76)	**9.01** (7.29-11.4)	**10.2** (8.00-13.2)	**11.7** (8.87-15.8)	**13.0** (9.49-18.1)
7-day	**2.94** (2.60-3.39)	**3.96** (3.50-4.58)	**5.33** (4.69-6.17)	**6.46** (5.65-7.55)	**8.04** (6.80-9.70)	**9.28** (7.69-11.4)	**10.6** (8.54-13.3)	**11.9** (9.36-15.4)	**13.7** (10.4-18.6)	**15.2** (11.1-21.2)
10-day	**3.17** (2.80-3.66)	**4.29** (3.79-4.96)	**5.79** (5.10-6.71)	**7.03** (6.14-8.21)	**8.76** (7.41-10.6)	**10.1** (8.38-12.4)	**11.5** (9.31-14.5)	**13.0** (10.2-16.8)	**15.0** (11.3-20.2)	**16.6** (12.1-23.1)
20-day	**3.75** (3.31-4.32)	**5.12** (4.52-5.92)	**6.97** (6.14-8.08)	**8.51** (7.44-9.94)	**10.6** (9.00-12.8)	**12.3** (10.2-15.2)	**14.1** (11.4-17.7)	**15.9** (12.5-20.6)	**18.4** (13.9-24.8)	**20.3** (14.9-28.4)
30-day	**4.44** (3.93-5.13)	**6.10** (5.39-7.05)	**8.33** (7.34-9.66)	**10.2** (8.90-11.9)	**12.8** (10.8-15.4)	**14.8** (12.3-18.2)	**16.9** (13.7-21.3)	**19.1** (15.0-24.7)	**22.1** (16.7-29.9)	**24.5** (17.9-34.2)
45-day	**5.22** (4.62-6.03)	**7.16** (6.32-8.28)	**9.77** (8.61-11.3)	**11.9** (10.4-14.0)	**15.0** (12.7-18.1)	**17.4** (14.4-21.4)	**19.8** (16.1-25.0)	**22.4** (17.7-29.1)	**26.0** (19.7-35.1)	**28.9** (21.1-40.3)
60-day	**6.07** (5.37-7.01)	**8.28** (7.31-9.57)	**11.3** (9.91-13.0)	**13.7** (12.0-16.1)	**17.2** (14.6-20.8)	**20.0** (16.5-24.6)	**22.8** (18.4-28.7)	**25.8** (20.3-33.4)	**29.9** (22.6-40.4)	**33.2** (24.3-46.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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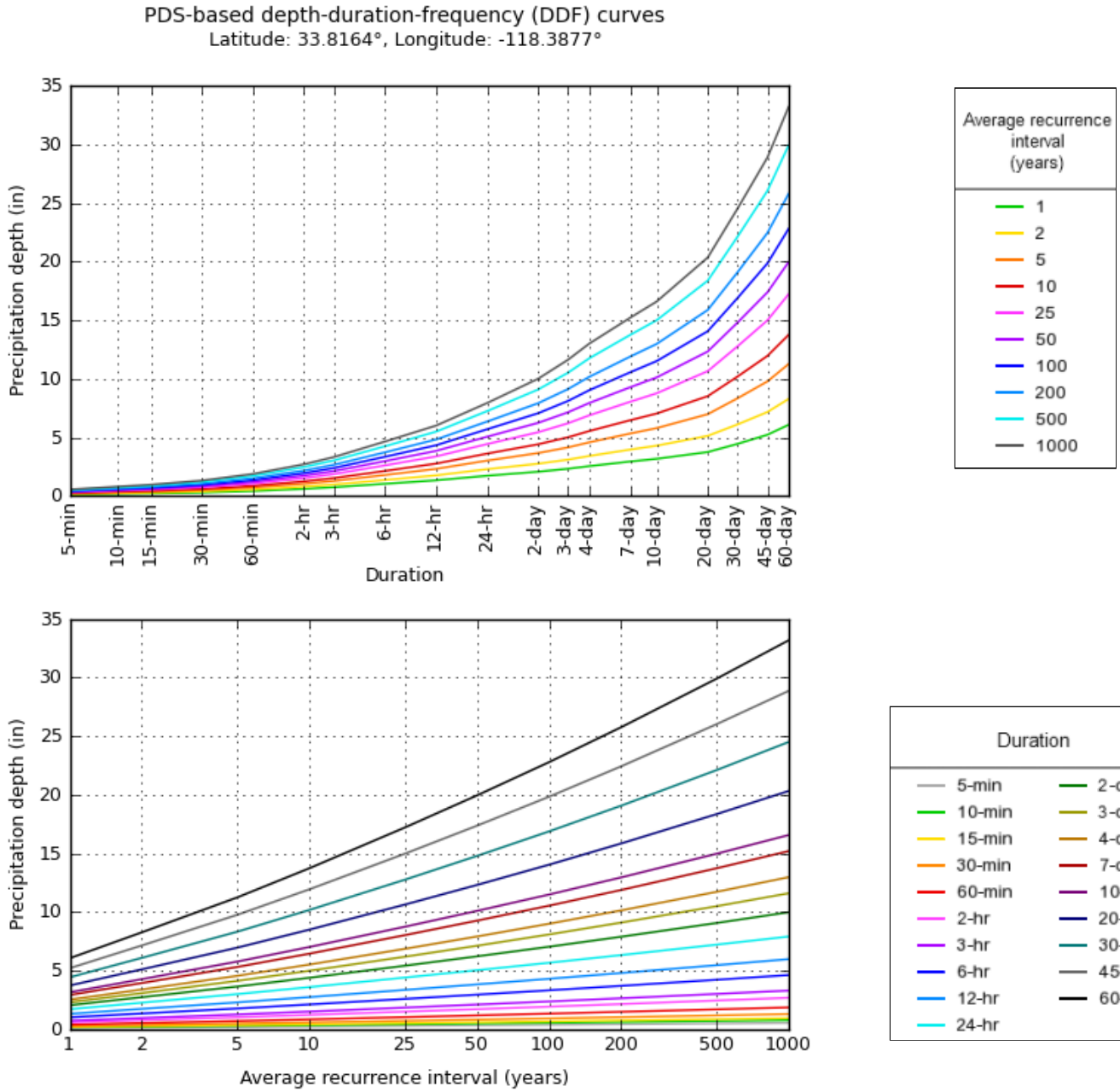
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Sep 17 03:41:13 2020

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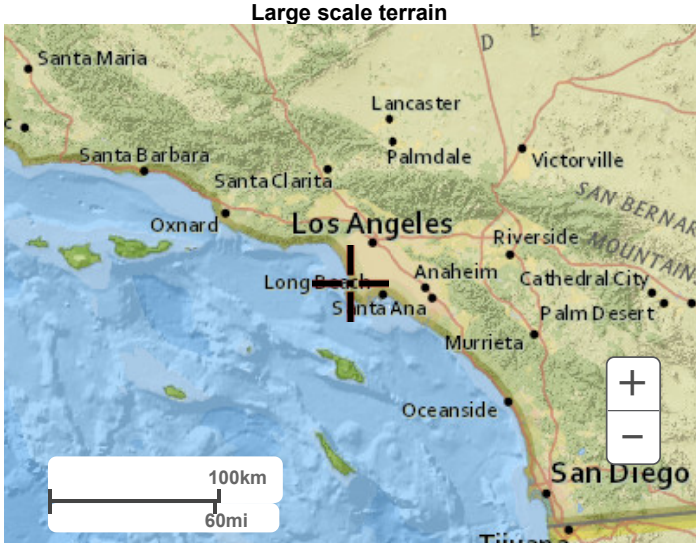
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map

Large scale aerial

LEGEND

- XX / X.XX — DRAINAGE AREA IDENTIFIER; DRAINAGE AREA, ACRES
- DRAINAGE AREA BOUNDARY
- DRAINAGE AREA SUB-AREA BOUNDARY
- ELEV = XX FS; Q XX = X.XX (X.XX) — FINISH SURFACE ELEVATION; STORM EVENT FREQUENCY; FLOW (CFS) AT NODE; FLOW (CFS) INTERCEPTED BY CATCH BASIN, WHERE APPLICABLE

N

100' 0' 50' 100'

SCALE: 1" = 100'

Project No.:	01050-20001
Designed By:	JH
Drawn By:	JH
Checked By:	JD

EH-1

HYDROLOGY MAP

RIVIERA VILLAGE AREA
RIVIERA VILLAGE ASSOCIATION

1799 S CATALINA AVE
REDONDO BEACH, CA

MARK	DATE	DESCRIPTION	BY

DSC ENGINEERING
STRUCTURAL & CIVIL ENGINEERS
25411 CABOT ROAD, SUITE 205
LAGUNA HILLS, CA. 92653
949.215.5935

RIVIERA VILLAGE

Appendix C – LA County HydroCalc Results

Peak Flow Hydrologic Analysis

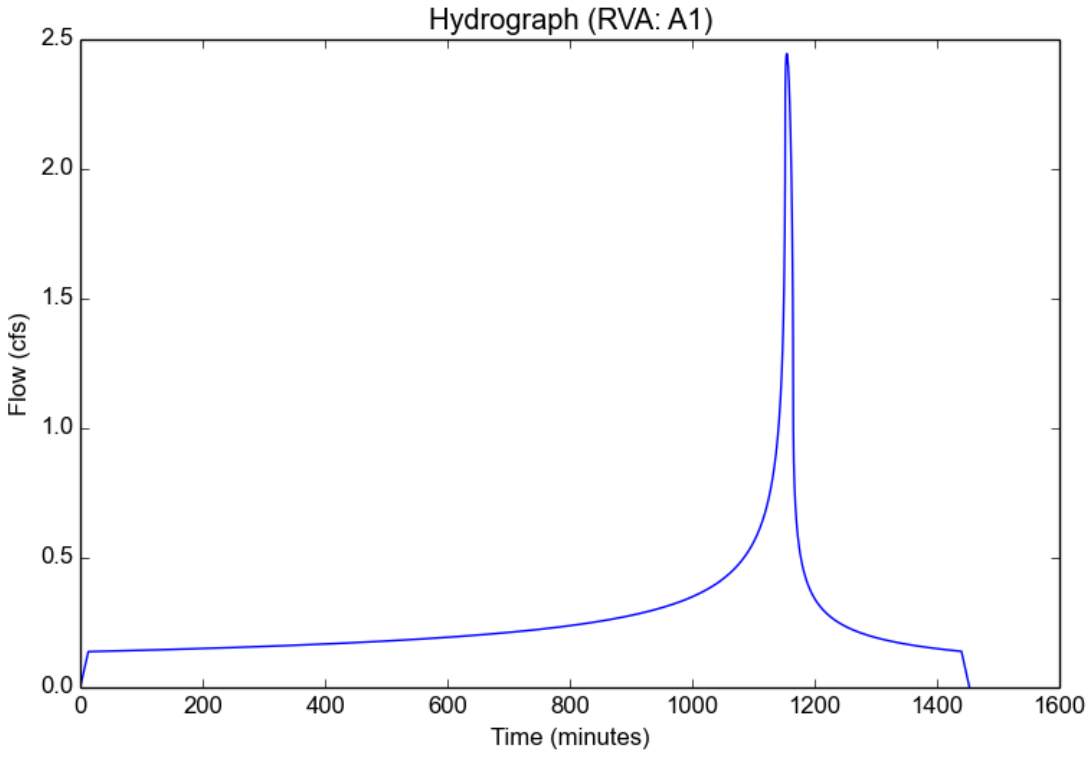
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	A1
Area (ac)	1.73
Flow Path Length (ft)	900.0
Flow Path Slope (vft/hft)	0.0088
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.6883
Undeveloped Runoff Coefficient (Cu)	0.3287
Developed Runoff Coefficient (Cd)	0.8372
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	2.4451
Burned Peak Flow Rate (cfs)	2.4451
24-Hr Clear Runoff Volume (ac-ft)	0.5159
24-Hr Clear Runoff Volume (cu-ft)	22471.3338



Peak Flow Hydrologic Analysis

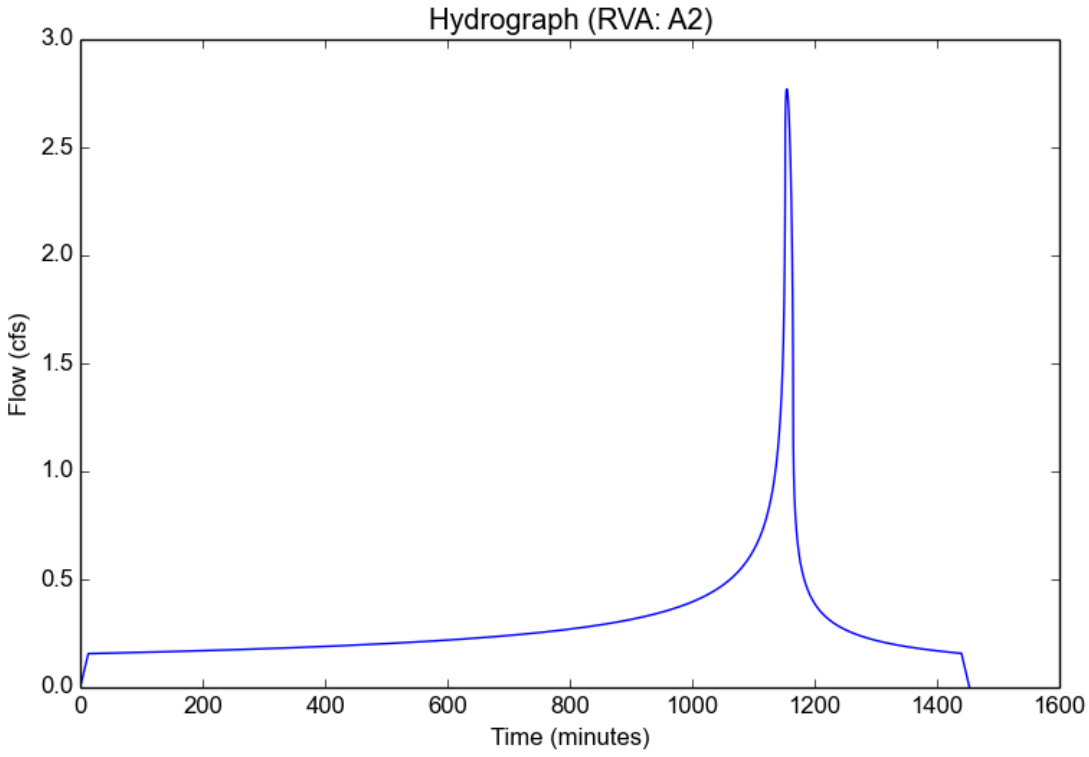
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	A2
Area (ac)	1.96
Flow Path Length (ft)	750.0
Flow Path Slope (vft/hft)	0.005
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.6883
Undeveloped Runoff Coefficient (Cu)	0.3287
Developed Runoff Coefficient (Cd)	0.8372
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	2.7702
Burned Peak Flow Rate (cfs)	2.7702
24-Hr Clear Runoff Volume (ac-ft)	0.5845
24-Hr Clear Runoff Volume (cu-ft)	25458.8521



Peak Flow Hydrologic Analysis

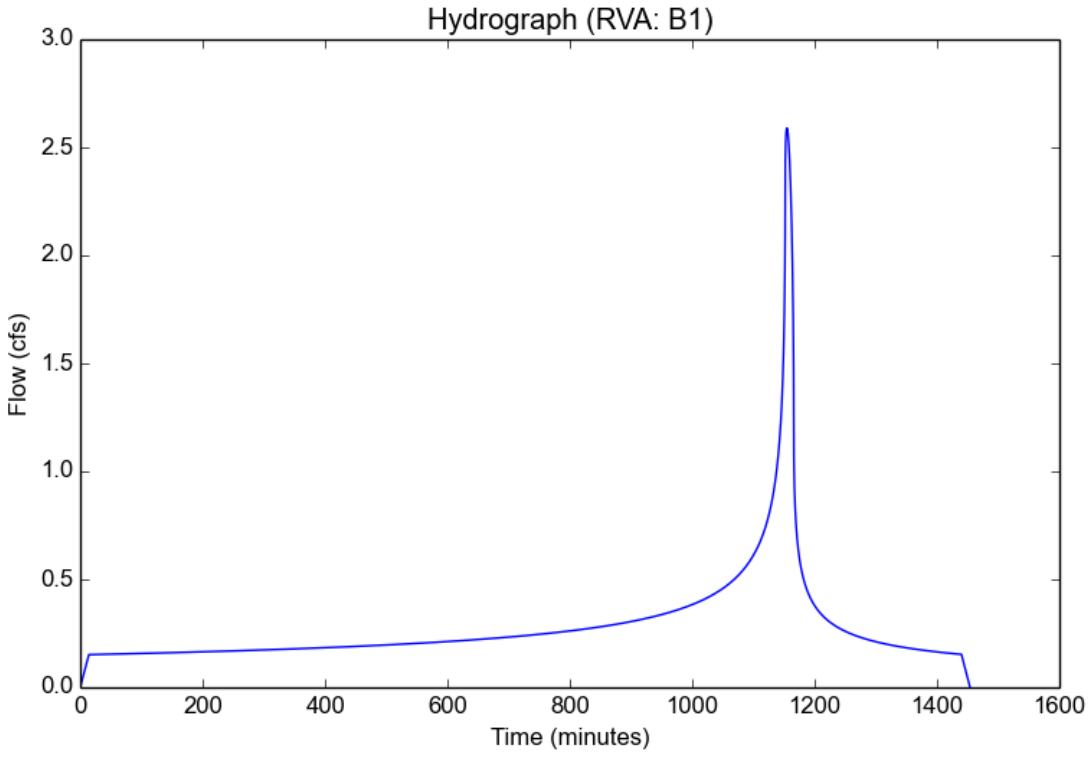
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B1
Area (ac)	1.9
Flow Path Length (ft)	840.0
Flow Path Slope (vft/hft)	0.005
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.6305
Undeveloped Runoff Coefficient (Cu)	0.3177
Developed Runoff Coefficient (Cd)	0.8359
Time of Concentration (min)	14.0
Clear Peak Flow Rate (cfs)	2.5897
Burned Peak Flow Rate (cfs)	2.5897
24-Hr Clear Runoff Volume (ac-ft)	0.5665
24-Hr Clear Runoff Volume (cu-ft)	24677.8536



Peak Flow Hydrologic Analysis

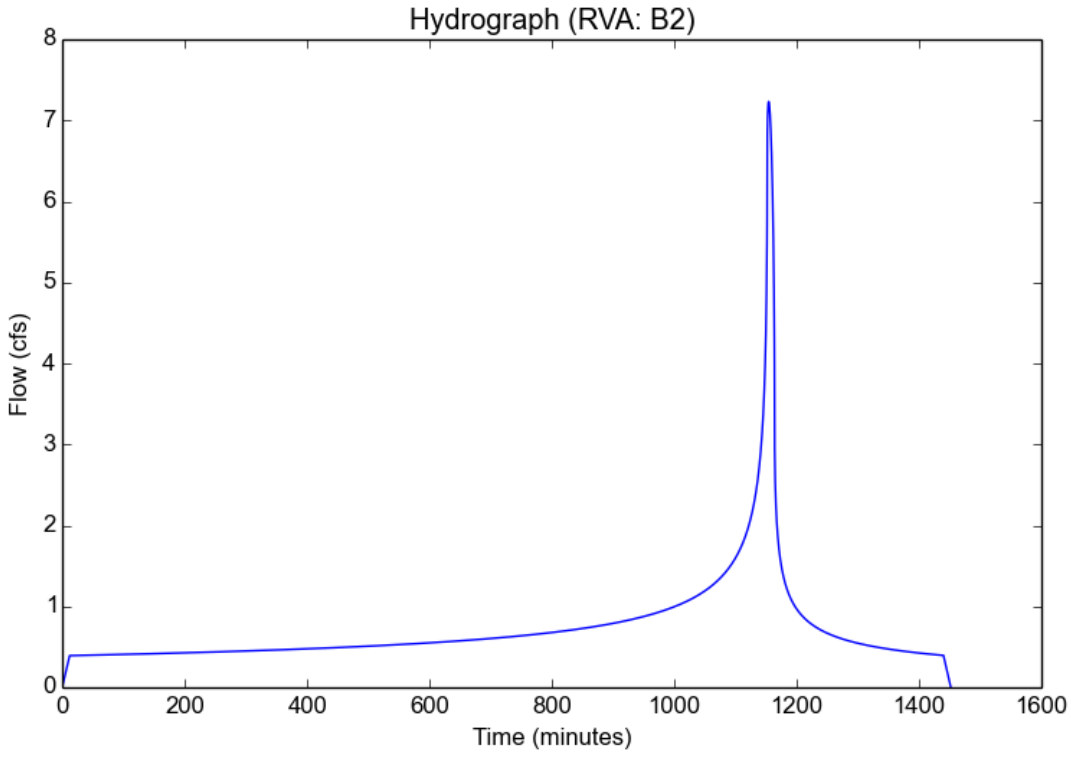
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B2
Area (ac)	4.92
Flow Path Length (ft)	860.0
Flow Path Slope (vft/hft)	0.0105
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.753
Undeveloped Runoff Coefficient (Cu)	0.3409
Developed Runoff Coefficient (Cd)	0.8385
Time of Concentration (min)	12.0
Clear Peak Flow Rate (cfs)	7.232
Burned Peak Flow Rate (cfs)	7.232
24-Hr Clear Runoff Volume (ac-ft)	1.4672
24-Hr Clear Runoff Volume (cu-ft)	63911.2442



Peak Flow Hydrologic Analysis

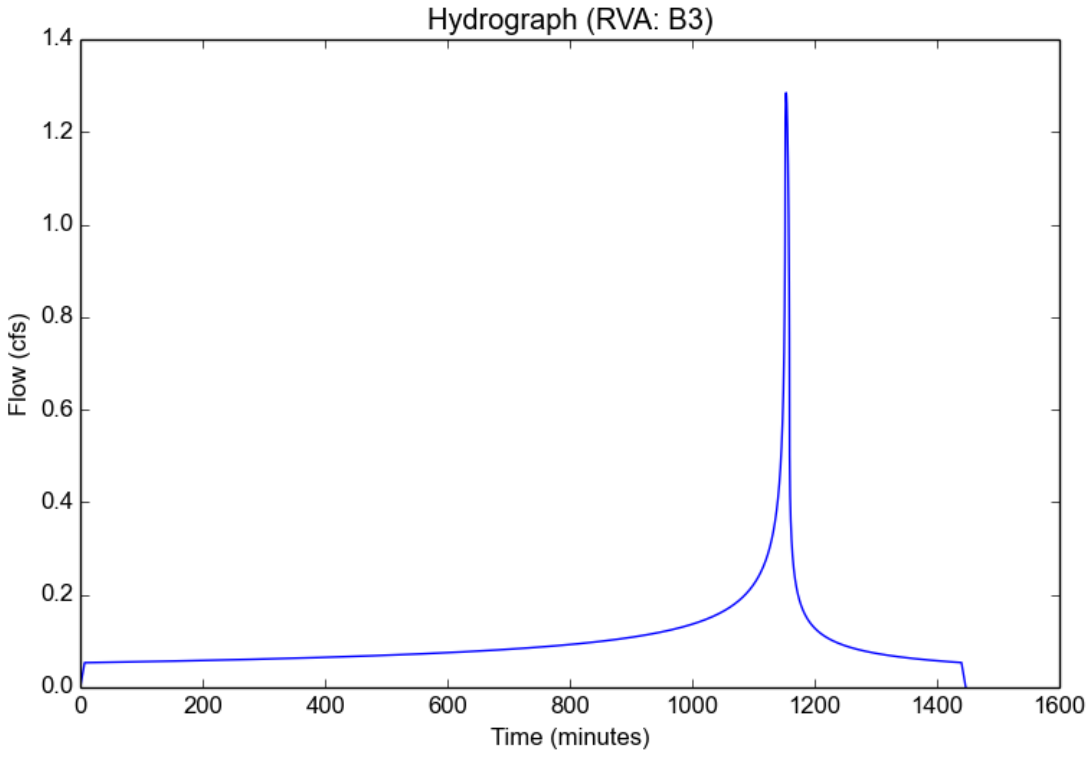
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B3
Area (ac)	0.67
Flow Path Length (ft)	310.0
Flow Path Slope (vft/hft)	0.0065
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	2.2584
Undeveloped Runoff Coefficient (Cu)	0.437
Developed Runoff Coefficient (Cd)	0.8491
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	1.2848
Burned Peak Flow Rate (cfs)	1.2848
24-Hr Clear Runoff Volume (ac-ft)	0.1999
24-Hr Clear Runoff Volume (cu-ft)	8706.9271



Peak Flow Hydrologic Analysis

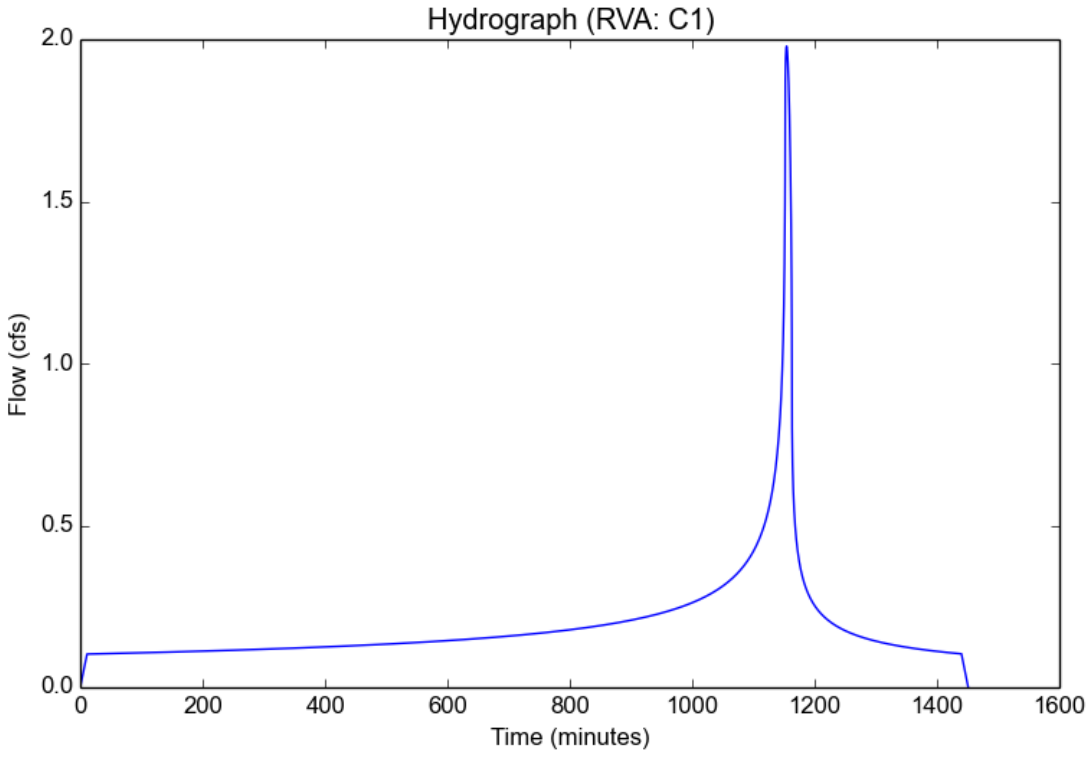
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	C1
Area (ac)	1.29
Flow Path Length (ft)	740.0
Flow Path Slope (vft/hft)	0.0095
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.8262
Undeveloped Runoff Coefficient (Cu)	0.3548
Developed Runoff Coefficient (Cd)	0.84
Time of Concentration (min)	11.0
Clear Peak Flow Rate (cfs)	1.979
Burned Peak Flow Rate (cfs)	1.979
24-Hr Clear Runoff Volume (ac-ft)	0.3847
24-Hr Clear Runoff Volume (cu-ft)	16758.4069



Peak Flow Hydrologic Analysis

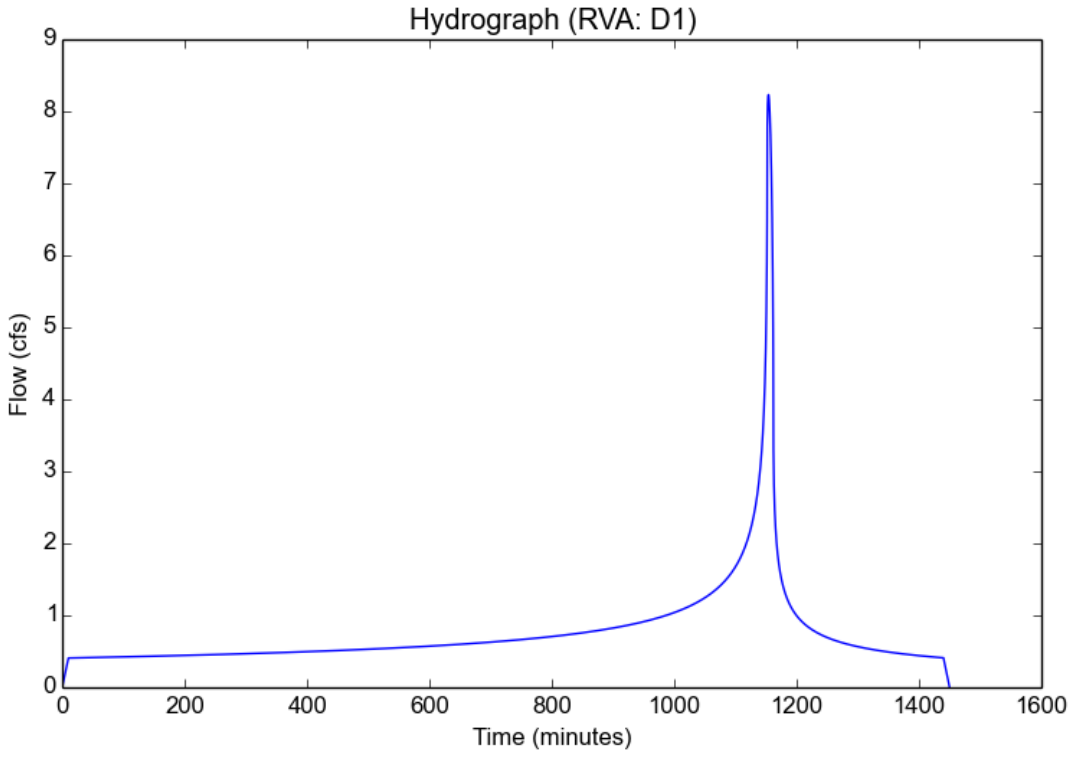
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	D1
Area (ac)	5.12
Flow Path Length (ft)	680.0
Flow Path Slope (vft/hft)	0.0162
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.9099
Undeveloped Runoff Coefficient (Cu)	0.3707
Developed Runoff Coefficient (Cd)	0.8418
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	8.2314
Burned Peak Flow Rate (cfs)	8.2314
24-Hr Clear Runoff Volume (ac-ft)	1.5271
24-Hr Clear Runoff Volume (cu-ft)	66518.9629



Peak Flow Hydrologic Analysis

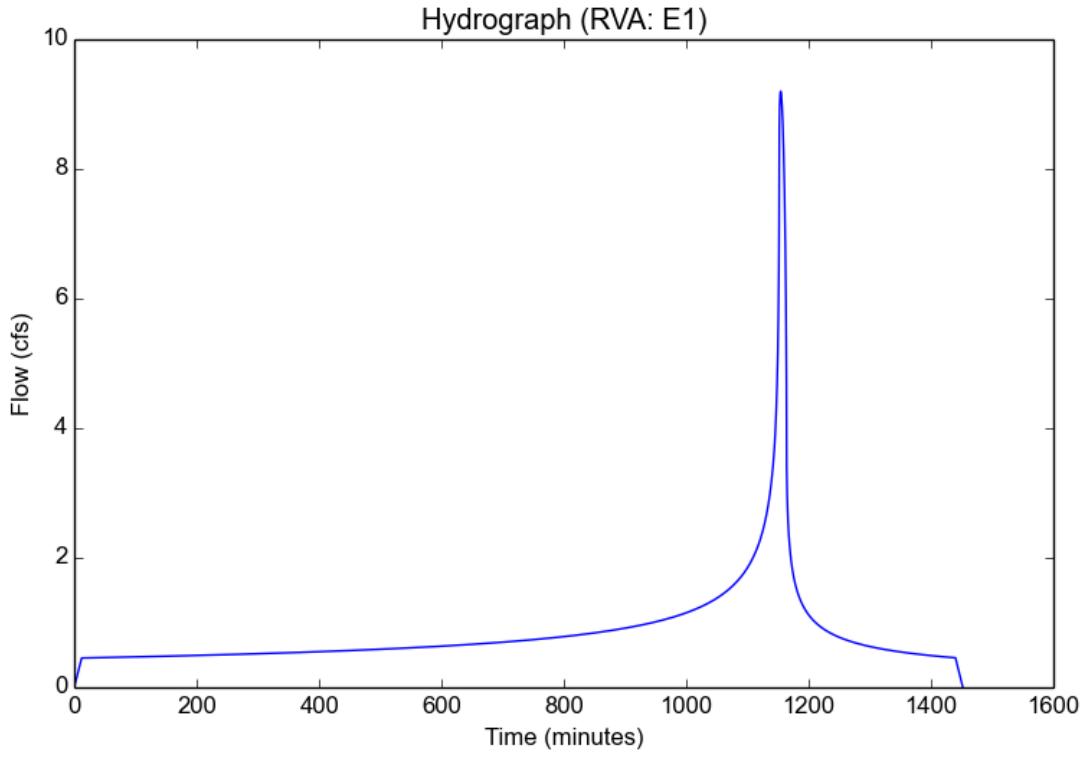
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E1
Area (ac)	7.45
Flow Path Length (ft)	1090.0
Flow Path Slope (vft/hft)	0.0523
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.65
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.753
Undeveloped Runoff Coefficient (Cu)	0.3409
Developed Runoff Coefficient (Cd)	0.7043
Time of Concentration (min)	12.0
Clear Peak Flow Rate (cfs)	9.1986
Burned Peak Flow Rate (cfs)	9.1986
24-Hr Clear Runoff Volume (ac-ft)	1.7083
24-Hr Clear Runoff Volume (cu-ft)	74413.6275



Peak Flow Hydrologic Analysis

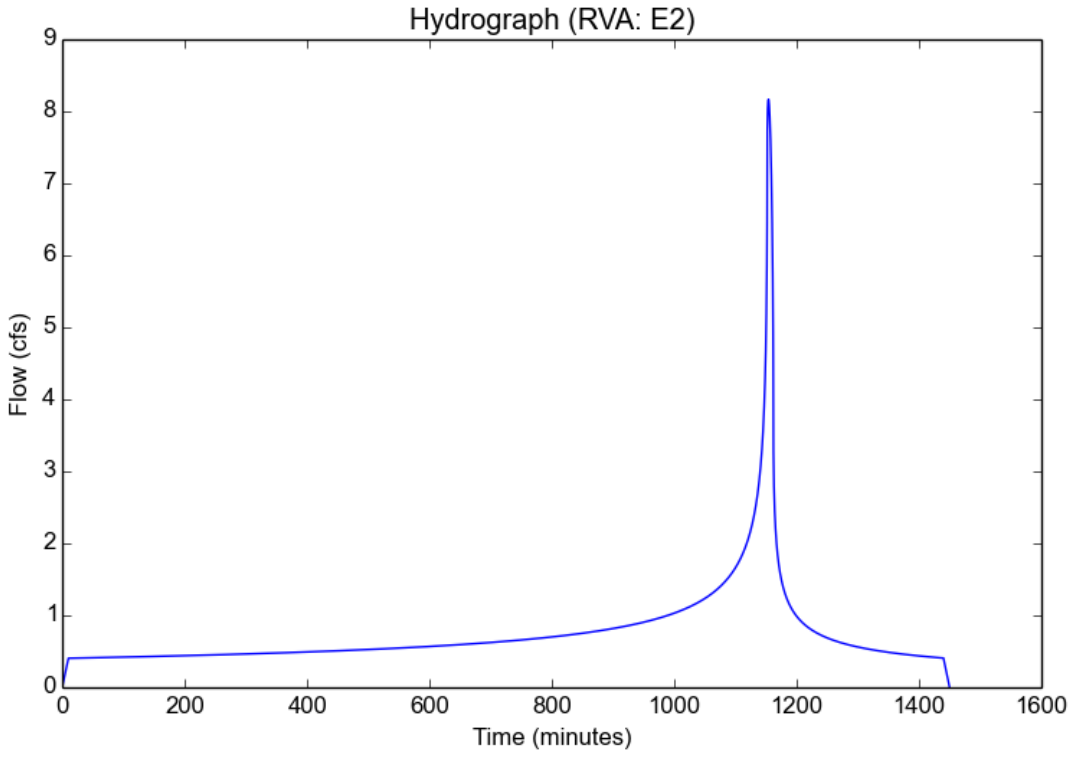
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E2
Area (ac)	5.08
Flow Path Length (ft)	790.0
Flow Path Slope (vft/hft)	0.0215
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.9099
Undeveloped Runoff Coefficient (Cu)	0.3707
Developed Runoff Coefficient (Cd)	0.8418
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	8.1671
Burned Peak Flow Rate (cfs)	8.1671
24-Hr Clear Runoff Volume (ac-ft)	1.5151
24-Hr Clear Runoff Volume (cu-ft)	65999.2835



Peak Flow Hydrologic Analysis

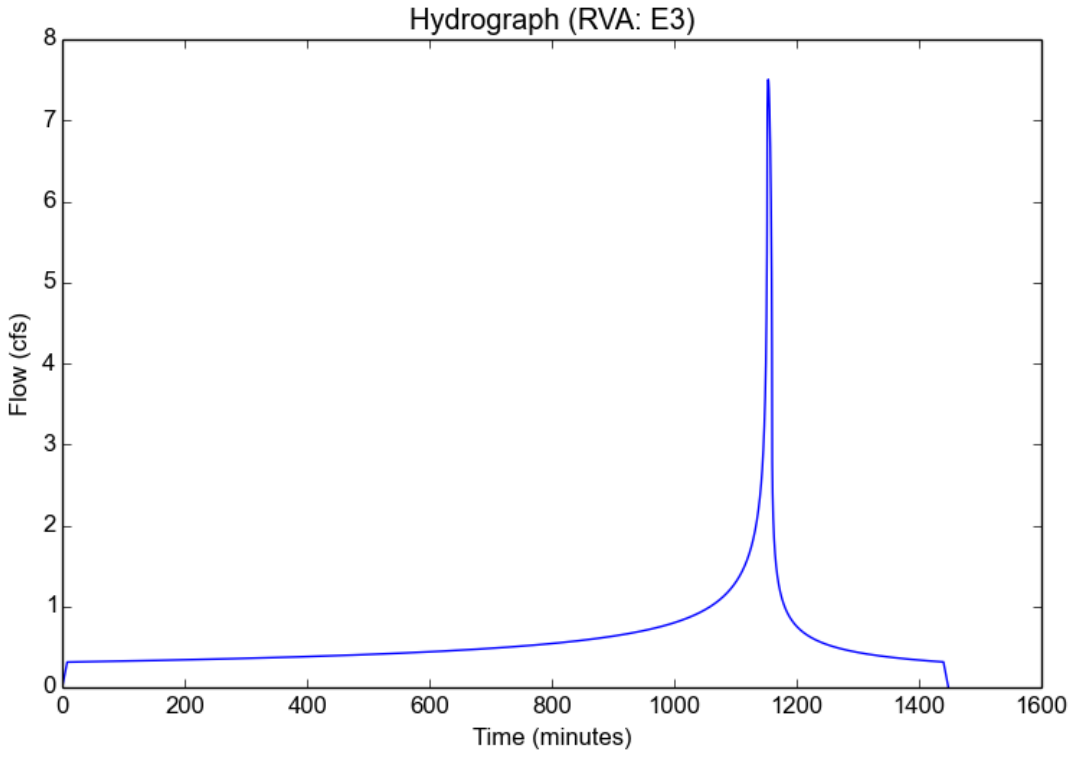
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E3
Area (ac)	4.55
Flow Path Length (ft)	720.0
Flow Path Slope (vft/hft)	0.0625
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.75
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	2.1211
Undeveloped Runoff Coefficient (Cu)	0.4109
Developed Runoff Coefficient (Cd)	0.7777
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	7.5056
Burned Peak Flow Rate (cfs)	7.5056
24-Hr Clear Runoff Volume (ac-ft)	1.1749
24-Hr Clear Runoff Volume (cu-ft)	51180.0466



Peak Flow Hydrologic Analysis

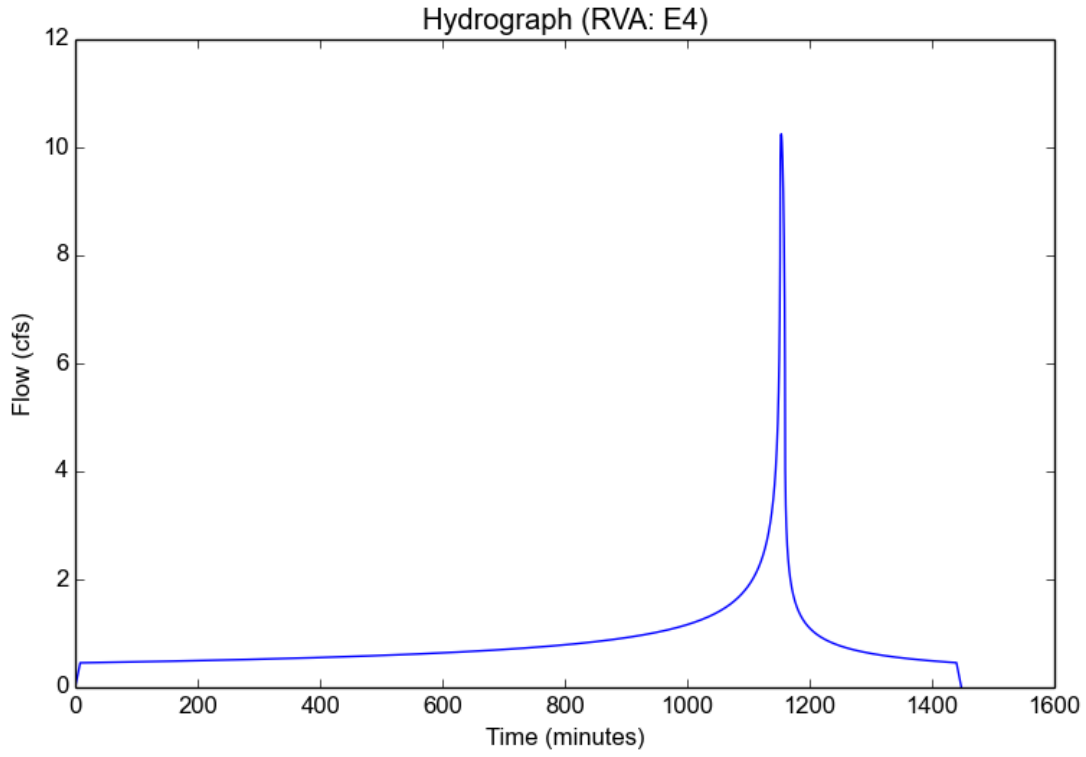
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E4
Area (ac)	5.71
Flow Path Length (ft)	650.0
Flow Path Slope (vft/hft)	0.0327
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	2.1211
Undeveloped Runoff Coefficient (Cu)	0.4109
Developed Runoff Coefficient (Cd)	0.8462
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	10.2485
Burned Peak Flow Rate (cfs)	10.2485
24-Hr Clear Runoff Volume (ac-ft)	1.7033
24-Hr Clear Runoff Volume (cu-ft)	74196.6186



Peak Flow Hydrologic Analysis

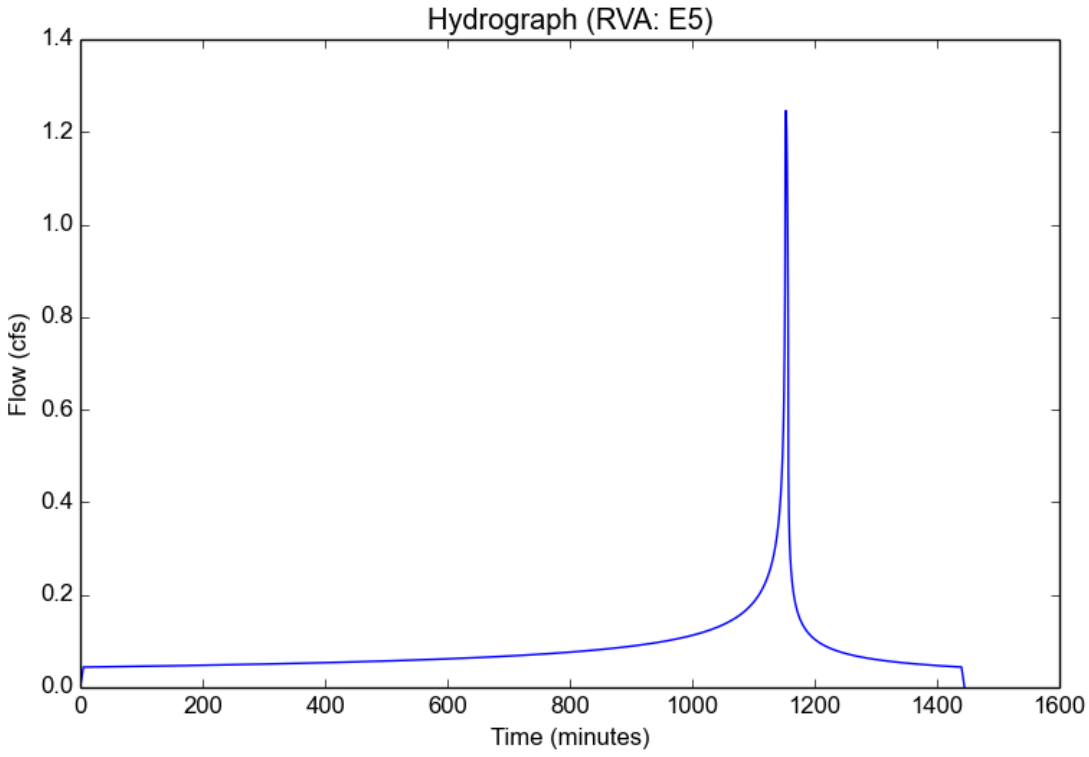
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E5
Area (ac)	0.55
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	2.6454
Undeveloped Runoff Coefficient (Cu)	0.5025
Developed Runoff Coefficient (Cd)	0.8563
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.2458
Burned Peak Flow Rate (cfs)	1.2458
24-Hr Clear Runoff Volume (ac-ft)	0.1641
24-Hr Clear Runoff Volume (cu-ft)	7149.0722



Peak Flow Hydrologic Analysis

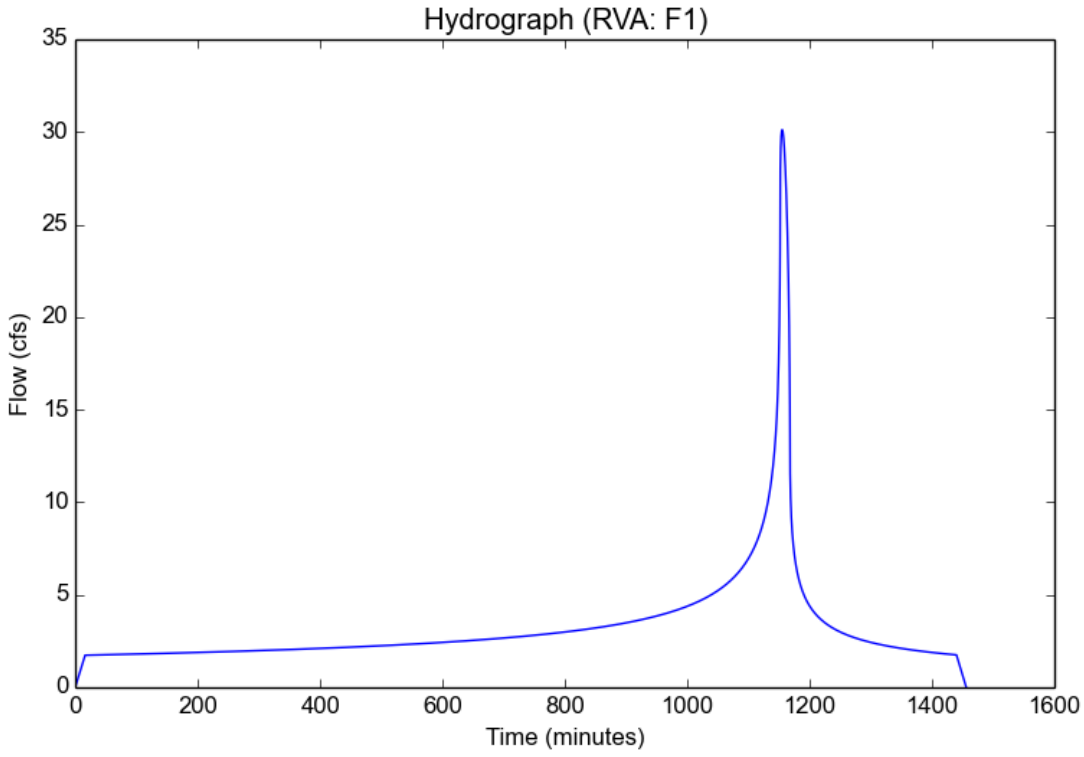
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	F1
Area (ac)	28.52
Flow Path Length (ft)	1640.0
Flow Path Slope (vft/hft)	0.0598
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.65
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.5313
Undeveloped Runoff Coefficient (Cu)	0.2988
Developed Runoff Coefficient (Cd)	0.6896
Time of Concentration (min)	16.0
Clear Peak Flow Rate (cfs)	30.1169
Burned Peak Flow Rate (cfs)	30.1169
24-Hr Clear Runoff Volume (ac-ft)	6.5324
24-Hr Clear Runoff Volume (cu-ft)	284549.2885



Peak Flow Hydrologic Analysis

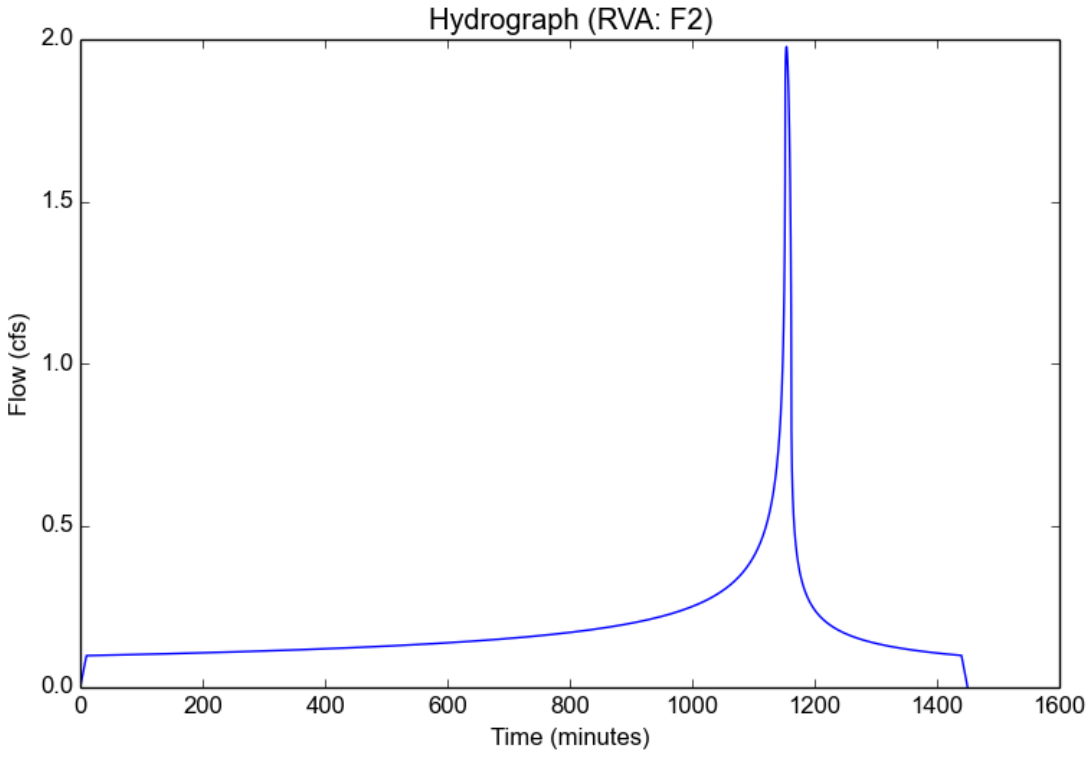
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	F2
Area (ac)	1.23
Flow Path Length (ft)	820.0
Flow Path Slope (vft/hft)	0.0293
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4339
Peak Intensity (in/hr)	1.9099
Undeveloped Runoff Coefficient (Cu)	0.3707
Developed Runoff Coefficient (Cd)	0.8418
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	1.9775
Burned Peak Flow Rate (cfs)	1.9775
24-Hr Clear Runoff Volume (ac-ft)	0.3669
24-Hr Clear Runoff Volume (cu-ft)	15980.1415



Peak Flow Hydrologic Analysis

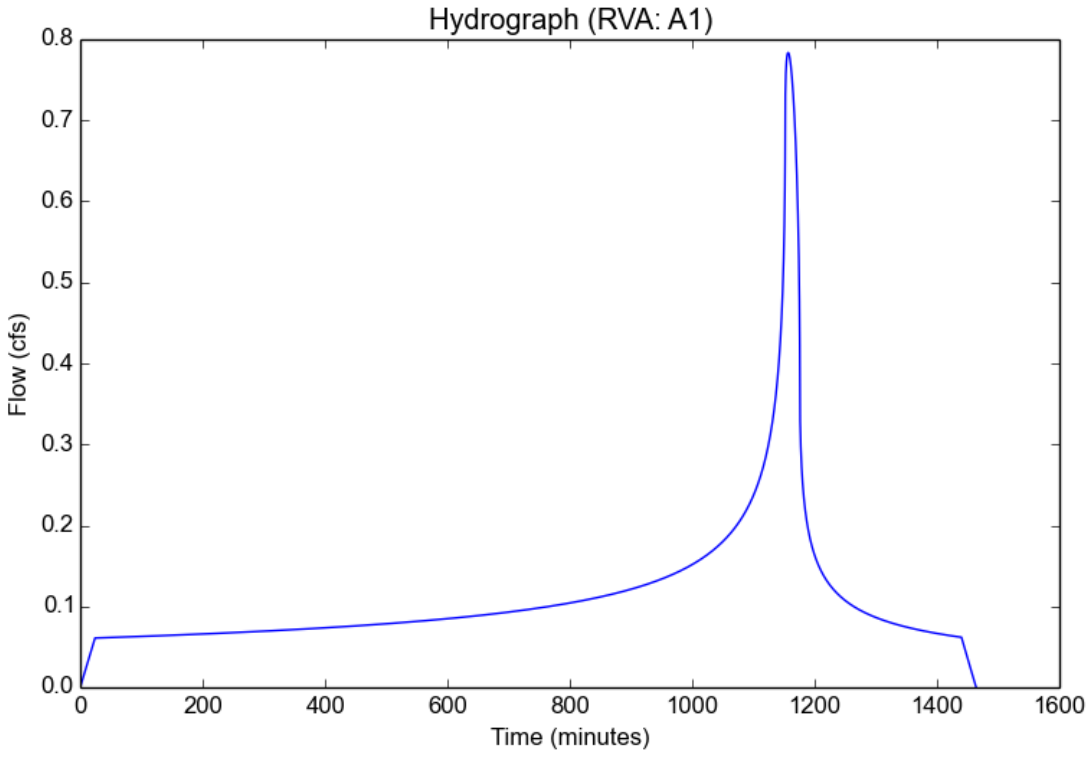
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	A1
Area (ac)	1.73
Flow Path Length (ft)	900.0
Flow Path Slope (vft/hft)	0.0088
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.5579
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	24.0
Clear Peak Flow Rate (cfs)	0.7837
Burned Peak Flow Rate (cfs)	0.7837
24-Hr Clear Runoff Volume (ac-ft)	0.2269
24-Hr Clear Runoff Volume (cu-ft)	9883.4861



Peak Flow Hydrologic Analysis

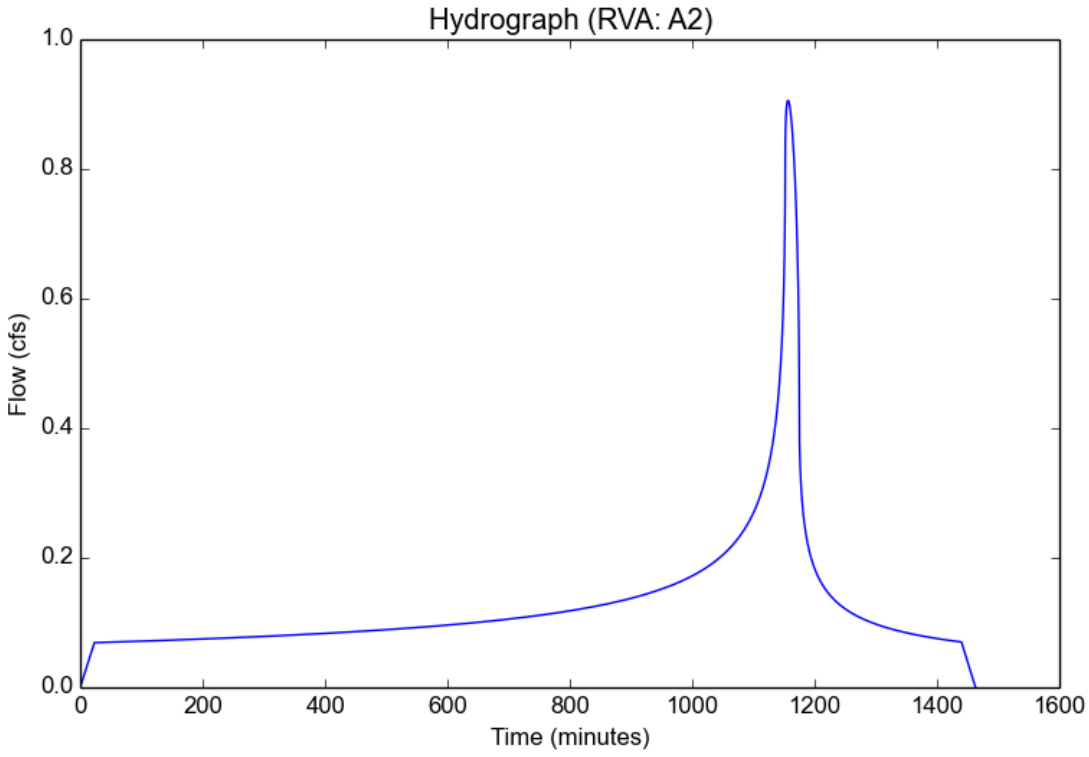
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	A2
Area (ac)	1.96
Flow Path Length (ft)	750.0
Flow Path Slope (vft/hft)	0.005
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.5691
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	23.0
Clear Peak Flow Rate (cfs)	0.9058
Burned Peak Flow Rate (cfs)	0.9058
24-Hr Clear Runoff Volume (ac-ft)	0.2571
24-Hr Clear Runoff Volume (cu-ft)	11197.4688



Peak Flow Hydrologic Analysis

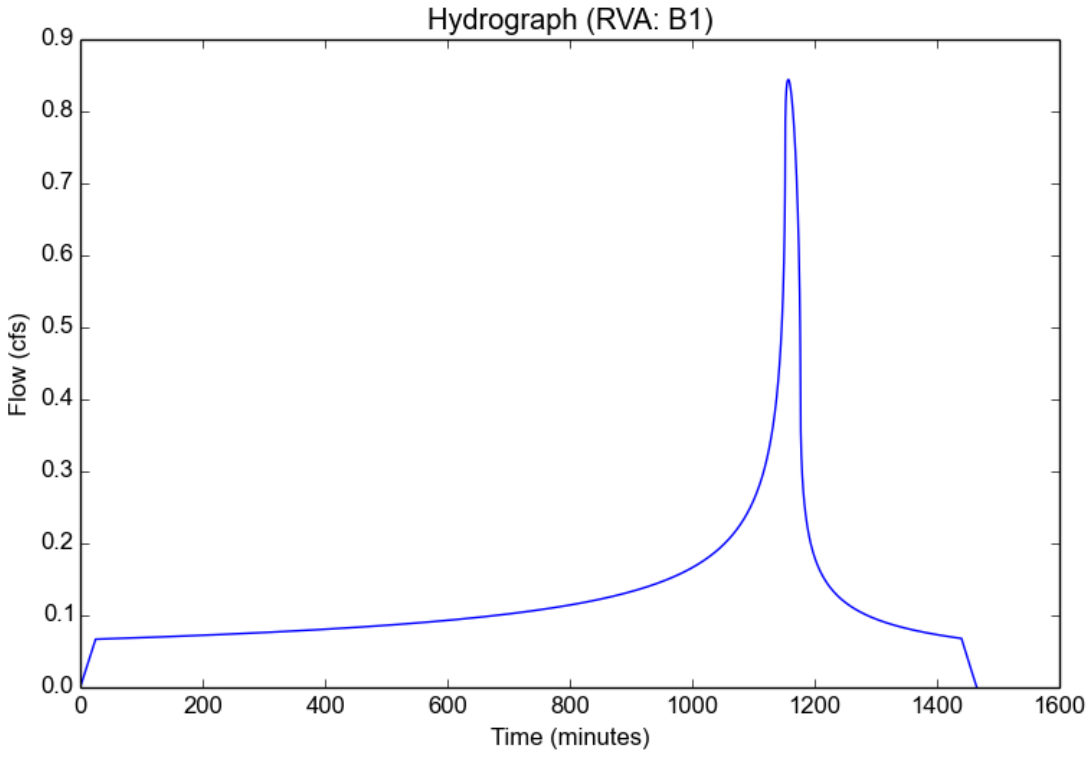
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B1
Area (ac)	1.9
Flow Path Length (ft)	840.0
Flow Path Slope (vft/hft)	0.005
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.5473
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	25.0
Clear Peak Flow Rate (cfs)	0.8443
Burned Peak Flow Rate (cfs)	0.8443
24-Hr Clear Runoff Volume (ac-ft)	0.2492
24-Hr Clear Runoff Volume (cu-ft)	10854.7025



Peak Flow Hydrologic Analysis

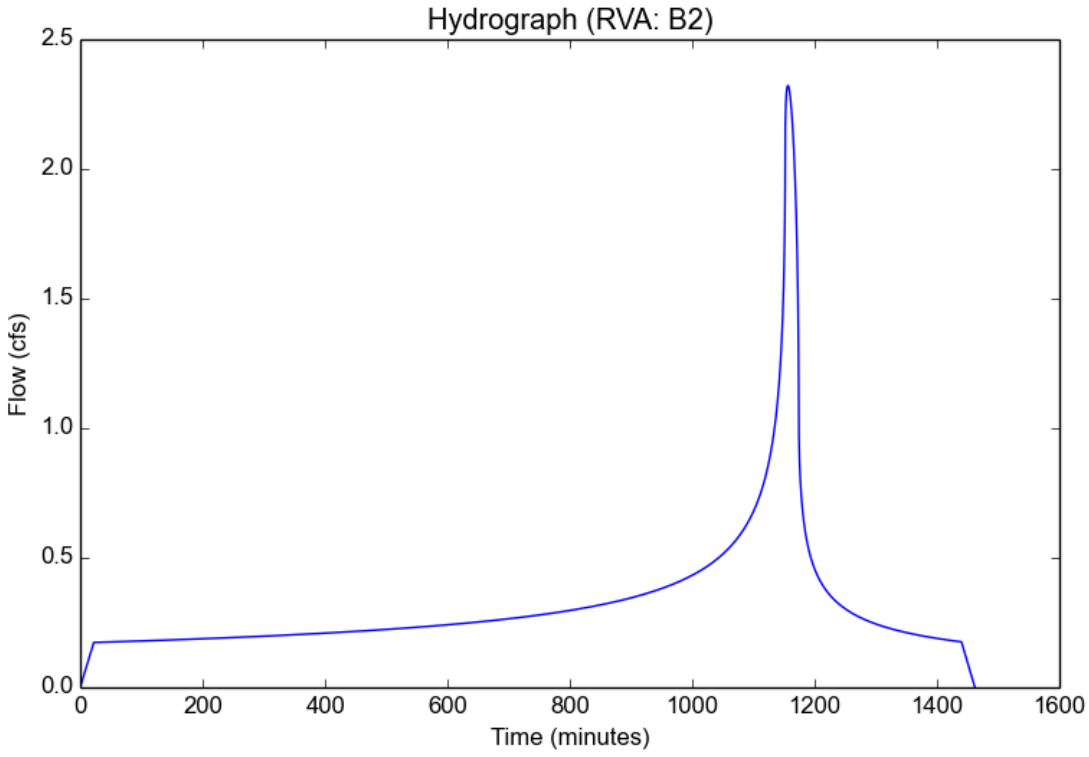
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B2
Area (ac)	4.92
Flow Path Length (ft)	860.0
Flow Path Slope (vft/hft)	0.0105
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.5811
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	22.0
Clear Peak Flow Rate (cfs)	2.3217
Burned Peak Flow Rate (cfs)	2.3217
24-Hr Clear Runoff Volume (ac-ft)	0.6453
24-Hr Clear Runoff Volume (cu-ft)	28107.9158



Peak Flow Hydrologic Analysis

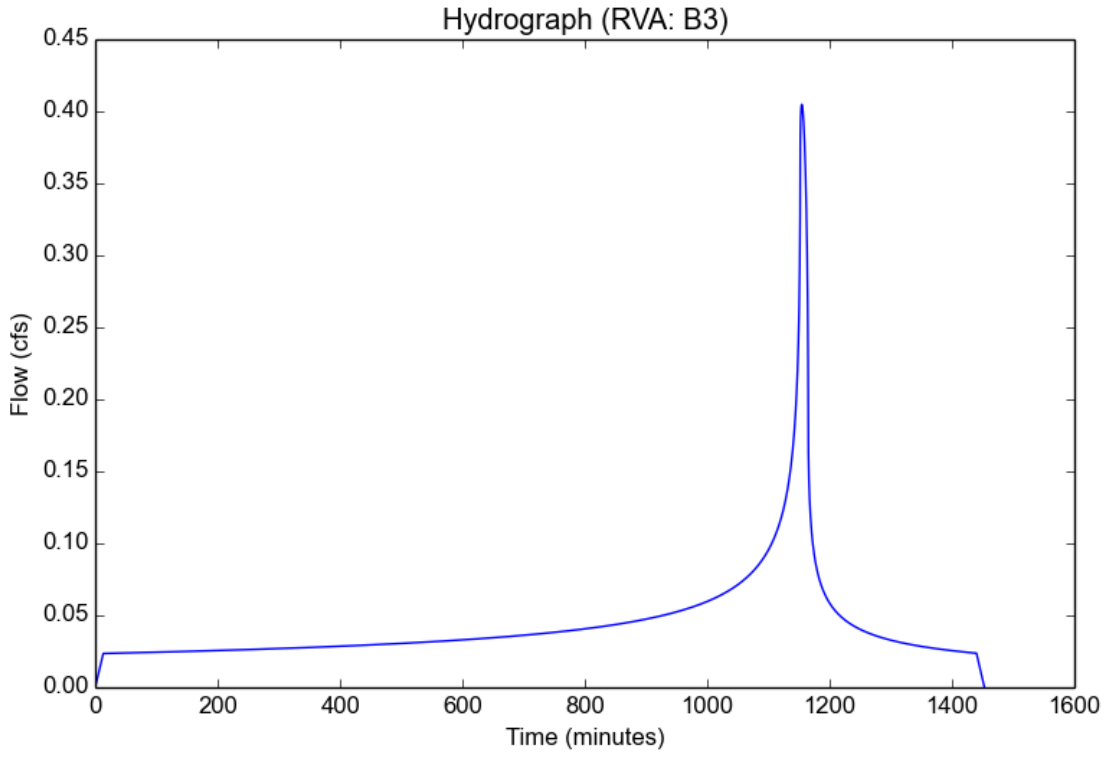
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B3
Area (ac)	0.67
Flow Path Length (ft)	310.0
Flow Path Slope (vft/hft)	0.0065
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.7442
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	0.4049
Burned Peak Flow Rate (cfs)	0.4049
24-Hr Clear Runoff Volume (ac-ft)	0.0879
24-Hr Clear Runoff Volume (cu-ft)	3827.6886



Peak Flow Hydrologic Analysis

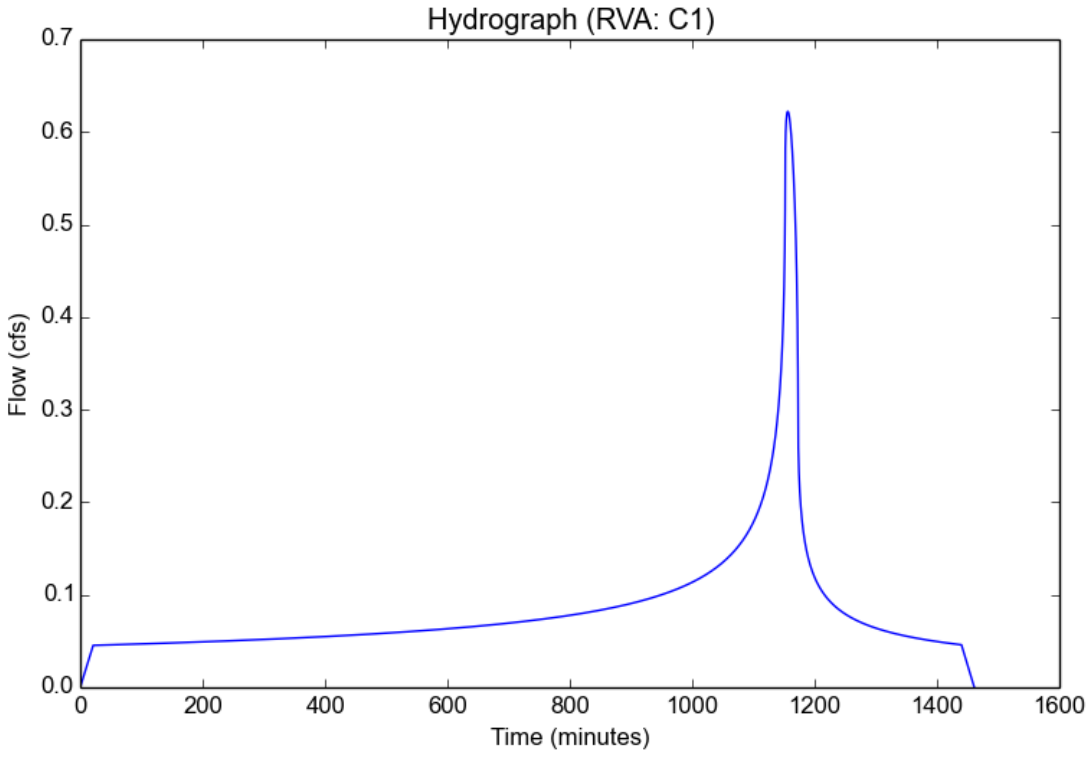
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	C1
Area (ac)	1.29
Flow Path Length (ft)	740.0
Flow Path Slope (vft/hft)	0.0095
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.594
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	21.0
Clear Peak Flow Rate (cfs)	0.6222
Burned Peak Flow Rate (cfs)	0.6222
24-Hr Clear Runoff Volume (ac-ft)	0.1692
24-Hr Clear Runoff Volume (cu-ft)	7369.7544



Peak Flow Hydrologic Analysis

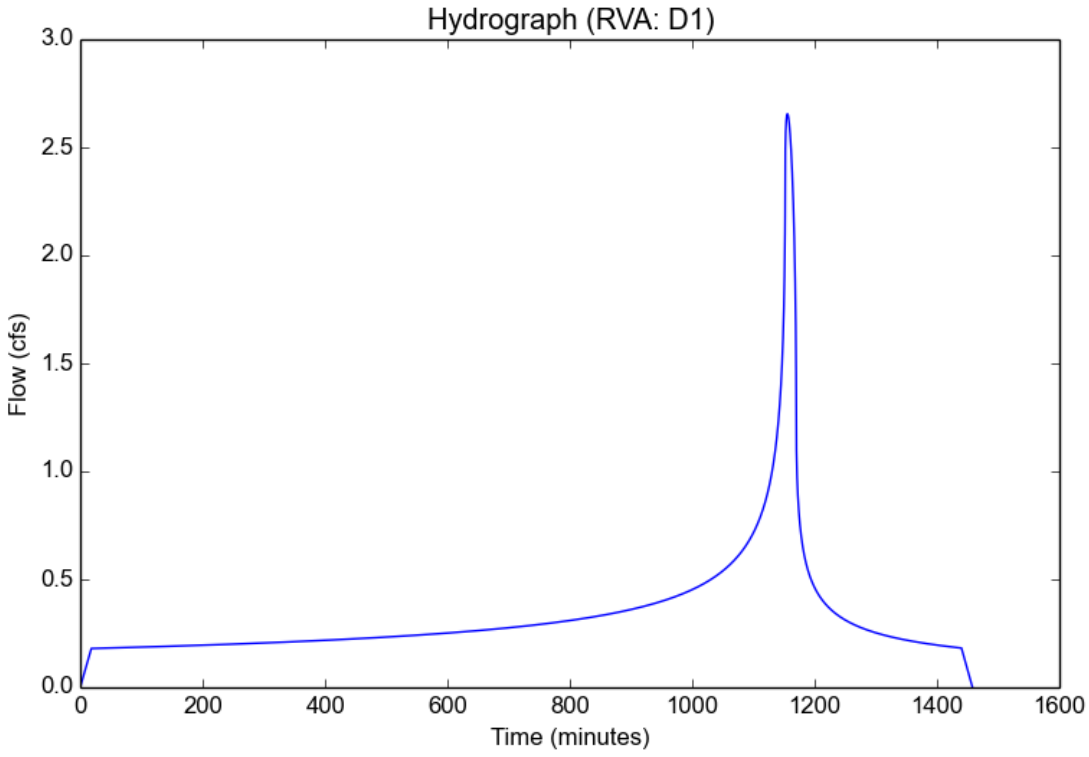
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	D1
Area (ac)	5.12
Flow Path Length (ft)	680.0
Flow Path Slope (vft/hft)	0.0162
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.6386
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	2.655
Burned Peak Flow Rate (cfs)	2.655
24-Hr Clear Runoff Volume (ac-ft)	0.6715
24-Hr Clear Runoff Volume (cu-ft)	29250.4543



Peak Flow Hydrologic Analysis

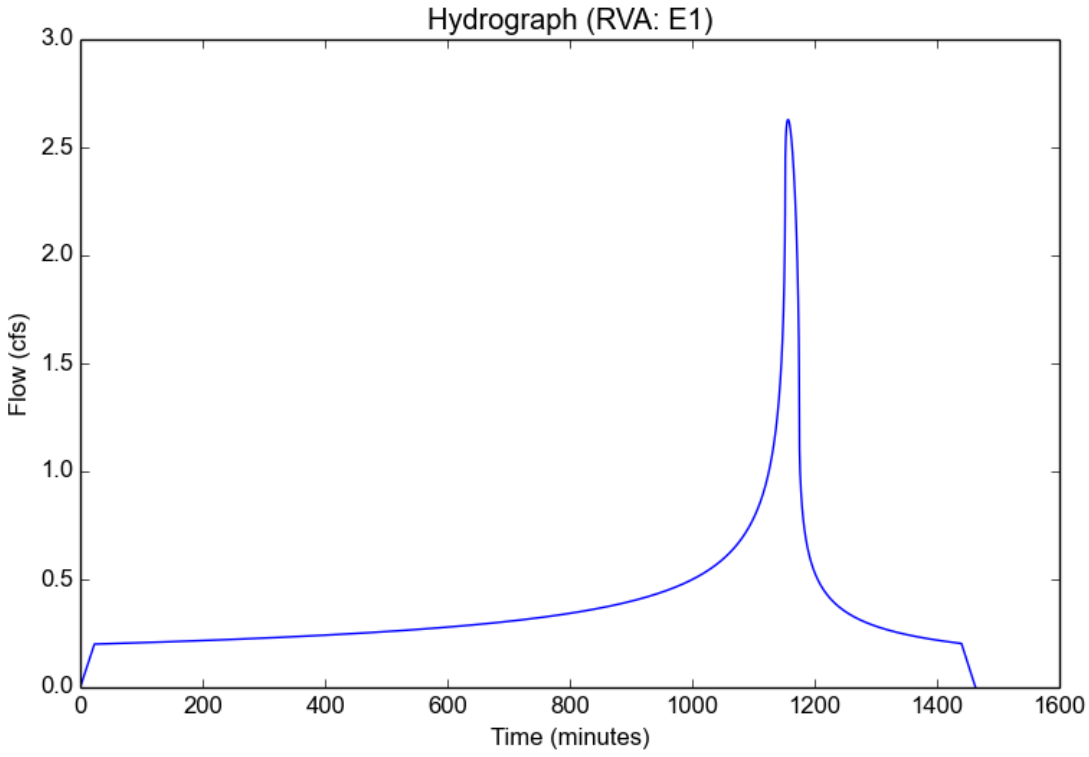
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E1
Area (ac)	7.45
Flow Path Length (ft)	1090.0
Flow Path Slope (vft/hft)	0.0523
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.65
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.5691
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.62
Time of Concentration (min)	23.0
Clear Peak Flow Rate (cfs)	2.6288
Burned Peak Flow Rate (cfs)	2.6288
24-Hr Clear Runoff Volume (ac-ft)	0.746
24-Hr Clear Runoff Volume (cu-ft)	32497.9319



Peak Flow Hydrologic Analysis

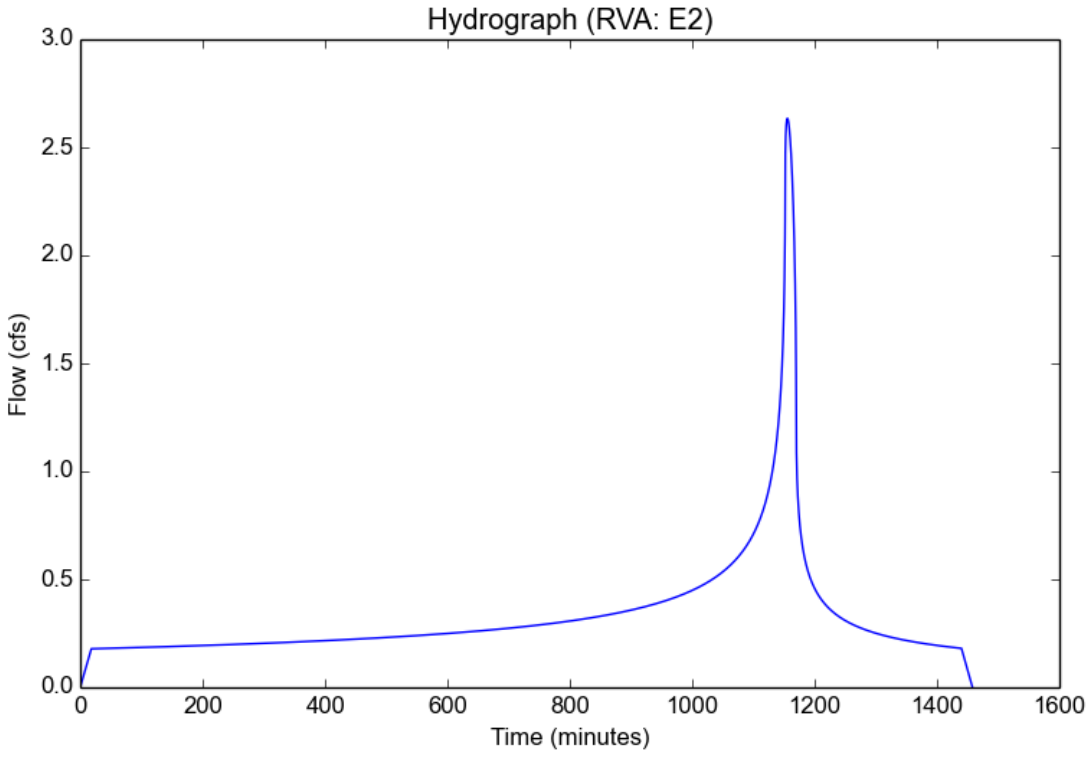
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E2
Area (ac)	5.08
Flow Path Length (ft)	790.0
Flow Path Slope (vft/hft)	0.0215
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.6386
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	2.6343
Burned Peak Flow Rate (cfs)	2.6343
24-Hr Clear Runoff Volume (ac-ft)	0.6663
24-Hr Clear Runoff Volume (cu-ft)	29021.9351



Peak Flow Hydrologic Analysis

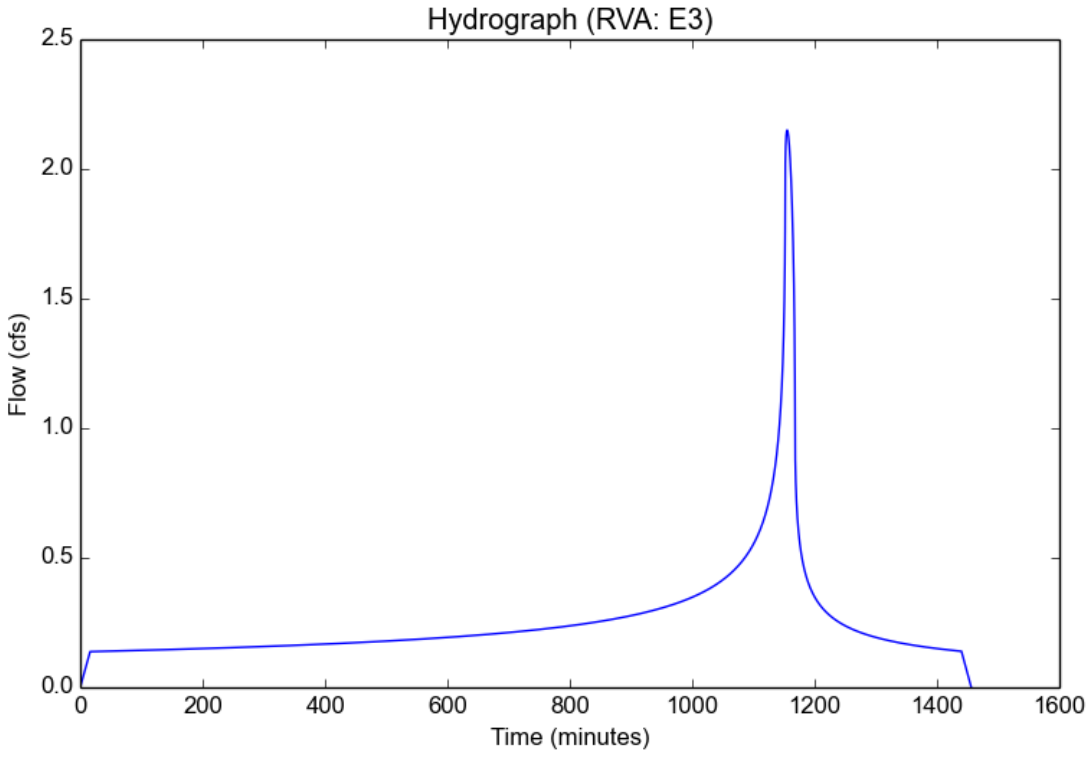
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E3
Area (ac)	4.55
Flow Path Length (ft)	720.0
Flow Path Slope (vft/hft)	0.0625
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.75
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.675
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.7
Time of Concentration (min)	16.0
Clear Peak Flow Rate (cfs)	2.1498
Burned Peak Flow Rate (cfs)	2.1498
24-Hr Clear Runoff Volume (ac-ft)	0.5144
24-Hr Clear Runoff Volume (cu-ft)	22408.6496



Peak Flow Hydrologic Analysis

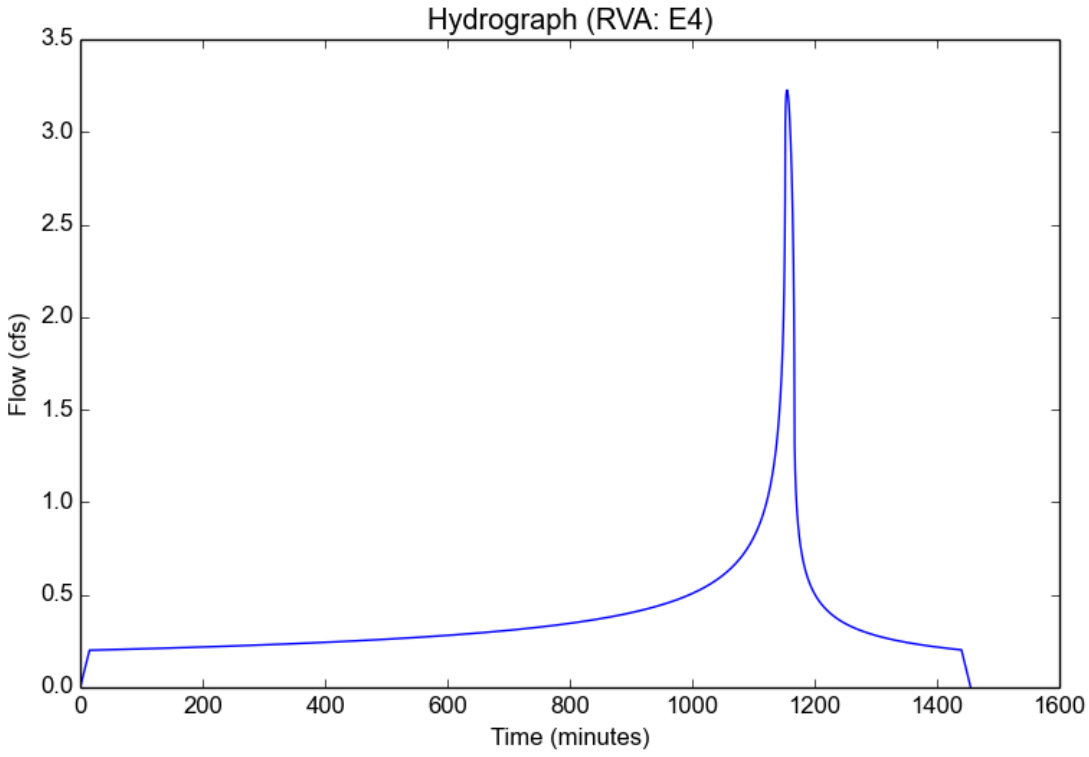
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E4
Area (ac)	5.71
Flow Path Length (ft)	650.0
Flow Path Slope (vft/hft)	0.0327
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.6958
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	3.2259
Burned Peak Flow Rate (cfs)	3.2259
24-Hr Clear Runoff Volume (ac-ft)	0.7489
24-Hr Clear Runoff Volume (cu-ft)	32621.071



Peak Flow Hydrologic Analysis

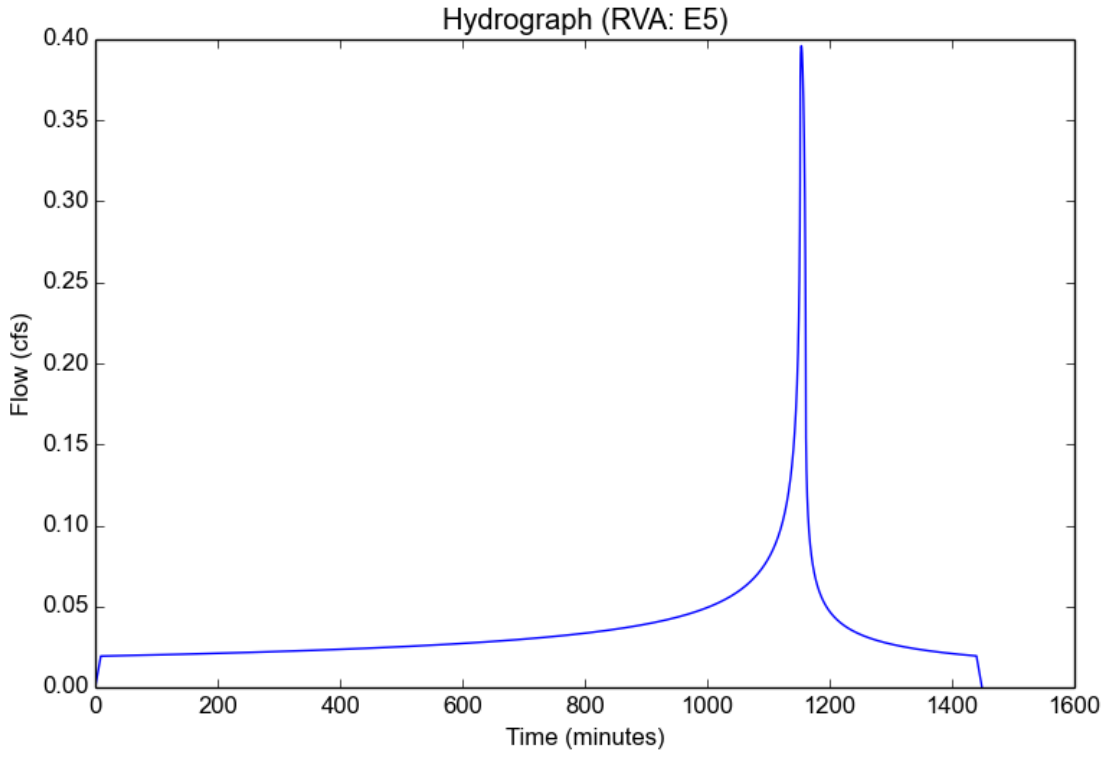
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E5
Area (ac)	0.55
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.8846
Undeveloped Runoff Coefficient (Cu)	0.1183
Developed Runoff Coefficient (Cd)	0.814
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	0.396
Burned Peak Flow Rate (cfs)	0.396
24-Hr Clear Runoff Volume (ac-ft)	0.0721
24-Hr Clear Runoff Volume (cu-ft)	3142.3305



Peak Flow Hydrologic Analysis

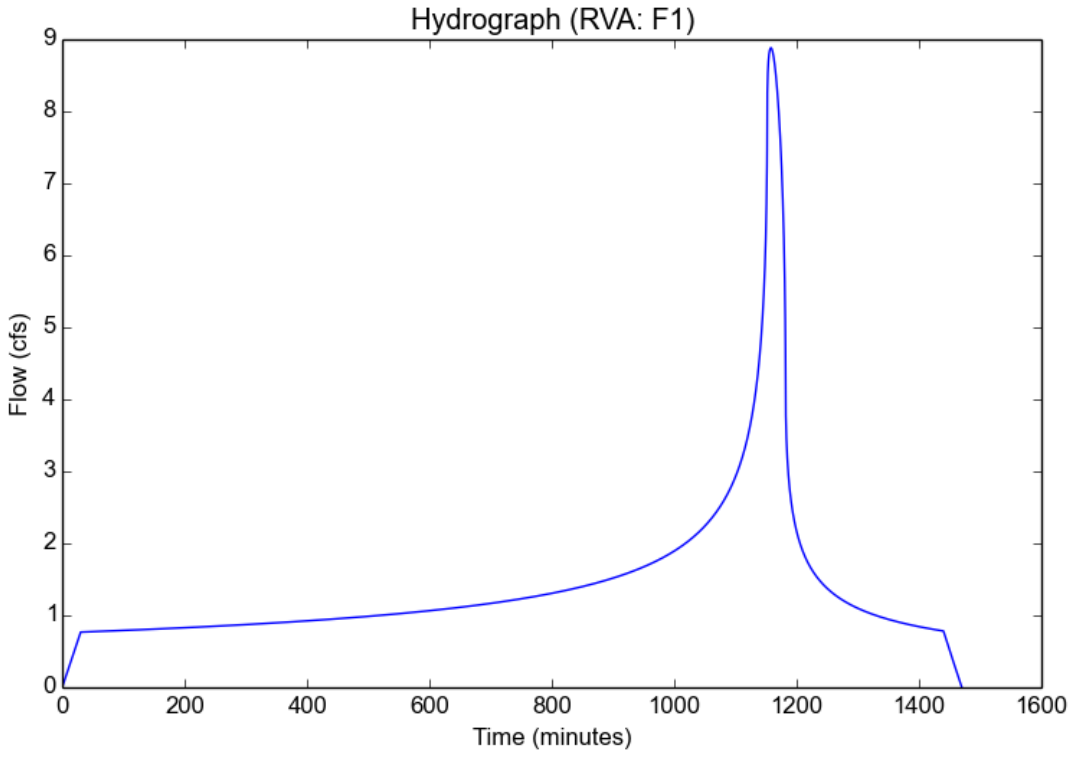
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	F1
Area (ac)	28.52
Flow Path Length (ft)	1640.0
Flow Path Slope (vft/hft)	0.0598
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.65
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.5023
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.62
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	8.8821
Burned Peak Flow Rate (cfs)	8.8821
24-Hr Clear Runoff Volume (ac-ft)	2.856
24-Hr Clear Runoff Volume (cu-ft)	124408.7828



Peak Flow Hydrologic Analysis

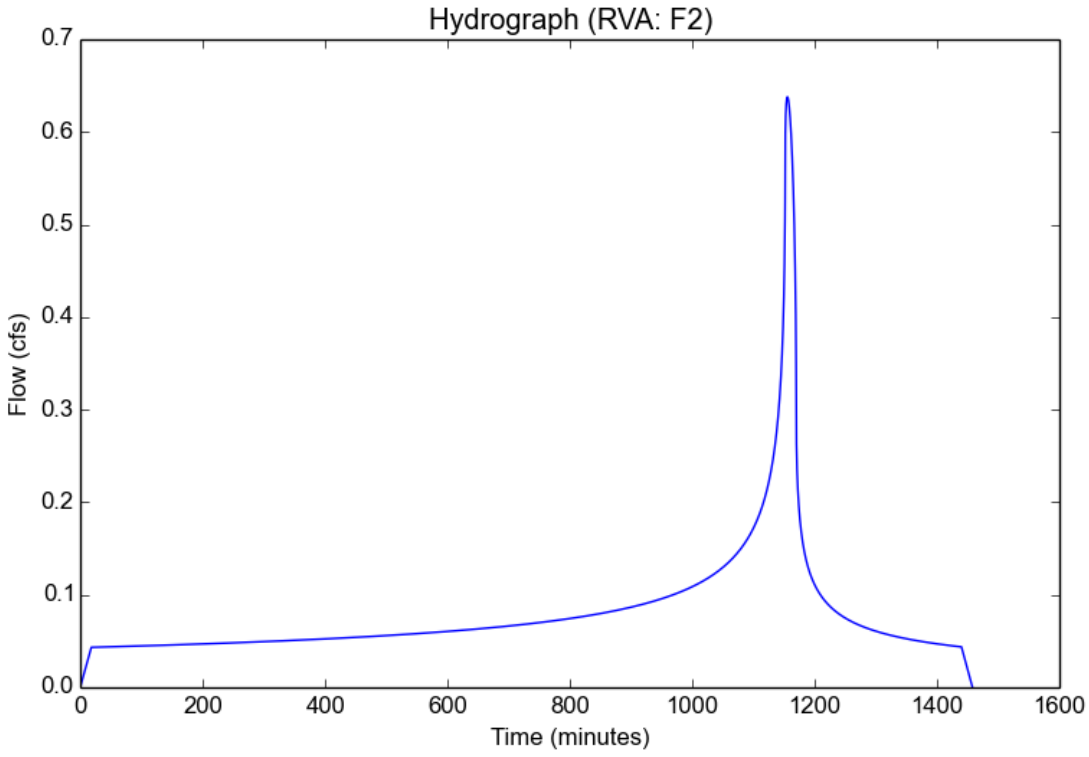
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	F2
Area (ac)	1.23
Flow Path Length (ft)	820.0
Flow Path Slope (vft/hft)	0.0293
50-yr Rainfall Depth (in)	5.05
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	1.9544
Peak Intensity (in/hr)	0.6386
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	0.6378
Burned Peak Flow Rate (cfs)	0.6378
24-Hr Clear Runoff Volume (ac-ft)	0.1613
24-Hr Clear Runoff Volume (cu-ft)	7026.9646



Peak Flow Hydrologic Analysis

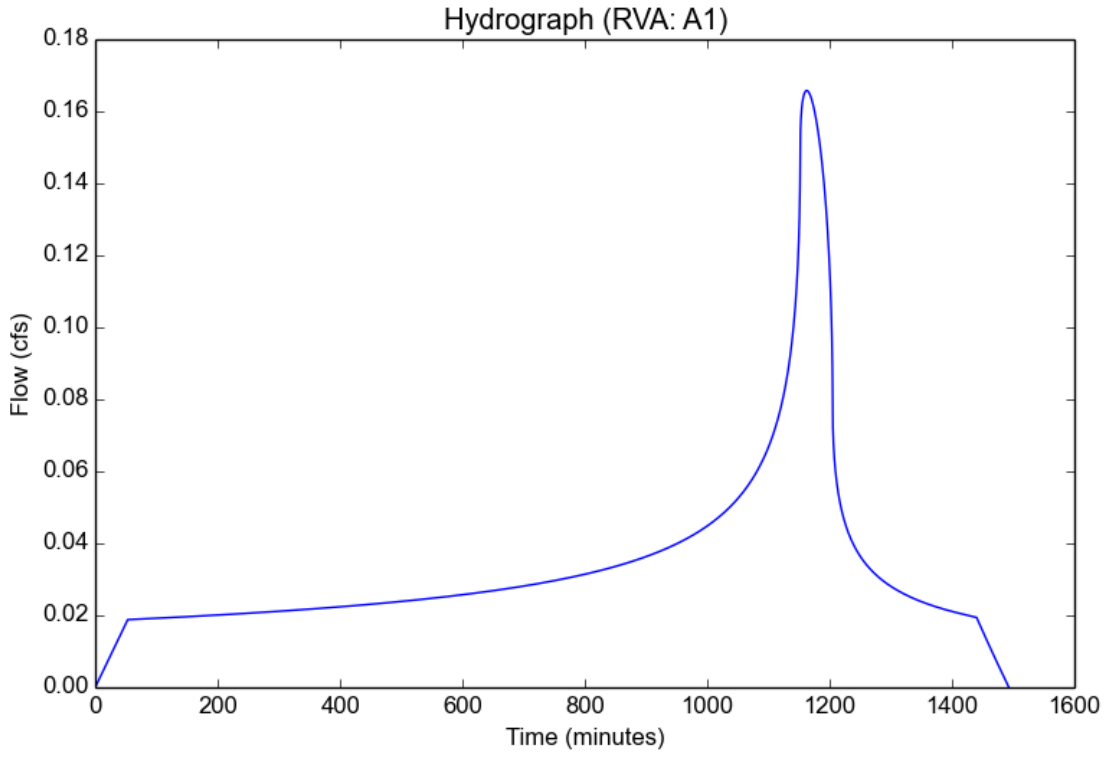
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	A1
Area (ac)	1.73
Flow Path Length (ft)	900.0
Flow Path Slope (vft/hft)	0.0088
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.118
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	53.0
Clear Peak Flow Rate (cfs)	0.1658
Burned Peak Flow Rate (cfs)	0.1658
24-Hr Clear Runoff Volume (ac-ft)	0.0697
24-Hr Clear Runoff Volume (cu-ft)	3034.392



Peak Flow Hydrologic Analysis

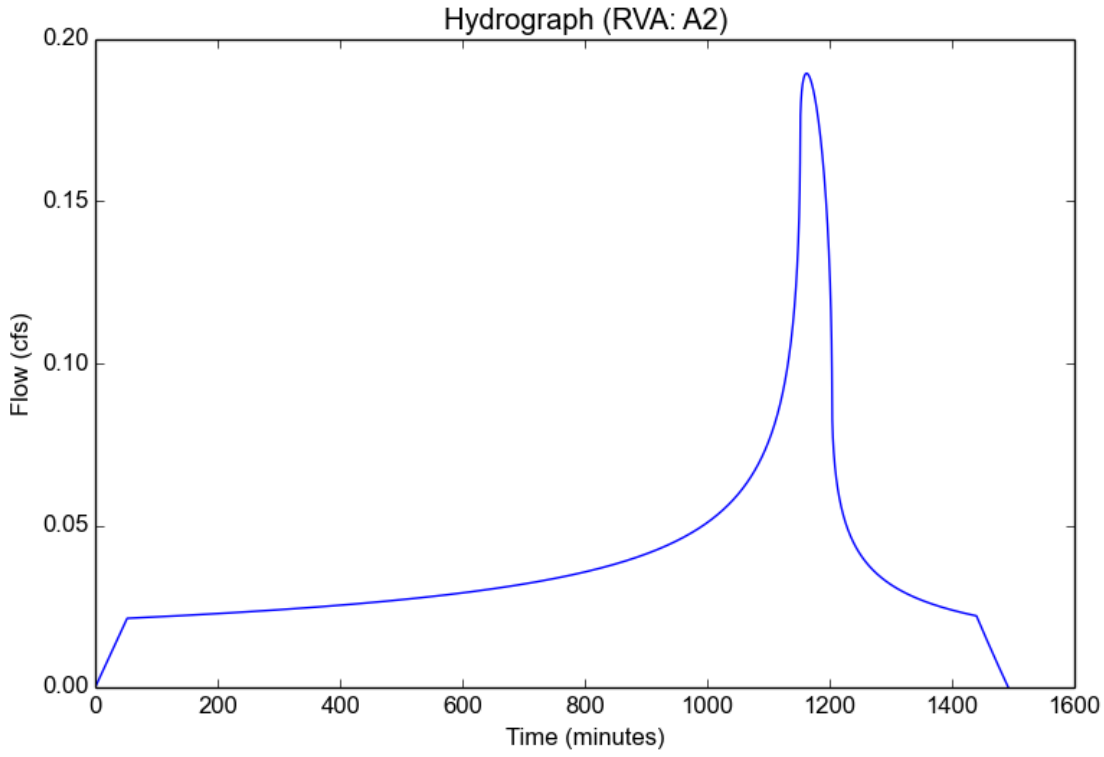
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	A2
Area (ac)	1.96
Flow Path Length (ft)	750.0
Flow Path Slope (vft/hft)	0.005
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1191
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	52.0
Clear Peak Flow Rate (cfs)	0.1895
Burned Peak Flow Rate (cfs)	0.1895
24-Hr Clear Runoff Volume (ac-ft)	0.0789
24-Hr Clear Runoff Volume (cu-ft)	3437.8035



Peak Flow Hydrologic Analysis

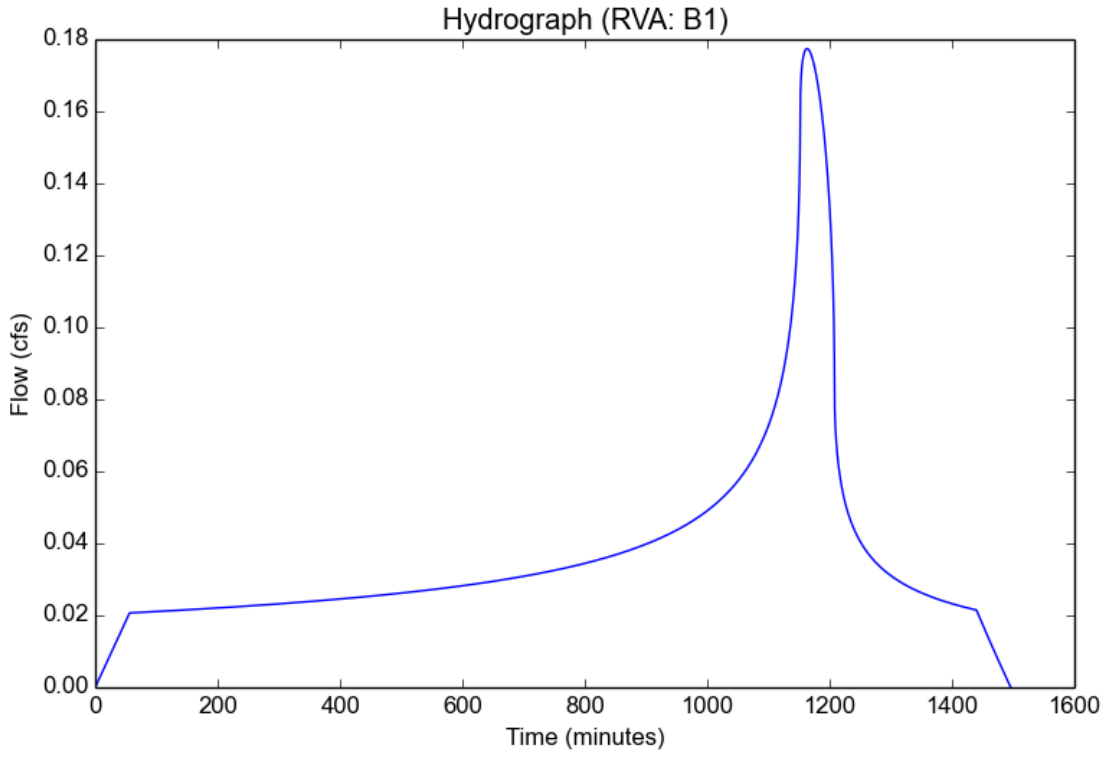
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B1
Area (ac)	1.9
Flow Path Length (ft)	840.0
Flow Path Slope (vft/hft)	0.005
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.115
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	56.0
Clear Peak Flow Rate (cfs)	0.1774
Burned Peak Flow Rate (cfs)	0.1774
24-Hr Clear Runoff Volume (ac-ft)	0.0765
24-Hr Clear Runoff Volume (cu-ft)	3332.5836



Peak Flow Hydrologic Analysis

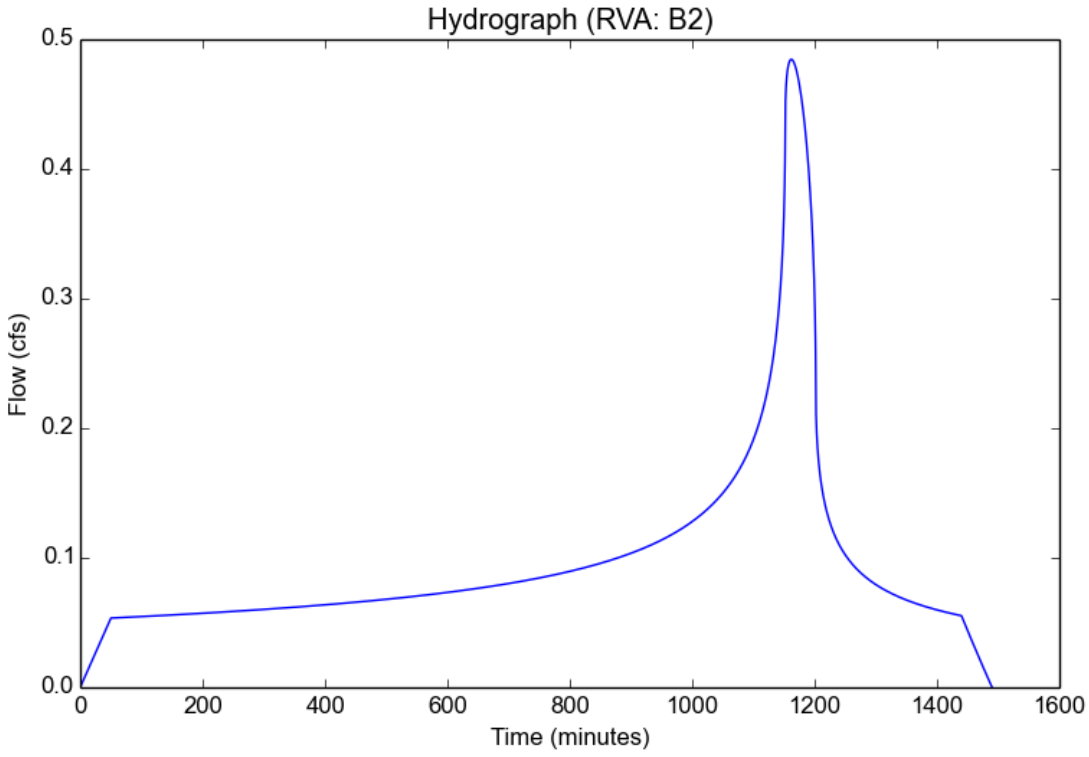
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B2
Area (ac)	4.92
Flow Path Length (ft)	860.0
Flow Path Slope (vft/hft)	0.0105
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1213
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	50.0
Clear Peak Flow Rate (cfs)	0.4846
Burned Peak Flow Rate (cfs)	0.4846
24-Hr Clear Runoff Volume (ac-ft)	0.1981
24-Hr Clear Runoff Volume (cu-ft)	8629.5652



Peak Flow Hydrologic Analysis

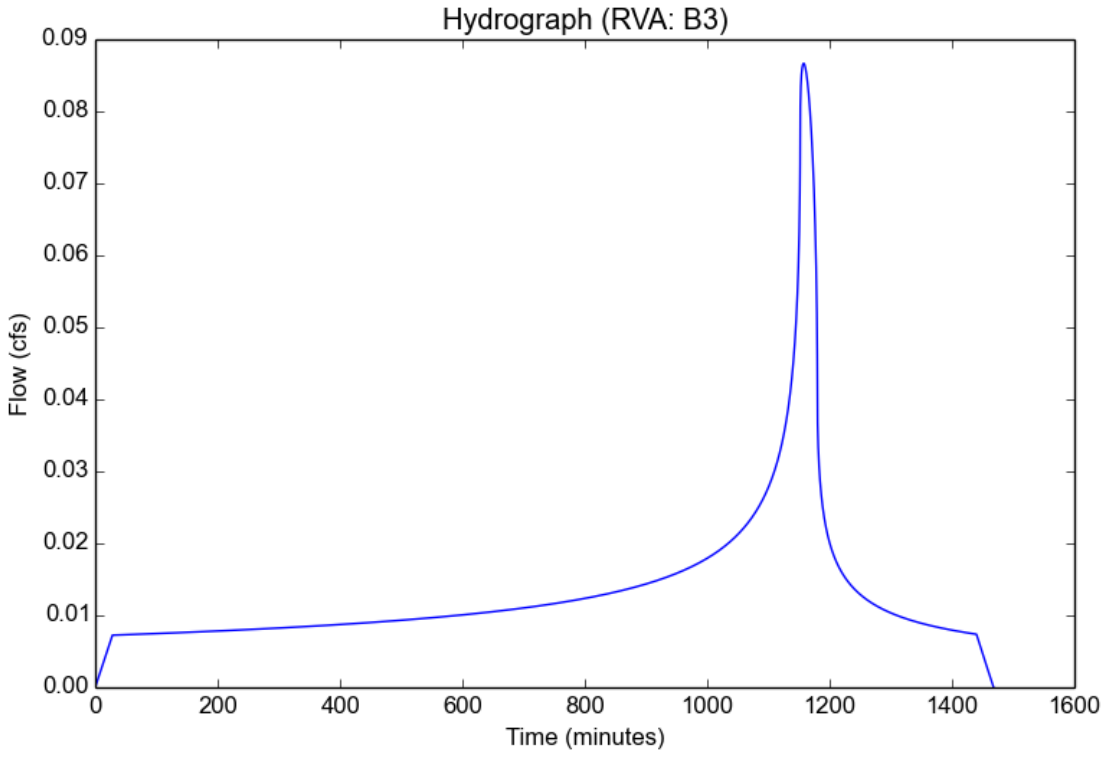
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	B3
Area (ac)	0.67
Flow Path Length (ft)	310.0
Flow Path Slope (vft/hft)	0.0065
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1593
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	28.0
Clear Peak Flow Rate (cfs)	0.0867
Burned Peak Flow Rate (cfs)	0.0867
24-Hr Clear Runoff Volume (ac-ft)	0.027
24-Hr Clear Runoff Volume (cu-ft)	1175.1381



Peak Flow Hydrologic Analysis

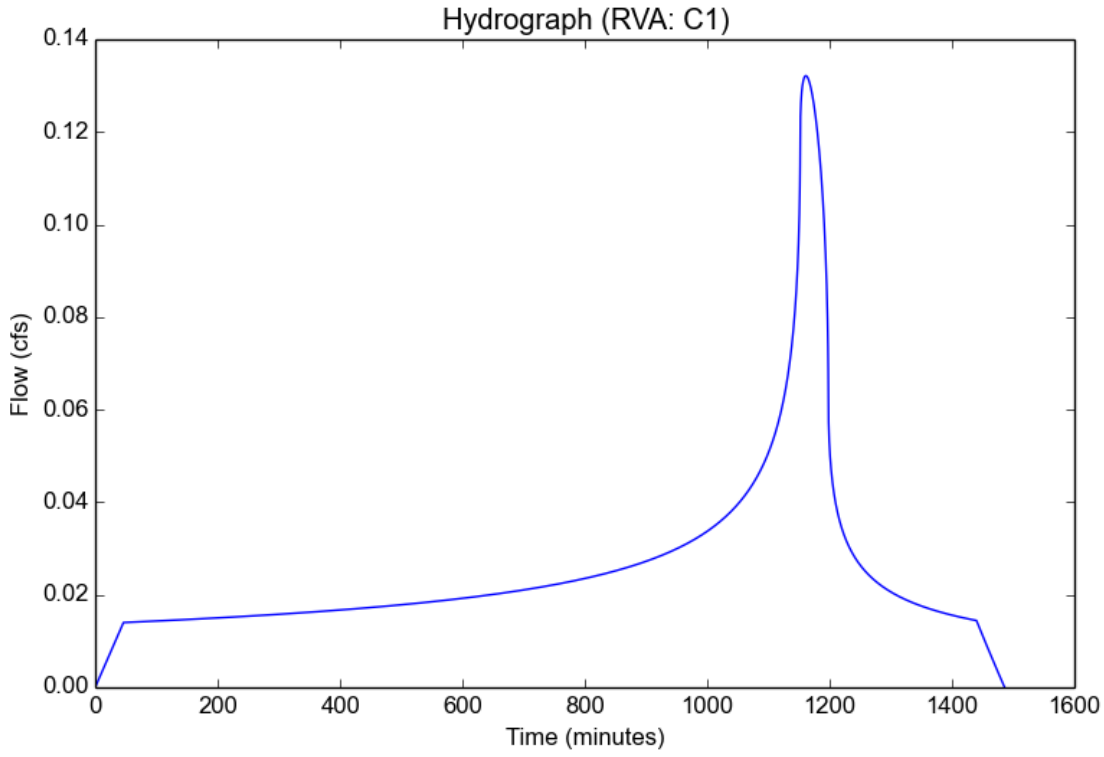
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	C1
Area (ac)	1.29
Flow Path Length (ft)	740.0
Flow Path Slope (vft/hft)	0.0095
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1261
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	46.0
Clear Peak Flow Rate (cfs)	0.1321
Burned Peak Flow Rate (cfs)	0.1321
24-Hr Clear Runoff Volume (ac-ft)	0.0519
24-Hr Clear Runoff Volume (cu-ft)	2262.6185



Peak Flow Hydrologic Analysis

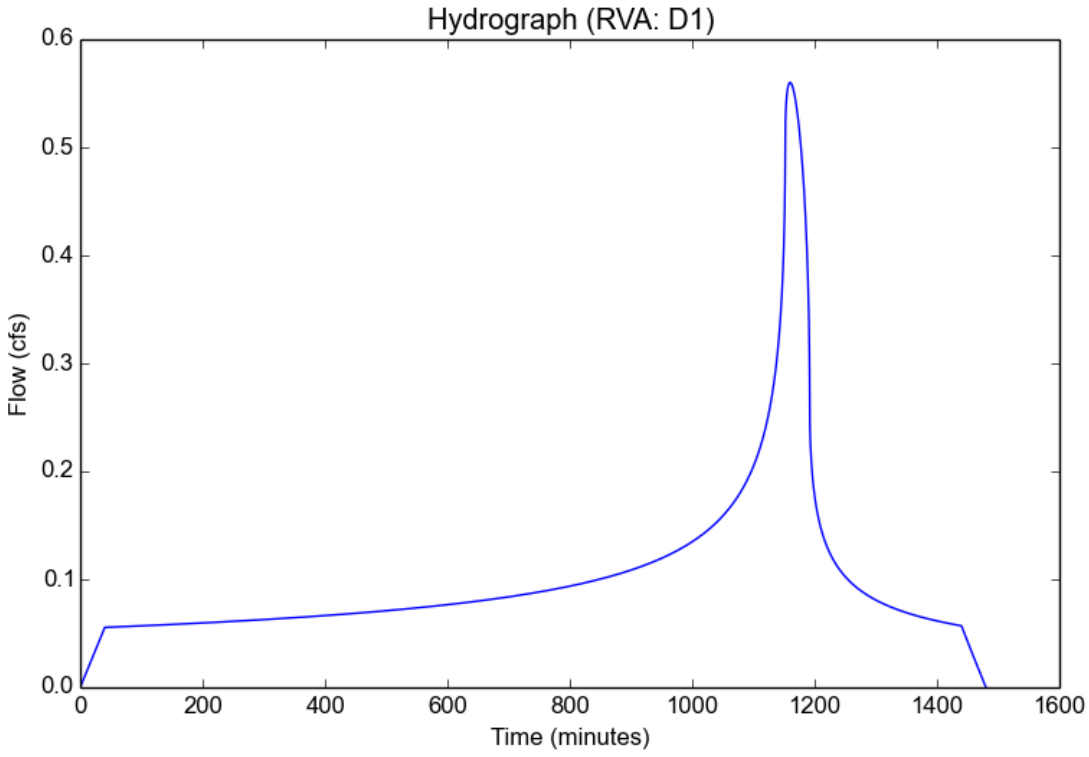
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	D1
Area (ac)	5.12
Flow Path Length (ft)	680.0
Flow Path Slope (vft/hft)	0.0162
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1347
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	40.0
Clear Peak Flow Rate (cfs)	0.5601
Burned Peak Flow Rate (cfs)	0.5601
24-Hr Clear Runoff Volume (ac-ft)	0.2062
24-Hr Clear Runoff Volume (cu-ft)	8980.2549



Peak Flow Hydrologic Analysis

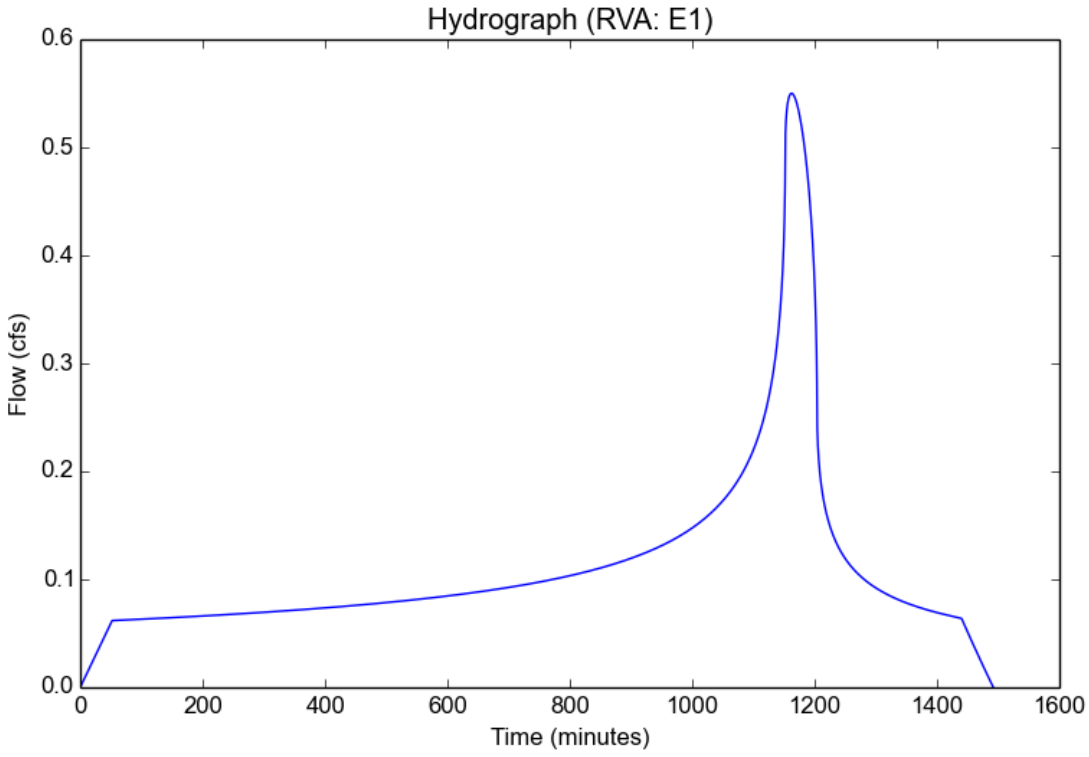
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E1
Area (ac)	7.45
Flow Path Length (ft)	1090.0
Flow Path Slope (vft/hft)	0.0523
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.65
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1191
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.62
Time of Concentration (min)	52.0
Clear Peak Flow Rate (cfs)	0.55
Burned Peak Flow Rate (cfs)	0.55
24-Hr Clear Runoff Volume (ac-ft)	0.229
24-Hr Clear Runoff Volume (cu-ft)	9977.3892



Peak Flow Hydrologic Analysis

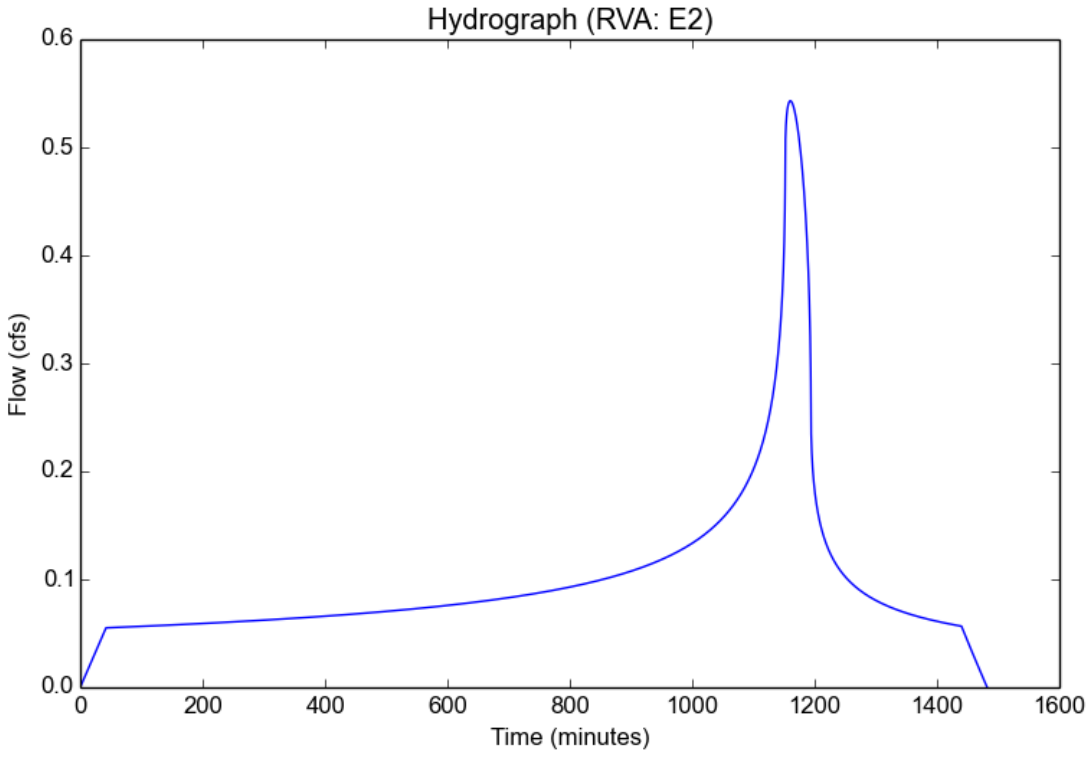
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E2
Area (ac)	5.08
Flow Path Length (ft)	790.0
Flow Path Slope (vft/hft)	0.0215
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1317
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	42.0
Clear Peak Flow Rate (cfs)	0.5431
Burned Peak Flow Rate (cfs)	0.5431
24-Hr Clear Runoff Volume (ac-ft)	0.2045
24-Hr Clear Runoff Volume (cu-ft)	8910.1157



Peak Flow Hydrologic Analysis

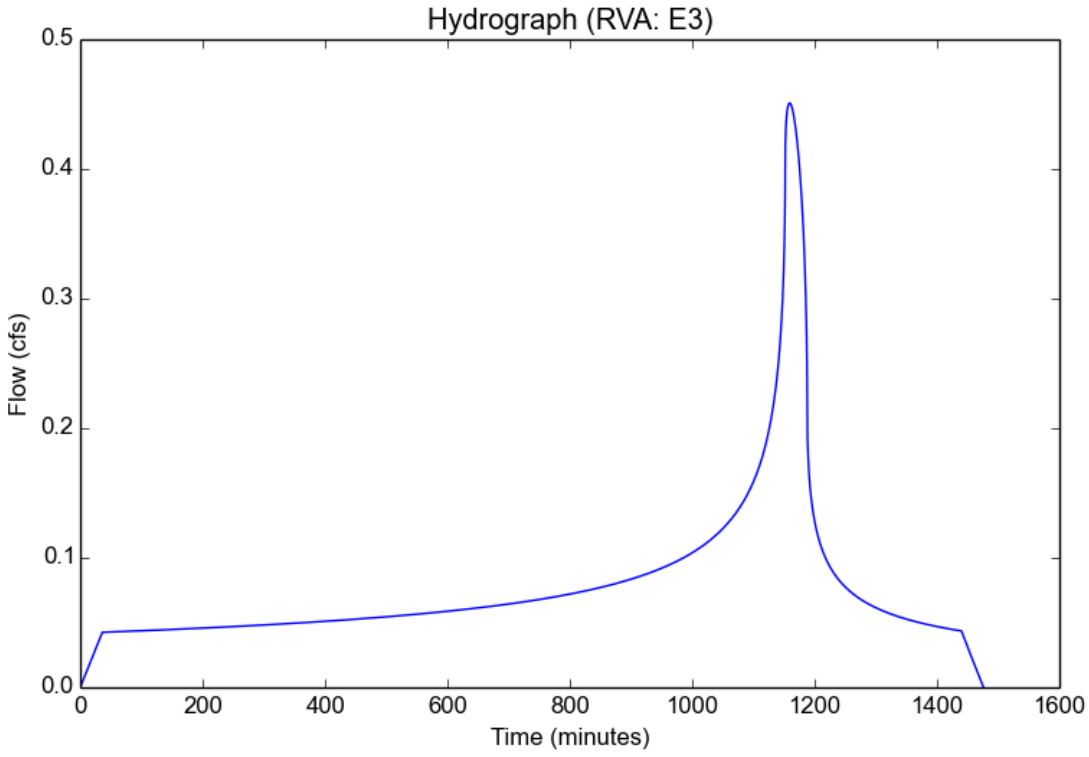
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E3
Area (ac)	4.55
Flow Path Length (ft)	720.0
Flow Path Slope (vft/hft)	0.0625
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.75
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1415
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.7
Time of Concentration (min)	36.0
Clear Peak Flow Rate (cfs)	0.4508
Burned Peak Flow Rate (cfs)	0.4508
24-Hr Clear Runoff Volume (ac-ft)	0.1579
24-Hr Clear Runoff Volume (cu-ft)	6879.7142



Peak Flow Hydrologic Analysis

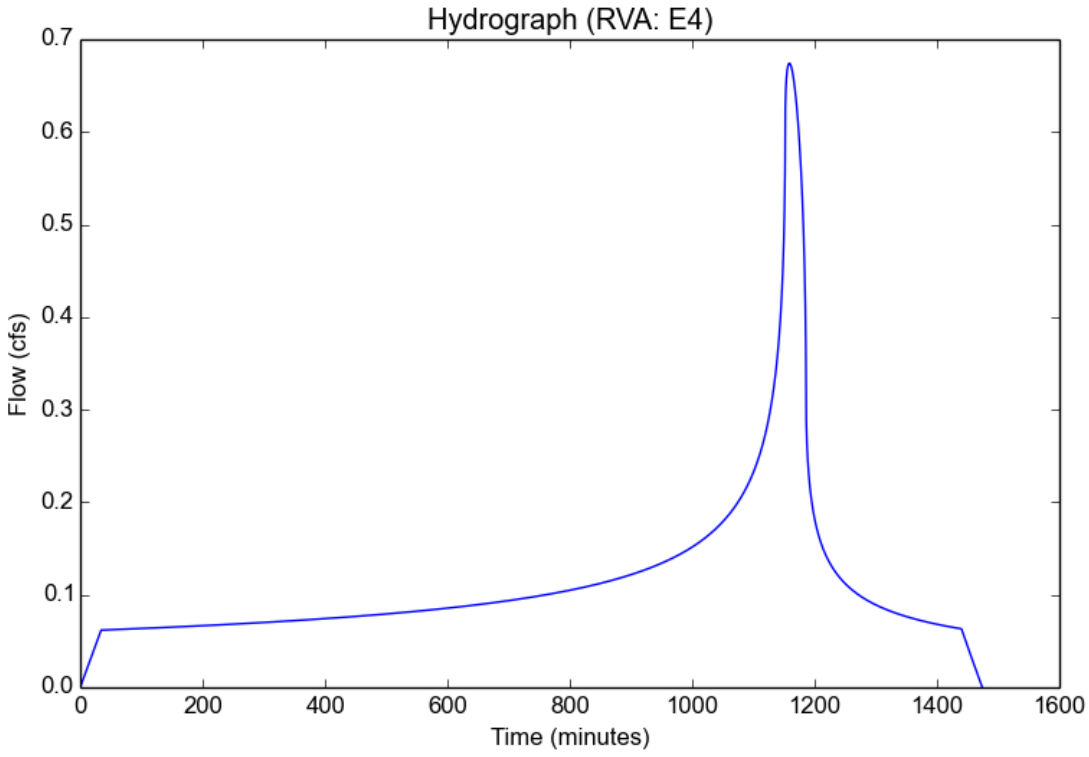
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E4
Area (ac)	5.71
Flow Path Length (ft)	650.0
Flow Path Slope (vft/hft)	0.0327
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1454
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	34.0
Clear Peak Flow Rate (cfs)	0.6742
Burned Peak Flow Rate (cfs)	0.6742
24-Hr Clear Runoff Volume (ac-ft)	0.2299
24-Hr Clear Runoff Volume (cu-ft)	10015.0313



Peak Flow Hydrologic Analysis

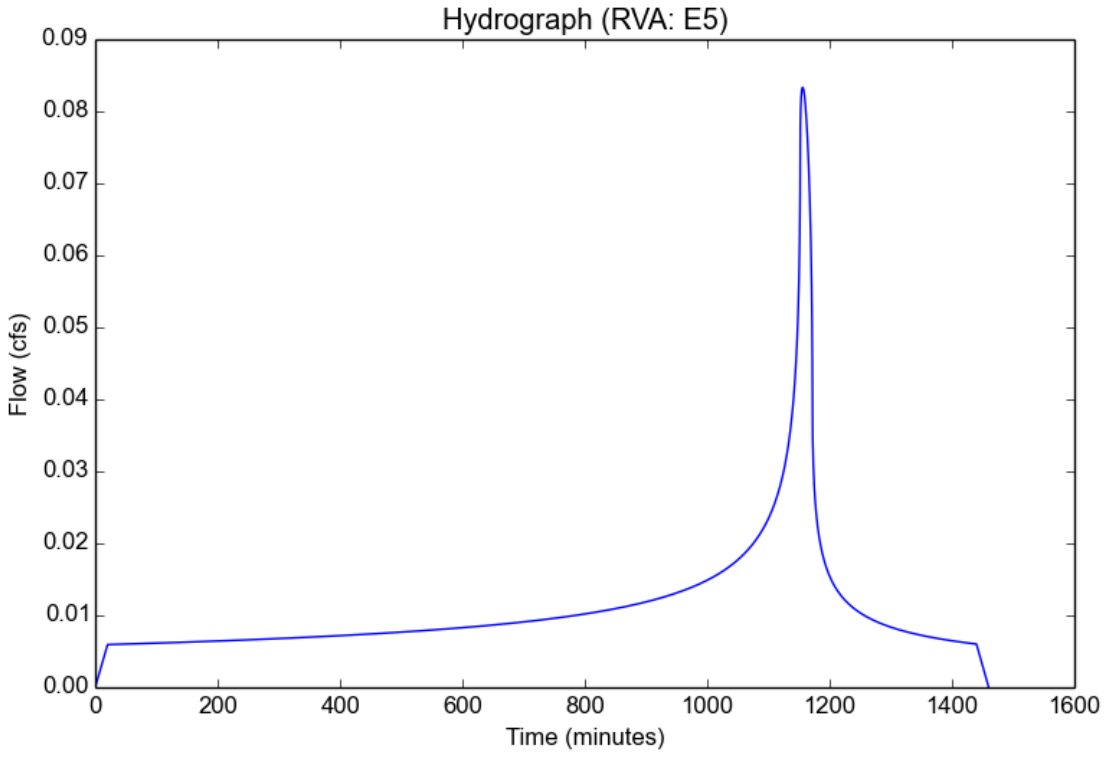
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	E5
Area (ac)	0.55
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1866
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	0.0833
Burned Peak Flow Rate (cfs)	0.0833
24-Hr Clear Runoff Volume (ac-ft)	0.0221
24-Hr Clear Runoff Volume (cu-ft)	964.6609



Peak Flow Hydrologic Analysis

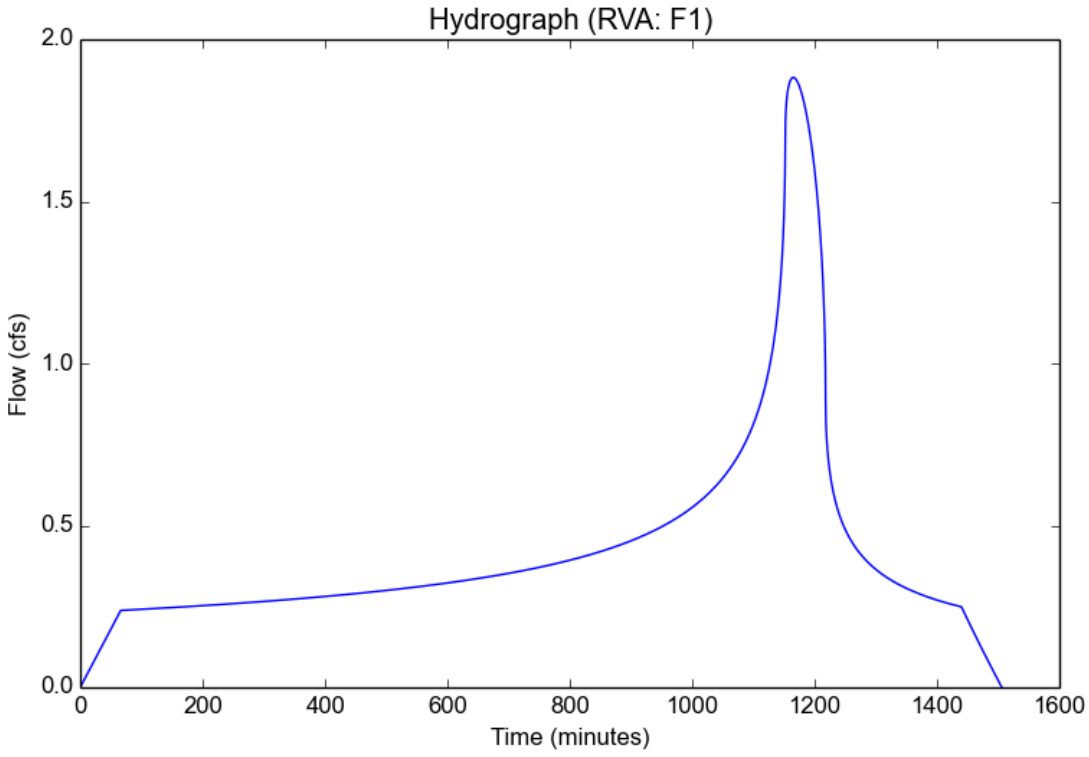
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	F1
Area (ac)	28.52
Flow Path Length (ft)	1640.0
Flow Path Slope (vft/hft)	0.0598
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.65
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1065
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.62
Time of Concentration (min)	66.0
Clear Peak Flow Rate (cfs)	1.8825
Burned Peak Flow Rate (cfs)	1.8825
24-Hr Clear Runoff Volume (ac-ft)	0.8769
24-Hr Clear Runoff Volume (cu-ft)	38196.1574



Peak Flow Hydrologic Analysis

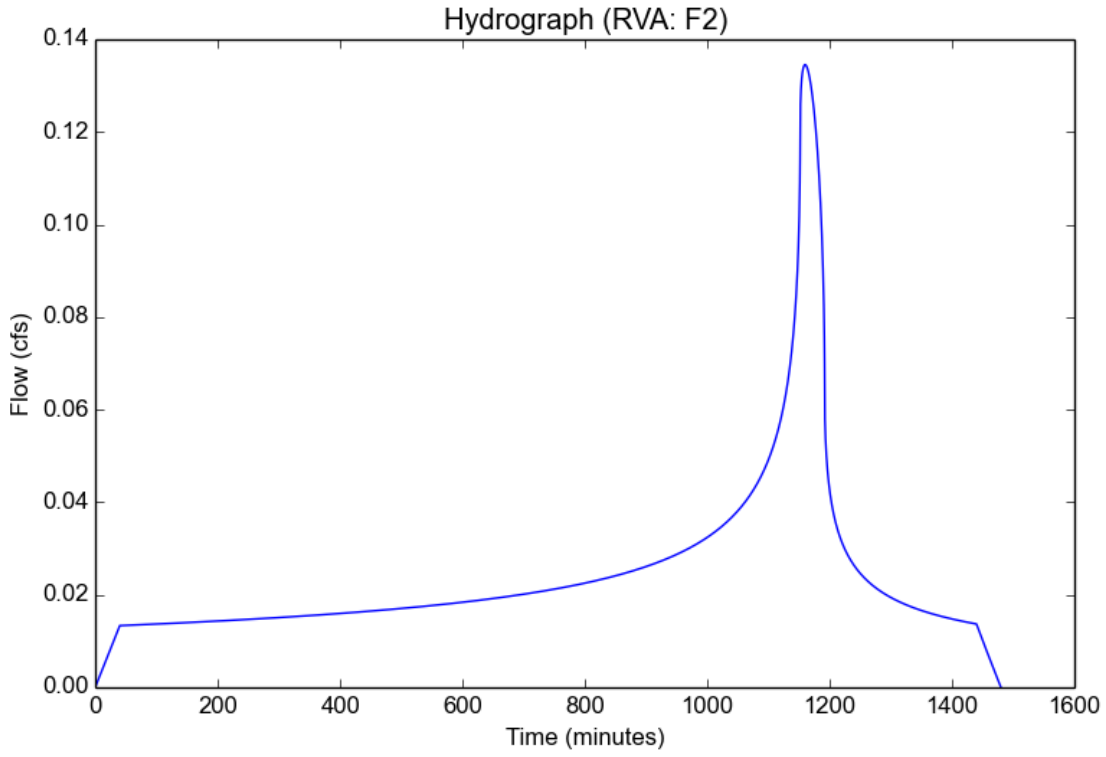
File location: P:/01050_RVA/20001_Hydrology Study/Calcs/HydroCalc Output/RVA Report_REV.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	RVA
Subarea ID	F2
Area (ac)	1.23
Flow Path Length (ft)	820.0
Flow Path Slope (vft/hft)	0.0293
85th Percentile Rainfall Depth (in)	0.6
Percent Impervious	0.89
Soil Type	10
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.6
Peak Intensity (in/hr)	0.1347
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.812
Time of Concentration (min)	40.0
Clear Peak Flow Rate (cfs)	0.1345
Burned Peak Flow Rate (cfs)	0.1345
24-Hr Clear Runoff Volume (ac-ft)	0.0495
24-Hr Clear Runoff Volume (cu-ft)	2157.3659



Appendix D – Hydraulic Calculations, Inlet and Conduit Sizing Calculations

Hydraulic Calculations Summary Table														
Location	**Conduit Size**		**Flow Depth (in.)**			**Upstream Flow Depth (in.)**			**Upstream Flow Velocity (ft/sec)**			**Upstream Street Spread Width (ft.)**		
	85th	**2-yr**	**85th**	**2-yr**	**25-yr**	**85th**	**2-yr**	**25-yr**	**85th**	**2-yr**	**25-yr**	**85th**	**2-yr**	**25-yr**
Avenue I (Both Sides)	6"H x 6" W	6"H x 6" W	1.6	5.3	6.7	1.4	2.3	3.5	2.46	3.36	3.92	1.4	3.3	8.4
Catalina East	6"H x 6" W	6"H x 16" W	4.3	5.4	7.3	2.2	3.6	4.9	2.71	3.23	3.98	2.9	8.7	14.0
Catalina West	6"H x 6" W	6"H x 6" W	1.5	4.6	6.6	1.3	2.3	3.3	1.92	2.73	3.05	1.3	3.2	7.2
Catalina Southeast	6"H x 6" W	6"H x 30" W	4.6	5.5	8.7	2.3	4.5	7.0	1.93	2.66	3.72	3.2	12.5	22.9
Catalina Southwest	6"H x 6" W	6"H x 16" W	1.8	5.8	8.6	1.5	3.7	6.8	1.48	2.32	3.63	1.5	9.1	22.0

Catalina Southwest_Street Flow_85th

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.500 %
Discharge	0.13 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	1.45 ft
Flow Area	0.1 ft²
Depth	1.5 in
Gutter Depression	1.5 in
Velocity	1.48 ft/s

Catalina Southwest_Street Flow_25yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.500 %
Discharge	18.07 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	22.01 ft
Flow Area	5.0 ft²
Depth	6.8 in
Gutter Depression	1.5 in
Velocity	3.63 ft/s

Catalina Southwest_SB @ Curb_25yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Discharge	18.07 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.75
0+14.0	0.47
0+14.1	2.50
0+15.0	2.50
0+15.1	0.50
0+26.9	0.50
0+27.0	0.00
0+29.5	0.00
0+29.6	0.50
0+40.0	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.75)	(0+40.0, 0.70)	0.013

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	8.5 in
Roughness Coefficient	0.013
Elevation	0.71 ft
Elevation Range	0.00 to 2.50 ft
Flow Area	7.0 ft²
Wetted Perimeter	38.23 ft
Hydraulic Radius	2.2 in
Top Width	36.97 ft
Normal Depth	8.5 in
Critical Depth	8.6 in
Critical Slope	0.445 %

Results	
Velocity	2.59 ft/s
Velocity Head	0.10 ft
Specific Energy	0.82 ft
Froude Number	1.054
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	8.5 in
Critical Depth	8.6 in
Channel Slope	0.500 %
Critical Slope	0.445 %

Catalina Southeast_Street Flow_25yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.500 %
Discharge	19.89 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	22.85 ft
Flow Area	5.3 ft²
Depth	7.0 in
Gutter Depression	1.5 in
Velocity	3.72 ft/s

Catalina Southeast_Street Flow_2yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.500 %
Discharge	4.48 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	12.49 ft
Flow Area	1.7 ft²
Depth	4.5 in
Gutter Depression	1.5 in
Velocity	2.66 ft/s

Catalina Southeast_Street Flow_85th

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.500 %
Discharge	0.44 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	3.18 ft
Flow Area	0.2 ft²
Depth	2.3 in
Gutter Depression	1.5 in
Velocity	1.93 ft/s

Catalina Southeast_SB @ Curb_25yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Discharge	19.89 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.75
0+14.0	0.47
0+14.1	2.50
0+15.0	2.50
0+15.1	0.50
0+26.9	0.50
0+27.0	0.00
0+29.5	0.00
0+29.6	0.50
0+40.0	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.75)	(0+40.0, 0.70)	0.013

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	8.7 in
Roughness Coefficient	0.013
Elevation	0.72 ft
Elevation Range	0.00 to 2.50 ft
Flow Area	7.4 ft²
Wetted Perimeter	38.88 ft
Hydraulic Radius	2.3 in
Top Width	37.58 ft
Normal Depth	8.7 in
Critical Depth	8.8 in
Critical Slope	0.438 %

Results	
Velocity	2.68 ft/s
Velocity Head	0.11 ft
Specific Energy	0.83 ft
Froude Number	1.064
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	8.7 in
Critical Depth	8.8 in
Channel Slope	0.500 %
Critical Slope	0.438 %

Catalina West_Street Flow_25 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.000 %
Discharge	1.98 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	7.23 ft
Flow Area	0.6 ft²
Depth	3.3 in
Gutter Depression	1.5 in
Velocity	3.05 ft/s

Catalina West_Street Flow_2 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.000 %
Discharge	0.62 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	3.17 ft
Flow Area	0.2 ft²
Depth	2.3 in
Gutter Depression	1.5 in
Velocity	2.73 ft/s

Catalina West_Street Flow_85th

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.000 %
Discharge	0.13 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	1.28 ft
Flow Area	0.1 ft²
Depth	1.3 in
Gutter Depression	1.5 in
Velocity	1.92 ft/s

Catalina West_SB @ Curb_25yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.000 %
Discharge	1.98 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.75
0+14.0	0.47
0+14.1	2.50
0+15.0	2.50
0+15.1	0.50
0+28.9	0.50
0+29.0	0.00
0+29.5	0.00
0+29.6	0.50
0+40.0	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.75)	(0+40.0, 0.70)	0.013

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	6.6 in
Roughness Coefficient	0.013
Elevation	0.55 ft
Elevation Range	0.00 to 2.50 ft
Flow Area	1.2 ft²
Wetted Perimeter	21.79 ft
Hydraulic Radius	0.7 in
Top Width	20.85 ft
Normal Depth	6.6 in
Critical Depth	6.7 in
Critical Slope	0.653 %

Results	
Velocity	1.65 ft/s
Velocity Head	0.04 ft
Specific Energy	0.59 ft
Froude Number	1.215
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.6 in
Critical Depth	6.7 in
Channel Slope	1.000 %
Critical Slope	0.653 %

Catalina SouthWest_2 yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.500 %
Height	0.50 ft
Bottom Width	1.33 ft
Discharge	2.22 cfs

Results	
Normal Depth	5.8 in
Flow Area	0.6 ft²
Wetted Perimeter	2.30 ft
Hydraulic Radius	3.4 in
Top Width	1.33 ft
Critical Depth	5.3 in
Percent Full	96.6 %
Critical Slope	0.638 %
Velocity	3.46 ft/s
Velocity Head	0.19 ft
Specific Energy	0.67 ft
Froude Number	0.877
Discharge Full	1.72 cfs
Slope Full	0.500 %
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	30.8 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.8 in
Critical Depth	5.3 in
Channel Slope	0.500 %
Critical Slope	0.638 %

Catalina SouthWest_85th

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.500 %
Height	0.50 ft
Bottom Width	0.50 ft
Discharge	0.13 cfs

Results	
Normal Depth	1.8 in
Flow Area	0.1 ft²
Wetted Perimeter	0.81 ft
Hydraulic Radius	1.1 in
Top Width	0.50 ft
Critical Depth	1.5 in
Percent Full	30.8 %
Critical Slope	0.848 %
Velocity	1.69 ft/s
Velocity Head	0.04 ft
Specific Energy	0.20 ft
Froude Number	0.757
Discharge Full	0.51 cfs
Slope Full	0.500 %
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.8 in
Critical Depth	1.5 in
Channel Slope	0.500 %
Critical Slope	0.848 %

Catalina Southeast_2 yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.500 %
Height	0.50 ft
Bottom Width	2.50 ft
Discharge	4.48 cfs

Results	
Normal Depth	5.5 in
Flow Area	1.1 ft²
Wetted Perimeter	3.42 ft
Hydraulic Radius	4.0 in
Top Width	2.50 ft
Critical Depth	5.6 in
Percent Full	91.8 %
Critical Slope	0.485 %
Velocity	3.90 ft/s
Velocity Head	0.24 ft
Specific Energy	0.70 ft
Froude Number	1.016
Discharge Full	3.55 cfs
Slope Full	0.500 %
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	91.8 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.5 in
Critical Depth	5.6 in
Channel Slope	0.500 %
Critical Slope	0.485 %

Catalina Southwest_Street Flow_2yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.500 %
Discharge	2.22 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	9.11 ft
Flow Area	1.0 ft²
Depth	3.7 in
Gutter Depression	1.5 in
Velocity	2.32 ft/s

Catalina Southeast_85th

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.500 %
Height	0.50 ft
Bottom Width	0.50 ft
Discharge	0.44 cfs

Results	
Normal Depth	4.6 in
Flow Area	0.2 ft²
Wetted Perimeter	1.27 ft
Hydraulic Radius	1.8 in
Top Width	0.50 ft
Critical Depth	3.5 in
Percent Full	76.7 %
Critical Slope	1.037 %
Velocity	2.30 ft/s
Velocity Head	0.08 ft
Specific Energy	0.47 ft
Froude Number	0.654
Discharge Full	0.51 cfs
Slope Full	0.500 %
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	24.2 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	4.6 in
Critical Depth	3.5 in
Channel Slope	0.500 %
Critical Slope	1.037 %

Catalina West_2 yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Height	0.50 ft
Bottom Width	0.50 ft
Discharge	0.62 cfs

Results	
Normal Depth	4.6 in
Flow Area	0.2 ft²
Wetted Perimeter	1.26 ft
Hydraulic Radius	1.8 in
Top Width	0.50 ft
Critical Depth	4.4 in
Percent Full	76.5 %
Critical Slope	1.141 %
Velocity	3.24 ft/s
Velocity Head	0.16 ft
Specific Energy	0.55 ft
Froude Number	0.925
Discharge Full	0.71 cfs
Slope Full	1.000 %
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	24.2 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	4.6 in
Critical Depth	4.4 in
Channel Slope	1.000 %
Critical Slope	1.141 %

Catalina West_85th

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Height	0.50 ft
Bottom Width	0.50 ft
Discharge	0.13 cfs

Results	
Normal Depth	1.5 in
Flow Area	0.1 ft²
Wetted Perimeter	0.74 ft
Hydraulic Radius	1.0 in
Top Width	0.50 ft
Critical Depth	1.5 in
Percent Full	24.2 %
Critical Slope	0.848 %
Velocity	2.15 ft/s
Velocity Head	0.07 ft
Specific Energy	0.19 ft
Froude Number	1.089
Discharge Full	0.71 cfs
Slope Full	1.000 %
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	24.2 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.5 in
Critical Depth	1.5 in
Channel Slope	1.000 %
Critical Slope	0.848 %

Catalina East_2 yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Height	0.50 ft
Bottom Width	1.33 ft
Discharge	2.85 cfs

Results	
Normal Depth	5.4 in
Flow Area	0.6 ft²
Wetted Perimeter	2.23 ft
Hydraulic Radius	3.2 in
Top Width	1.33 ft
Critical Depth	6.0 in
Percent Full	90.1 %
Critical Slope	0.655 %
Velocity	4.76 ft/s
Velocity Head	0.35 ft
Specific Energy	0.80 ft
Froude Number	1.250
Discharge Full	2.44 cfs
Slope Full	1.000 %
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	90.1 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.4 in
Critical Depth	6.0 in
Channel Slope	1.000 %
Critical Slope	0.655 %

Catalina East_85th

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Height	0.50 ft
Bottom Width	0.50 ft
Discharge	0.57 cfs

Results	
Normal Depth	4.3 in
Flow Area	0.2 ft²
Wetted Perimeter	1.22 ft
Hydraulic Radius	1.8 in
Top Width	0.50 ft
Critical Depth	4.1 in
Percent Full	71.6 %
Critical Slope	1.113 %
Velocity	3.19 ft/s
Velocity Head	0.16 ft
Specific Energy	0.52 ft
Froude Number	0.939
Discharge Full	0.71 cfs
Slope Full	1.000 %
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	88.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	4.3 in
Critical Depth	4.1 in
Channel Slope	1.000 %
Critical Slope	1.113 %

Ave I_85th

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.500 %
Height	0.50 ft
Bottom Width	0.50 ft
Discharge	0.19 cfs

Results	
Normal Depth	1.6 in
Flow Area	0.1 ft²
Wetted Perimeter	0.77 ft
Hydraulic Radius	1.1 in
Top Width	0.50 ft
Critical Depth	2.0 in
Percent Full	27.4 %
Critical Slope	0.883 %
Velocity	2.77 ft/s
Velocity Head	0.12 ft
Specific Energy	0.26 ft
Froude Number	1.321
Discharge Full	0.87 cfs
Slope Full	1.500 %
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	27.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.6 in
Critical Depth	2.0 in
Channel Slope	1.500 %
Critical Slope	0.883 %

Ave I_2 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.500 %
Height	0.50 ft
Bottom Width	0.50 ft
Discharge	0.91 cfs

Results	
Normal Depth	5.3 in
Flow Area	0.2 ft²
Wetted Perimeter	1.38 ft
Hydraulic Radius	1.9 in
Top Width	0.50 ft
Critical Depth	5.6 in
Percent Full	88.4 %
Critical Slope	1.296 %
Velocity	4.12 ft/s
Velocity Head	0.26 ft
Specific Energy	0.71 ft
Froude Number	1.093
Discharge Full	0.87 cfs
Slope Full	1.500 %
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	88.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.3 in
Critical Depth	5.6 in
Channel Slope	1.500 %
Critical Slope	1.296 %

CB E3_2 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.15 cfs
Slope	3.600 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	14.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	2.15 cfs
Bypass Flow	0.00 cfs
Spread	2.88 ft
Depth	2.9 in
Flow Area	0.3 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	6.26 ft/s
Equivalent Cross Slope	19.411 %
Length Factor	1.267
Total Interception Length	11.05 ft

CB F1_85TH

Project Description	
Solve For	Efficiency

Input Data	
Discharge	1.88 cfs
Slope	3.600 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	14.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	1.88 cfs
Bypass Flow	0.00 cfs
Spread	2.74 ft
Depth	2.7 in
Flow Area	0.3 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	6.05 ft/s
Equivalent Cross Slope	19.411 %
Length Factor	1.340
Total Interception Length	10.45 ft

CB E3_25 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.51 cfs
Slope	3.600 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	14.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	87.17 %
Intercepted Flow	6.55 cfs
Bypass Flow	0.96 cfs
Spread	8.69 ft
Depth	4.4 in
Flow Area	1.0 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	7.23 ft/s
Equivalent Cross Slope	16.539 %
Length Factor	0.680
Total Interception Length	20.58 ft

CB F1_2 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	8.89 cfs
Slope	3.600 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	14.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	82.21 %
Intercepted Flow	7.31 cfs
Bypass Flow	1.58 cfs
Spread	9.61 ft
Depth	4.6 in
Flow Area	1.2 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	7.37 ft/s
Equivalent Cross Slope	15.801 %
Length Factor	0.617
Total Interception Length	22.70 ft

CB B1_85TH

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.18 cfs
Slope	2.000 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	4.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.18 cfs
Bypass Flow	0.00 cfs
Spread	1.27 ft
Depth	1.3 in
Flow Area	0.1 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	2.70 ft/s
Equivalent Cross Slope	19.411 %
Length Factor	1.223
Total Interception Length	3.27 ft

CB B1_2 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.84 cfs
Slope	2.000 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	4.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	84.15 %
Intercepted Flow	0.71 cfs
Bypass Flow	0.13 cfs
Spread	2.26 ft
Depth	2.2 in
Flow Area	0.2 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	3.97 ft/s
Equivalent Cross Slope	19.411 %
Length Factor	0.641
Total Interception Length	6.24 ft

CB B1_25 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.58 cfs
Slope	2.000 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	4.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	59.71 %
Intercepted Flow	1.54 cfs
Bypass Flow	1.04 cfs
Spread	4.76 ft
Depth	3.4 in
Flow Area	0.5 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	5.06 ft/s
Equivalent Cross Slope	19.141 %
Length Factor	0.397
Total Interception Length	10.09 ft

CB A1_2 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.78 cfs
Slope	0.500 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	4.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.78 cfs
Bypass Flow	0.00 cfs
Spread	2.85 ft
Depth	2.8 in
Flow Area	0.3 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	2.32 ft/s
Equivalent Cross Slope	19.411 %
Length Factor	1.002
Total Interception Length	3.99 ft

CB A1_25 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.44 cfs
Slope	0.500 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	4.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	78.60 %
Intercepted Flow	1.92 cfs
Bypass Flow	0.52 cfs
Spread	7.97 ft
Depth	4.2 in
Flow Area	0.9 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	2.66 ft/s
Equivalent Cross Slope	17.119 %
Length Factor	0.575
Total Interception Length	6.95 ft

CB F1_25 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	30.11 cfs
Slope	3.600 %
Gutter Width	3.00 ft
Gutter Cross Slope	8.300 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Curb Opening Length	14.00 ft
Local Depression	4.0 in
Local Depression Width	24.0 in

Results	
Efficiency	46.57 %
Intercepted Flow	14.02 cfs
Bypass Flow	16.09 cfs
Spread	17.45 ft
Depth	6.5 in
Flow Area	3.3 ft²
Gutter Depression	2.3 in
Total Depression	6.3 in
Velocity	9.04 ft/s
Equivalent Cross Slope	10.802 %
Length Factor	0.294
Total Interception Length	47.60 ft

CB E4_85TH

Project Description	
Solve For	Efficiency

Input Data	
Discharge	1.76 cfs
Slope	0.500 %
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Grate Width	2.00 ft
Grate Length	7.00 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	79.49 %
Intercepted Flow	1.40 cfs
Bypass Flow	0.36 cfs
Spread	8.13 ft
Depth	3.5 in
Flow Area	0.8 ft²
Gutter Depression	1.5 in
Total Depression	1.5 in
Velocity	2.23 ft/s
Splash Over Velocity	10.76 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.359
Grate Flow Ratio	0.680
Active Grate Length	3.50 ft

CB E4_2 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	8.49 cfs
Slope	0.500 %
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Grate Width	2.00 ft
Grate Length	7.00 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	51.92 %
Intercepted Flow	4.41 cfs
Bypass Flow	4.08 cfs
Spread	16.30 ft
Depth	5.4 in
Flow Area	2.8 ft²
Gutter Depression	1.5 in
Total Depression	1.5 in
Velocity	3.05 ft/s
Splash Over Velocity	10.76 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.242
Grate Flow Ratio	0.366
Active Grate Length	3.50 ft

CB E4_25 YR

Project Description	
Solve For	Efficiency

Input Data	
Discharge	28.57 cfs
Slope	0.500 %
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013
Grate Width	2.00 ft
Grate Length	7.00 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	34.77 %
Intercepted Flow	9.93 cfs
Bypass Flow	18.64 cfs
Spread	26.30 ft
Depth	7.8 in
Flow Area	7.0 ft²
Gutter Depression	1.5 in
Total Depression	1.5 in
Velocity	4.05 ft/s
Splash Over Velocity	10.76 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.161
Grate Flow Ratio	0.223
Active Grate Length	3.50 ft

Catalina East_Street Flow_25 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.000 %
Discharge	8.27 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	13.98 ft
Flow Area	2.1 ft²
Depth	4.9 in
Gutter Depression	1.5 in
Velocity	3.98 ft/s

Catalina East_Street Flow_2 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.000 %
Discharge	2.85 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	8.70 ft
Flow Area	0.9 ft²
Depth	3.6 in
Gutter Depression	1.5 in
Velocity	3.23 ft/s

Catalina East_Street Flow_85 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.000 %
Discharge	0.57 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	2.89 ft
Flow Area	0.2 ft²
Depth	2.2 in
Gutter Depression	1.5 in
Velocity	2.71 ft/s

Ave I_Street Flow_85 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.500 %
Discharge	0.19 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	1.36 ft
Flow Area	0.1 ft²
Depth	1.4 in
Gutter Depression	1.5 in
Velocity	2.46 ft/s

Ave I_Street Flow_2 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.500 %
Discharge	0.78 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	3.25 ft
Flow Area	0.2 ft²
Depth	2.3 in
Gutter Depression	1.5 in
Velocity	3.36 ft/s

Ave I_Street Flow_25 yr

Project Description	
Solve For	Spread

Input Data	
Channel Slope	1.500 %
Discharge	3.29 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.013

Results	
Spread	8.45 ft
Flow Area	0.8 ft²
Depth	3.5 in
Gutter Depression	1.5 in
Velocity	3.92 ft/s

Catalina East_SB @ Curb_25yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.000 %
Discharge	8.27 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.75
0+14.0	0.47
0+14.1	2.50
0+15.0	2.50
0+15.1	0.50
0+28.1	0.50
0+28.2	0.00
0+29.5	0.00
0+29.6	0.50
0+40.0	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.75)	(0+40.0, 0.70)	0.013

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	7.3 in
Roughness Coefficient	0.013
Elevation	0.61 ft
Elevation Range	0.00 to 2.50 ft
Flow Area	3.1 ft²
Wetted Perimeter	28.44 ft
Hydraulic Radius	1.3 in
Top Width	27.35 ft
Normal Depth	7.3 in
Critical Depth	7.7 in
Critical Slope	0.508 %

Results	
Velocity	2.63 ft/s
Velocity Head	0.11 ft
Specific Energy	0.72 ft
Froude Number	1.371
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	7.3 in
Critical Depth	7.7 in
Channel Slope	1.000 %
Critical Slope	0.508 %

Ave I_SB @ Curb_25yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.500 %
Discharge	3.29 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.75
0+14.0	0.47
0+14.1	2.50
0+15.0	2.50
0+15.1	0.50
0+28.9	0.50
0+29.0	0.00
0+29.5	0.00
0+29.6	0.50
0+40.0	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.75)	(0+40.0, 0.70)	0.013

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	6.7 in
Roughness Coefficient	0.013
Elevation	0.56 ft
Elevation Range	0.00 to 2.50 ft
Flow Area	1.5 ft²
Wetted Perimeter	23.12 ft
Hydraulic Radius	0.8 in
Top Width	22.16 ft
Normal Depth	6.7 in
Critical Depth	7.0 in
Critical Slope	0.597 %

Results	
Velocity	2.23 ft/s
Velocity Head	0.08 ft
Specific Energy	0.64 ft
Froude Number	1.528
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.7 in
Critical Depth	7.0 in
Channel Slope	1.500 %
Critical Slope	0.597 %

Appendix E – Operations & Maintenance Plan

PLAN A: Baseline Rain Event (24 Hour Rain Forecast up to 0.6"):

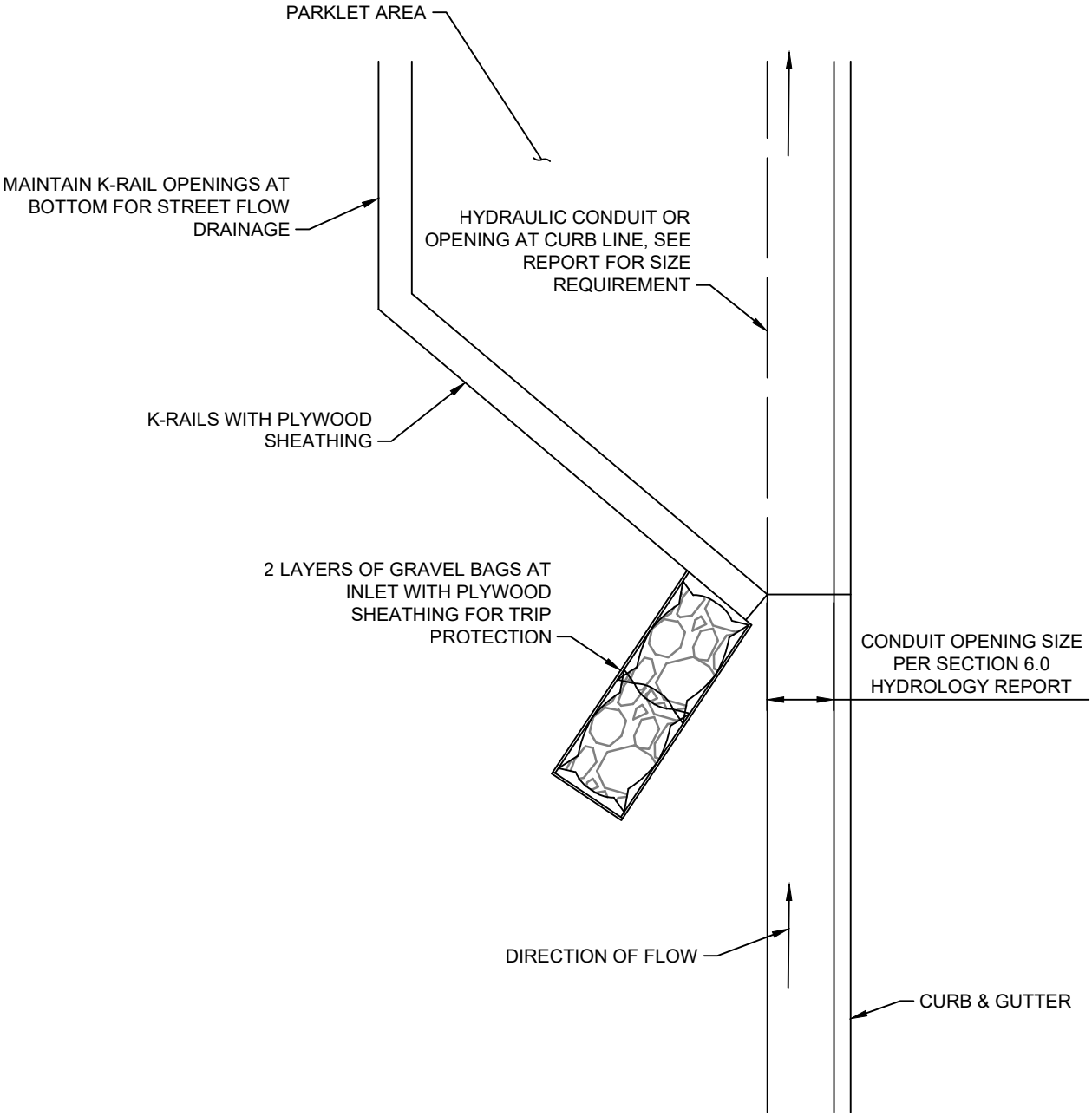
Catch Basins and Conduits: Prior to each forecasted rain even, catch basins in the RVA area shall be inspected to ensure they are clear of debris. Conduits and flow areas under and around the temporary parklets shall be cleaned of debris and jetted to ensure they have the full hydraulic capacity.

Gravel Bag Protection: Provide gravel bag protection as shown on Detail A on the following page consisting of 2 gravel bags stacked at the inlet of the conduit. RVA will provide plywood sheathing for these baseline gravel bags to provide trip protection. Gravel bag protection shall be installed and in place prior to the start of the forecasted rain event. Gravel bags shall be placed at the upstream inlet side of each parklet to direct flows into the opening or conduit provided at each parklet. Gravel bags shall be visually inspected to ensure they are not damaged. Gravel bags shall be placed at least 2 layers high (6" minimum height).

Hydraulic Conduit: Openings or flow areas shall be provided under the parklet facilities to accommodate the equivalent area per the following table (based on 2 year storm flows):

Location	Minimum Opening Size
Avenue I	6" Height x6" Width
Catalina Avenue, West Side North of Vista Del Mar	6" Height x6" Width
Catalina Avenue, East Side North of Vista Del Mar	6" Height x14" Width
Catalina Avenue, West Side South of Vista Del Mar	6" Height x16" Width
Catalina Avenue, East Side South of Vista Del Mar	6" Height x30" Width

In addition, openings shall be provided at the street side of the parklet k-rails to ensure that street flow is capable of flowing under the existing openings at the k-rails to convey flow from the street to the curb and gutter.



A BASELINE RESPONSE PLAN

NOT TO SCALE

PLAN B: 2 Year Storm (24 Hour Rain Forecast up to 2.0"):

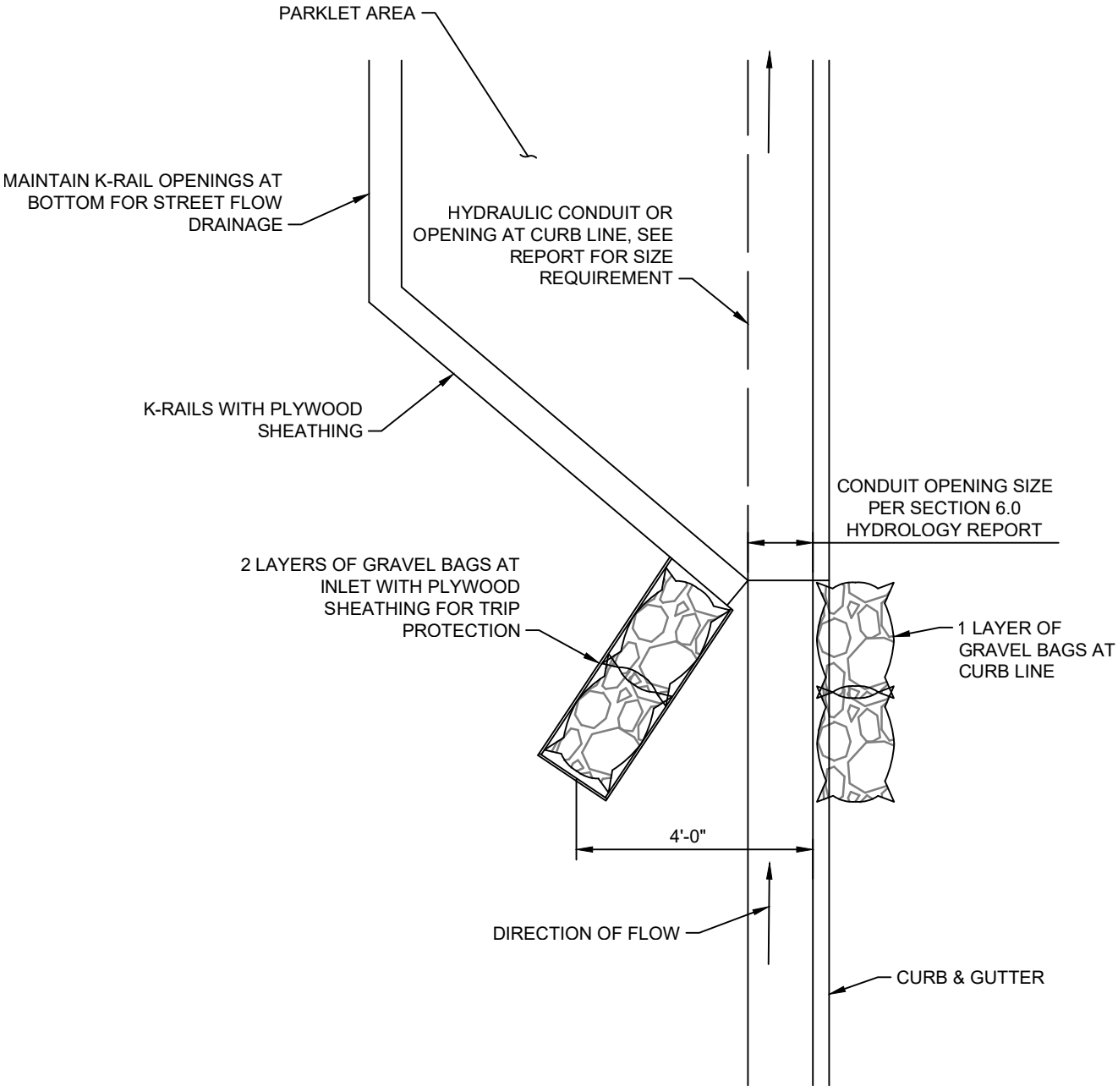
Catch Basins and Conduits: Prior to each forecasted rain even, catch basins in the RVA area shall be inspected to ensure they are clear of debris. Conduits and flow areas under and around the temporary parklets shall be cleaned of debris and jetted to ensure they have the full hydraulic capacity.

Gravel Bag Protection: Provide gravel bag protection as shown on Detail B on the following page consisting of gravel bags stacked at the inlet of the conduit, both in the street and along the top of the curb line. Gravel bags along the curb line shall be placed at least 24 hours prior to the storm event. Gravel bags along the curb line shall be removed within 48 hours after the end of the storm event. Gravel bags shall be placed to meet the minimum dimensions as shown on the detail. At conditions where adjacent driveways or ADA parking stalls will interfere with the placement, the angle and length shall be adjusted to provide the equivalent dimension from curb line and the conduit inlet. Gravel bags shall be placed at the upstream inlet side of each parklet to direct flows into the opening or conduit provided at each parklet. Gravel bags shall be visually inspected to ensure they are not damaged. Gravel bags shall be placed at least 2 layers high (6" minimum height).

Provide the following openings or conduit sizes under the parklet facilities:

Location	Minimum Opening Size
Avenue I	6" Height x6" Width
Catalina Avenue, West Side North of Vista Del Mar	6" Height x6" Width
Catalina Avenue, East Side North of Vista Del Mar	6" Height x14" Width
Catalina Avenue, West Side South of Vista Del Mar	6" Height x16" Width
Catalina Avenue, East Side South of Vista Del Mar	6" Height x30" Width

In addition, openings shall be provided at the street side of the parklet k-rails to ensure that street flow is capable of flowing under the existing openings at the k-rails to convey flow from the street to the curb and gutter.



2 YEAR STORM RESPONSE PLAN (24 HOUR RAIN FORECAST UP TO 2")

B

NOT TO SCALE

PLAN C: 25 Year Storm (24 Hour Rain Forecast up to 4.4"):

Catch Basins and Conduits: Prior to each forecasted rain even, catch basins in the RVA area shall be inspected to ensure they are clear of debris. Conduits and flow areas under and around the temporary parklets shall be cleaned of debris and jetted to ensure they have the full hydraulic capacity.

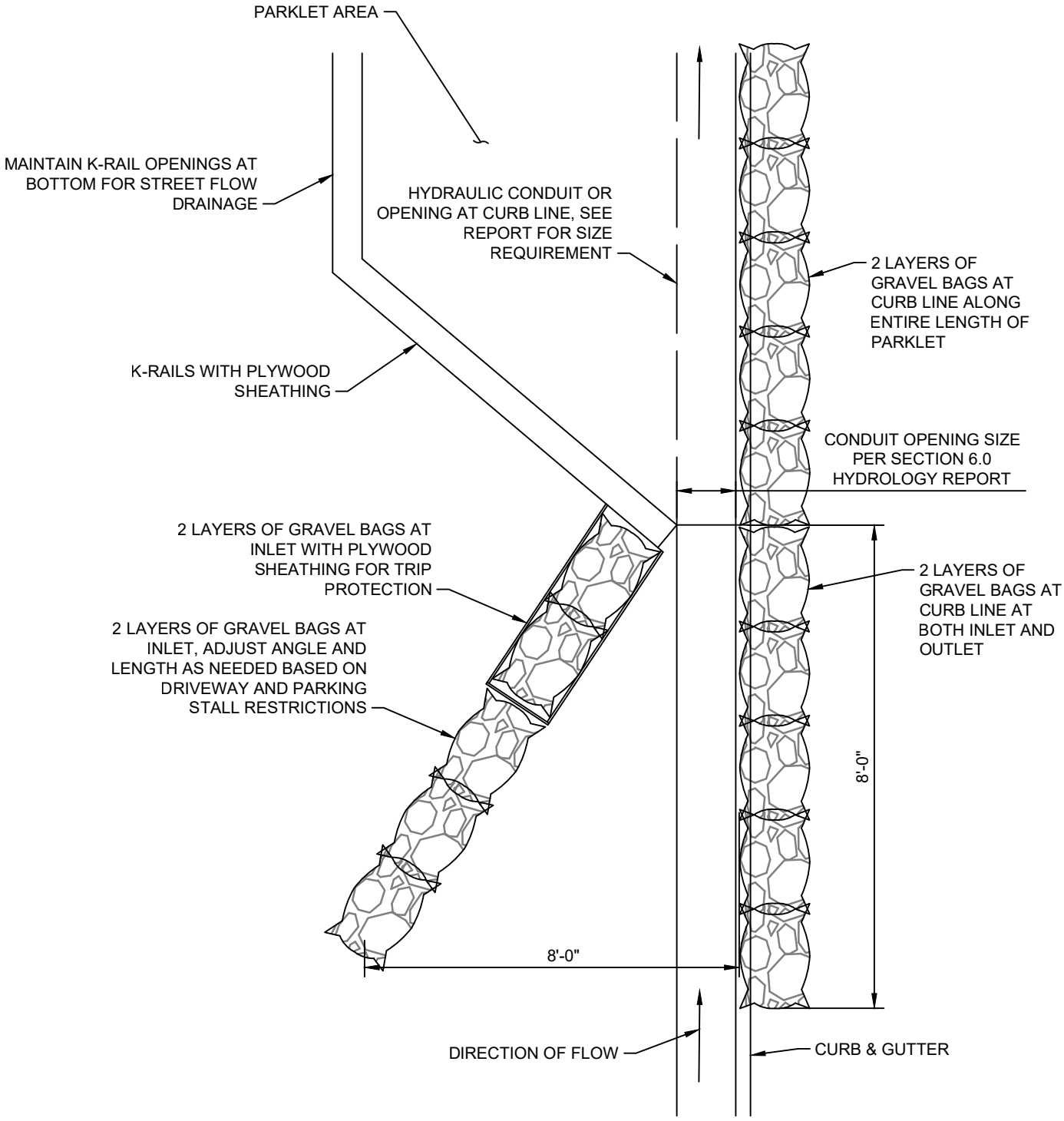
Gravel Bag Protection: Provide gravel bag protection as shown on Detail C on the following page consisting of gravel bags stacked at the inlet of the conduit, both in the street and along the top of the curb line. Gravel bags shall be placed at least 24 hours prior to the storm event. Gravel bags shall be removed within 48 hours after the end of the storm event. Gravel bags shall be placed to meet the minimum dimensions as shown on the detail. Gravel bags are also required to be placed along the curb line along the entire length of the parklet in order to protect flooding of the sidewalk. At conditions where adjacent driveways or ADA parking stalls will interfere with the placement, the angle and length shall be adjusted to provide the equivalent dimension from curb line and the conduit inlet. Gravel bags shall be placed at the upstream inlet side of each parklet to direct flows into the opening or conduit provided at each parklet. Gravel bags shall be visually inspected to ensure they are not damaged. Gravel bags shall be placed at least 2 layers high (6" minimum height).

For the 25 year event, flow will flood the parklet areas. Remove all furniture and loose items from the parklet area. Flooding and water damage to the parklet facilities will occur. After the storm event, parklet facilities shall be inspected for damage and repaired prior to use.

Provide the following openings or conduit sizes under the parklet facilities (Same as 2 year event):

Location	Minimum Opening Size
Avenue I	6" Height x6" Width
Catalina Avenue, West Side North of Vista Del Mar	6" Height x6" Width
Catalina Avenue, East Side North of Vista Del Mar	6" Height x14" Width
Catalina Avenue, West Side South of Vista Del Mar	6" Height x16" Width
Catalina Avenue, East Side South of Vista Del Mar	6" Height x30" Width

In addition, openings shall be provided at the street side of the parklet k-rails to ensure that street flow is capable of flowing under the existing openings at the k-rails to convey flow from the street to the curb and gutter.



25 YEAR STORM RESPONSE PLAN (24 HOUR RAIN FORECAST UP TO 4.4")

C

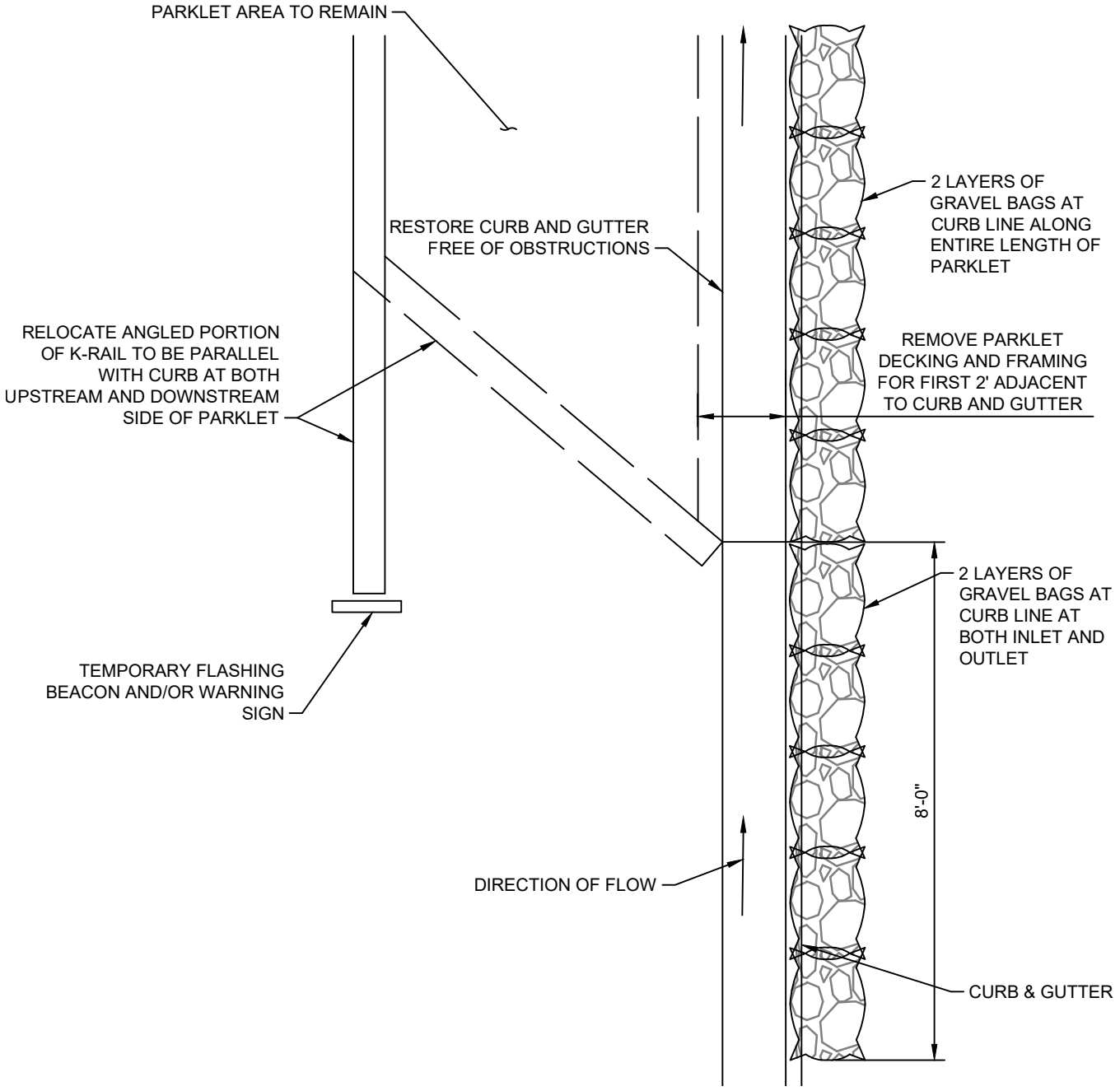
NOT TO SCALE

PLAN D: Excess of 25 Year Storm (24 Hour Rain Forecast exceeding 4.4”):

Parklets: A rain event exceeding the 25 year storm event has less than a 4% chance of occurring within any single year. This level of storm will exceed the design capacity of local storm drains and street flow carrying capacity as local facilities are only designed to contain the 25 year storm event. During a rain event exceeding the 25 year storm event, it is recommended to remove the first 2 feet of the parklet area to maintain free flow within the gutter section. Also, K-rails on the upstream and downstream side of the parklets shall be relocated such that they are parallel to the curb and gutter. Temporary flashing beacons and/or warning signs shall be placed at the end of the k-rails to warn traffic. Remove all furniture and loose items from the parklet area. Flooding and water damage to the parklet facilities will occur. After the storm event, parklet facilities shall be inspected for damage and repaired prior to use.

Catch Basins and Conduits: Prior to each forecasted rain even, catch basins in the RVA area shall be inspected to ensure they are clear of debris. Conduits and flow areas under and around the temporary parklets shall be cleaned of debris and jetted to ensure they have the full hydraulic capacity.

Gravel Bag Protection: Provide gravel bag protection as shown on Detail D on the following page consisting of gravel bags stacked along the top of the curb line. Gravel bags shall be placed at least 24 hours prior to the storm event. Gravel bags shall be removed within 48 hours after the end of the storm event. Gravel bags shall be placed to meet the minimum dimensions as shown on the detail. At conditions where adjacent driveways or ADA parking stalls will interfere with the placement, the angle and length shall be adjusted to provide the equivalent dimension from curb line and the conduit inlet. Gravel bags shall be visually inspected to ensure they are not damaged. Gravel bags shall be placed at least 2 layers high (6” minimum height).



EXTREME EVENT RESPONSE PLAN (24 HOUR RAIN FORECAST EXCEEDING 4.4")

D

NOT TO SCALE