DESIGN DEVELOPMENT
HYDROLOGY REPORT & LOW IMPACT DEVELOPMENT PLAN (LID PLAN)

ALAMITOS BEACH CONCESSION BUILDING

780 E. SHORELINE DRIVE
LONG BEACH, CALIFORNIA

Prepared For:

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Exhibit 2: Proposed Hydrology Exhibit
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SECTION 1 - INTRODUCTION

1.1 PURPOSE AND PROJECT DESCRIPTION

Michael Baker International has prepared a preliminary analysis for the Alamitos Concession Building project, located in the City of Long Beach. The project proposes to demolition of an existing concession/rental building and adjacent patio hardscape. Proposed development shall include commercial concession building, new public restroom, new playground, improvements to the adjacent parking lot, and a new bike path that runs northeast to west, just south of the proposed concession building. The project covers approximately 1.3 acres of disturbed area.

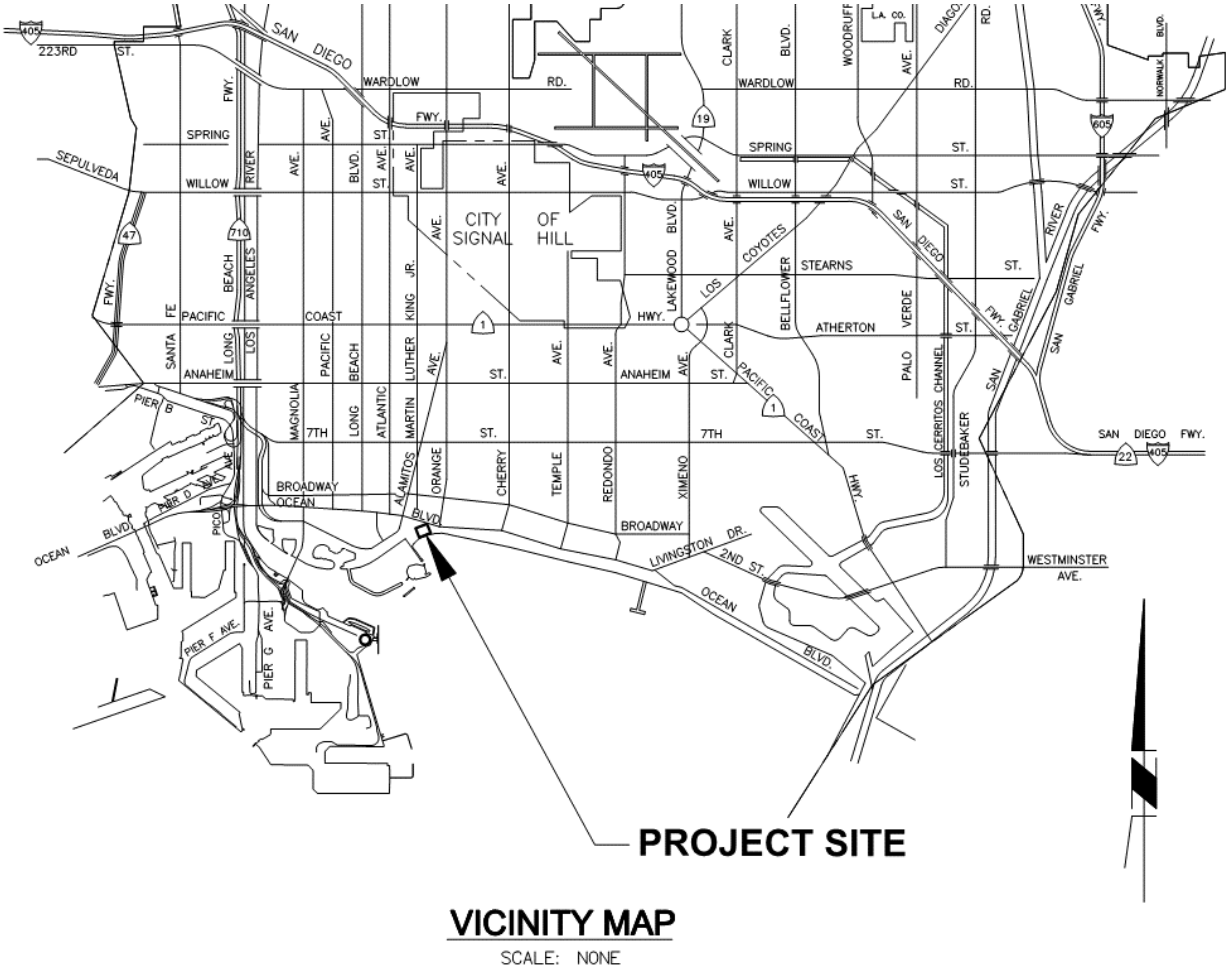
1.2 EXISTING CONDITION

The existing site consists of a concession/rental building surrounding by hardscape patio. Pervious areas consists of turf on the westerly side of the concession building, numerous tree wells on the norther and easterly sides, and beach sand to the south Existing impervious to pervious ratio of the proposed disturbed area is approximately 0.75 to 1. In general, the runoff flows in two main flow paths. One of the main flow paths starts at the south end of the existing concession building and flows north to an existing storm drain inlet at the north side of the parking lot. The other main flow path starts west of the existing concession building and flows southeast down the slope until it reaches the sand. These flow paths can be seen in the Existing Hydrology Exhibit in Exhibit 1.

1.3 PROPOSED CONDITION

Proposed development shall include commercial concession building, new public restroom, new playground, improvements to the adjacent parking lot, and a new bike path that runs northeast to west, just south of the proposed concession building. The proposed development shall increase the imperviousness of the site, changing the impervious to pervious ratio of the disturbed area to approximately 3.5 to 1. The proposed drainage plan was designed in such a way as to respect the flow paths of the existing hydrology as close as possible. In the proposed condition there are three main flow paths. One flow path starts west of the proposed building and restroom and flows southeast down the slope until it is captured in a vegetative swale that directions the runoff south to avoid the improvements and then continues southeast until it is captured in a drainage basin. The second flow path starts on the northwest side of the buildings and playground and sheet flows southeast across the existing pedestrian and bike paths before draining into the existing sand. The last main flow path starts on the north side of the concession building and flows north to the existing drain inlet on the north side of the parking lot. These flow paths can be seen in the Proposed Hydrology Exhibit in Exhibit 2.

Figure 1: Vicinity Map



SECTION 2 - HYDROLOGY

2.1 RATIONAL METHOD HYDROLOGY ANALYSIS

The existing and proposed hydrology was prepared based on the Los Angeles County Hydrocalc software. This software incorporates the many aspects of the runoff calculations previously specified in the Los Angeles County Hydrology Manual. This program utilizes all the isohyetal maps and soil maps provided in the Los Angeles County Hydrology Manual and combines them into a GIS application that can be found online. Using this GIS application one can enter the location of the project site and find the soil type, and 50 year Rainfall of the project site. See Appendix 1 for the LA County GIS Hydrology Map for soil and rainfall information used for this project. These values can then be entered into the Hydrocalc program along with the area, percent impervious, flow path length, and flow path slope of the desired area. This program was used on this project in order to calculate the 25 year, 50 year, and 100 year storm runoff values for both pre-project and post-project conditions. It is important to note that the site was split into multiple drainage areas in order to more accurately calculate the site runoff. All of these subareas can be seen in the Existing Hydrology Exhibit and the Proposed Hydrology Exhibit in Exhibits 1 & 2 respectively. The resulting peak runoff values for both the pre-project and post-project conditions can be summarized in tables 1 and 2 below and all calculations can be found in Appendices 1, 2 & 3.

Table 1 - Summary of Existing Subarea Runoff Values

	A1	A2	A3	A4	Total
25-yr Storm Peak Flow Rate (cfs)	2.64	1.99	0.23	0.18	5.04
50-yr Storm Peak Flow Rate (cfs)	3.28	2.34	0.28	0.21	6.11
100-yr Storm Peak Flow Rate (cfs)	3.71	2.7	0.32	0.24	6.97

Table 2 - Summary of Proposed Subarea Runoff Values

	A1	A2	A3	A4	A5	Total
25-yr Storm Peak Flow Rate (cfs)	2.19	1.48	1.24	0.29	0.22	5.42
50-yr Storm Peak Flow Rate (cfs)	2.71	1.7	1.47	0.33	0.25	6.46
100-yr Storm Peak Flow Rate (cfs)	3.34	1.92	1.72	0.37	0.28	7.63

SECTION 3 – WATER QUALITY

3.1 LOW IMPACT DEVELOPMENT PLAN

The development's water quality requirements is addressed in the Low Impact Development Plan and Water Quality Exhibit located in Appendix D and Exhibit 3 respectively.

APPENDIX A

LA County GIS Hydrology Map

Department of Public Works
dpw.lacounty.gov

search our site..

Hydrology Map

A GIS viewer application to view the data for the hydrology manual.

LAYERS

- [x] 50yr Two Tenths (Rainfall)
- [ ] DPA Zones
- [x] Soils 2004
- [ ] Final 85th Percentile, 24-hr Rainfall
- [x] Final 95th Percentile, 24-hr Rainfall
- [ ] 1-year, 1-hour Rainfall Intensity

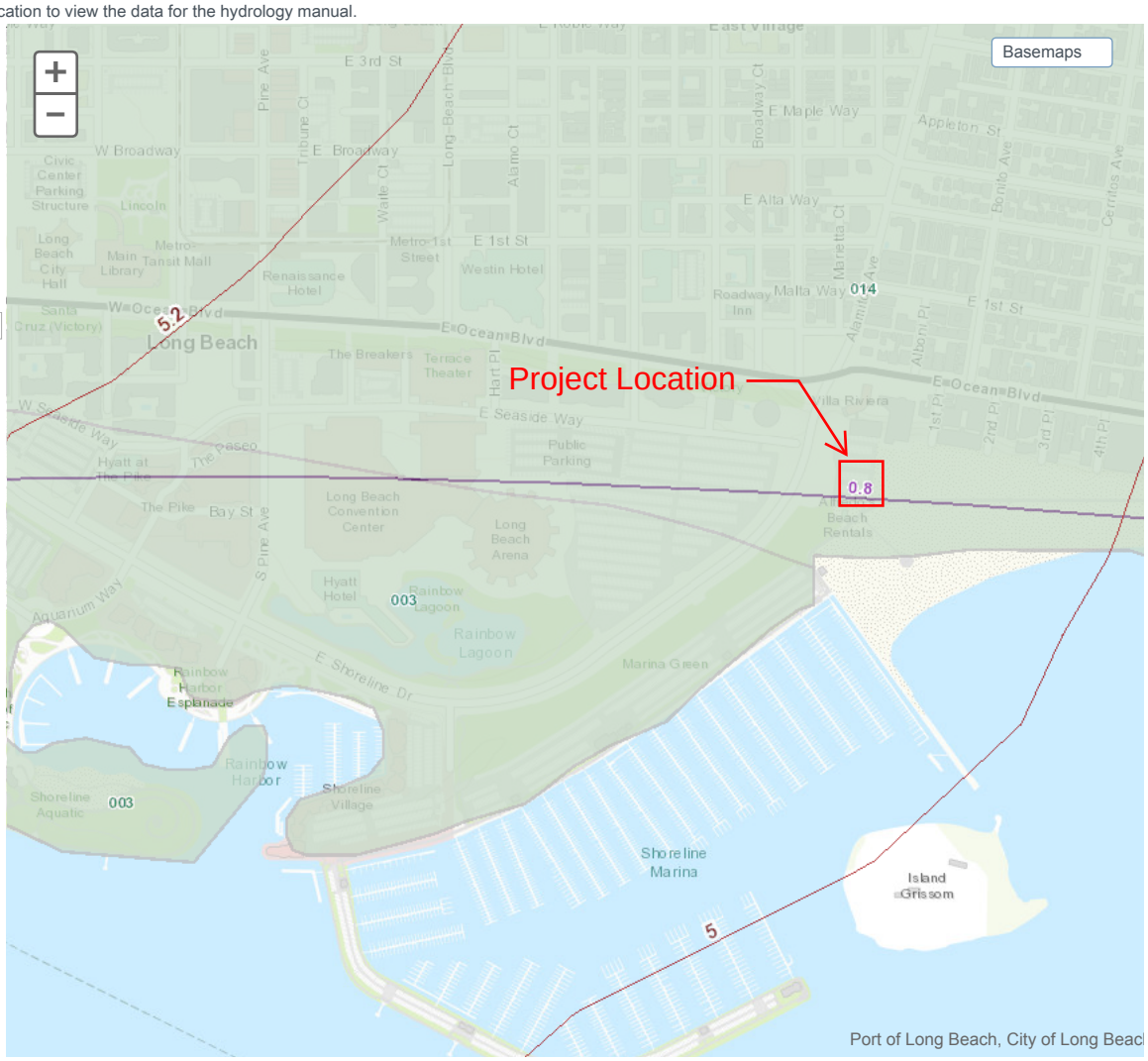
SEARCH

Enter Address, Cross Street, or Parcel No.:
(ex: 900 S. Fremont Ave., Fremont@Valley, 5342005904)

Search

Address Search Results:

226 grand ave long beach



Map Tips

APPENDIX B

Existing Condition Hydrology Calculations

Peak Flow Hydrologic Analysis

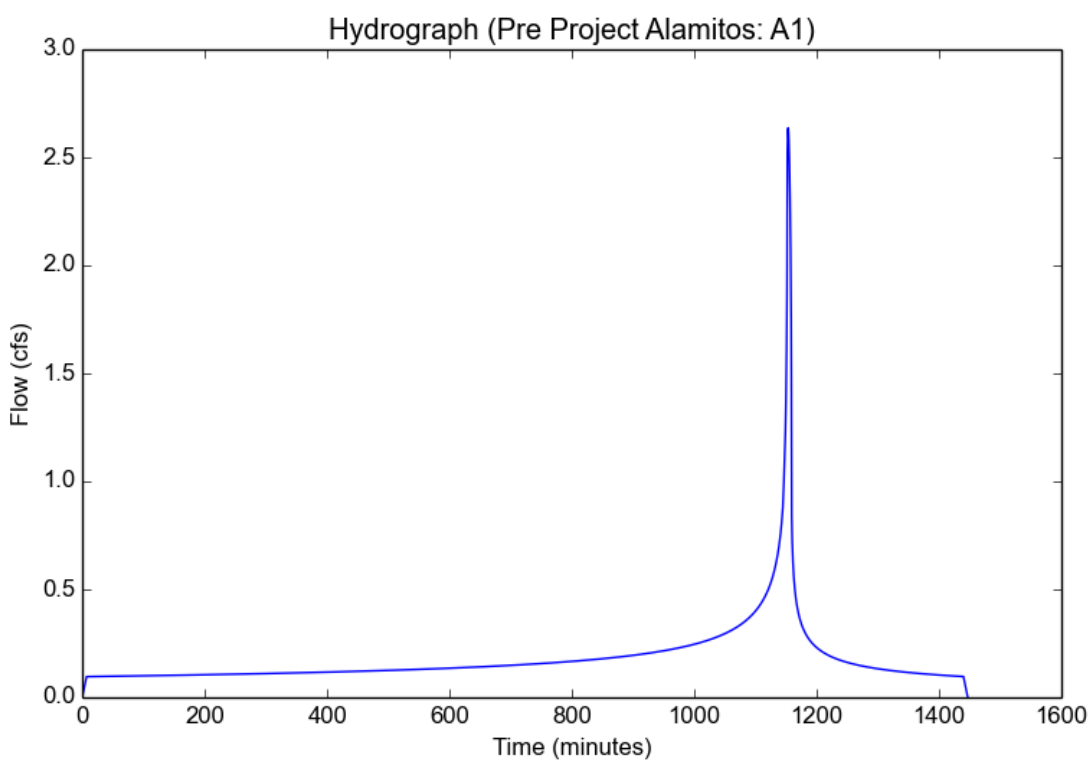
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Pre Project/Pre Project Alamitos - A1-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A1
Area (ac)	1.37
Flow Path Length (ft)	415.0
Flow Path Slope (vft/hft)	0.016
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.76
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.2808
Undeveloped Runoff Coefficient (Cu)	0.6656
Developed Runoff Coefficient (Cd)	0.8438
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	2.6365
Burned Peak Flow Rate (cfs)	2.6365
24-Hr Clear Runoff Volume (ac-ft)	0.3634
24-Hr Clear Runoff Volume (cu-ft)	15827.7311



Peak Flow Hydrologic Analysis

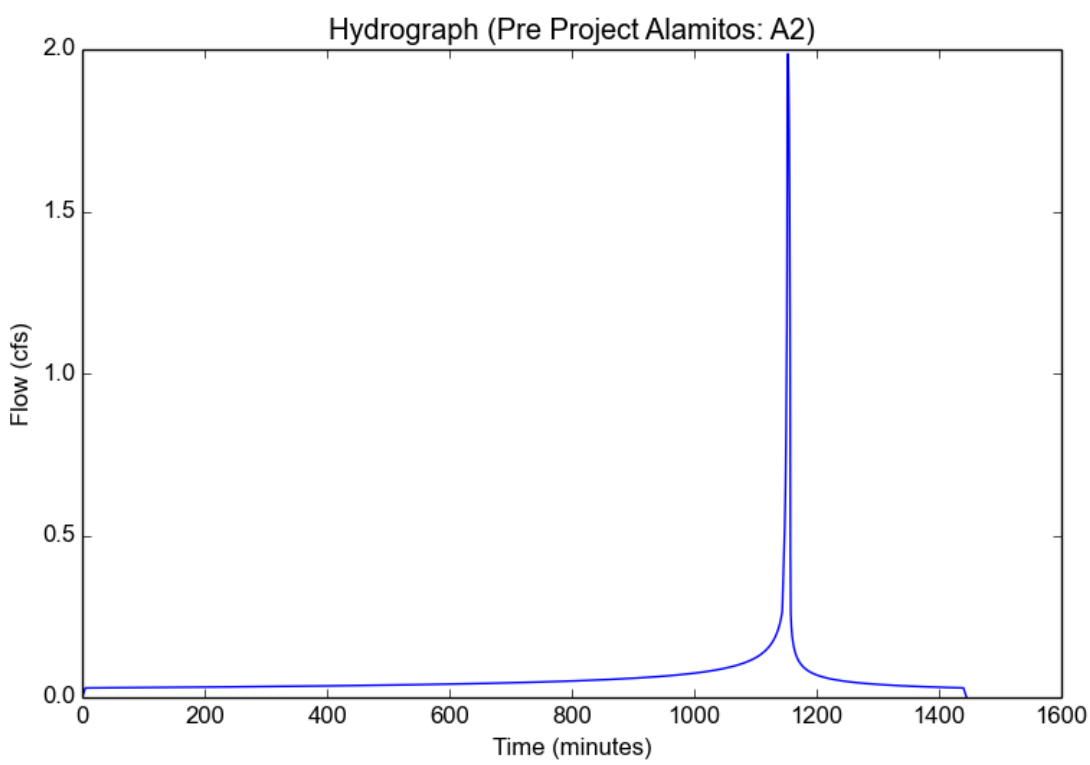
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Pre Project/Pre Project Alamitos - A2-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A2
Area (ac)	0.98
Flow Path Length (ft)	245.0
Flow Path Slope (vft/hft)	0.049
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.25
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.6716
Undeveloped Runoff Coefficient (Cu)	0.7117
Developed Runoff Coefficient (Cd)	0.7588
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.9866
Burned Peak Flow Rate (cfs)	1.9866
24-Hr Clear Runoff Volume (ac-ft)	0.1188
24-Hr Clear Runoff Volume (cu-ft)	5173.3704



Peak Flow Hydrologic Analysis

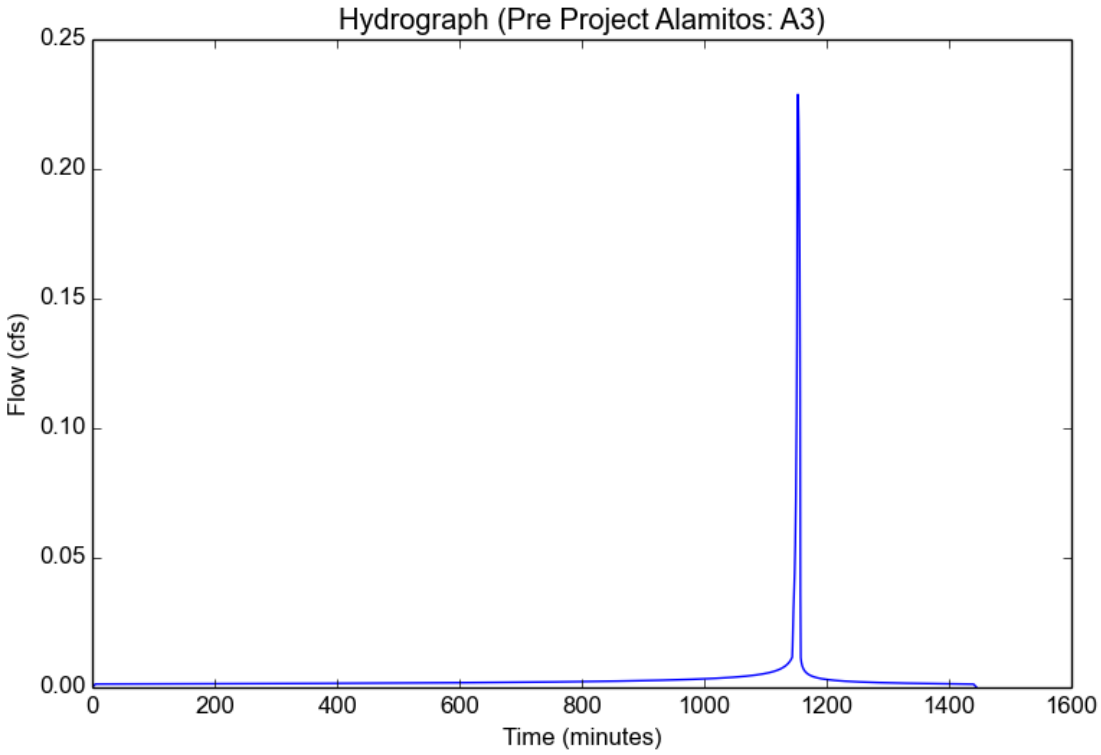
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Pre Project/Pre Project Alamitos - A3-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A3
Area (ac)	0.12
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.009
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.01
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.6716
Undeveloped Runoff Coefficient (Cu)	0.7117
Developed Runoff Coefficient (Cd)	0.7136
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2288
Burned Peak Flow Rate (cfs)	0.2288
24-Hr Clear Runoff Volume (ac-ft)	0.0064
24-Hr Clear Runoff Volume (cu-ft)	279.0754



Peak Flow Hydrologic Analysis

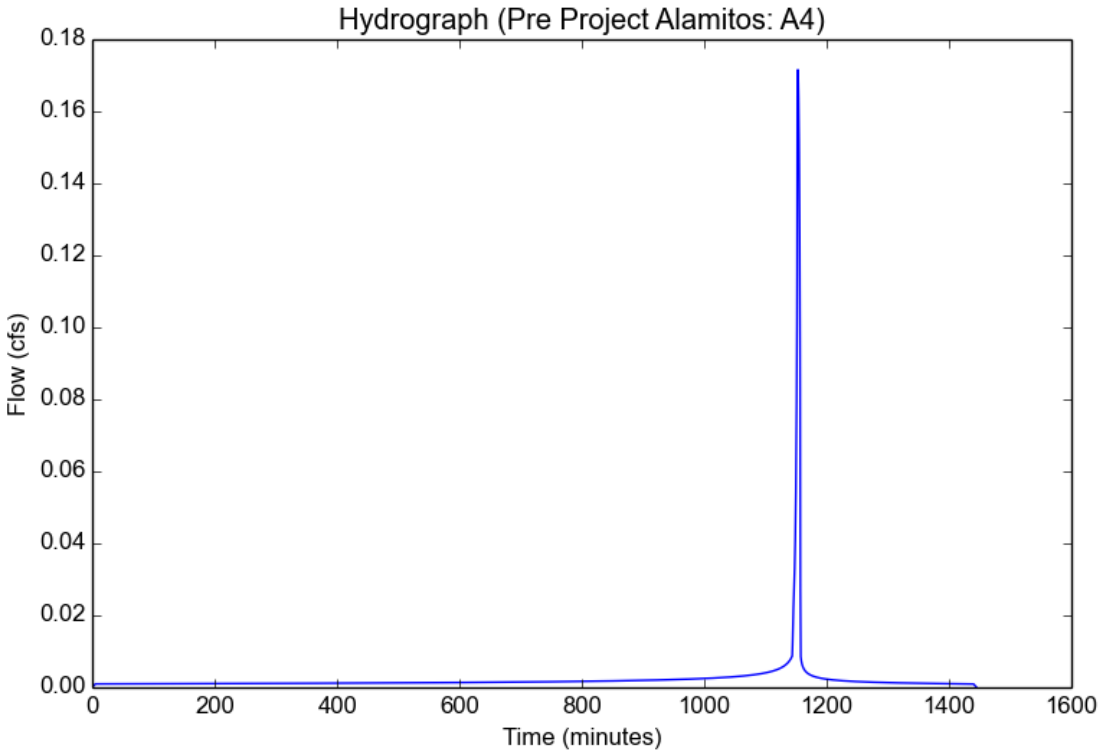
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Pre Project/Pre Project Alamitos - A4-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A4
Area (ac)	0.09
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.013
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.01
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.6716
Undeveloped Runoff Coefficient (Cu)	0.7117
Developed Runoff Coefficient (Cd)	0.7136
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.1716
Burned Peak Flow Rate (cfs)	0.1716
24-Hr Clear Runoff Volume (ac-ft)	0.0048
24-Hr Clear Runoff Volume (cu-ft)	209.3066



Peak Flow Hydrologic Analysis

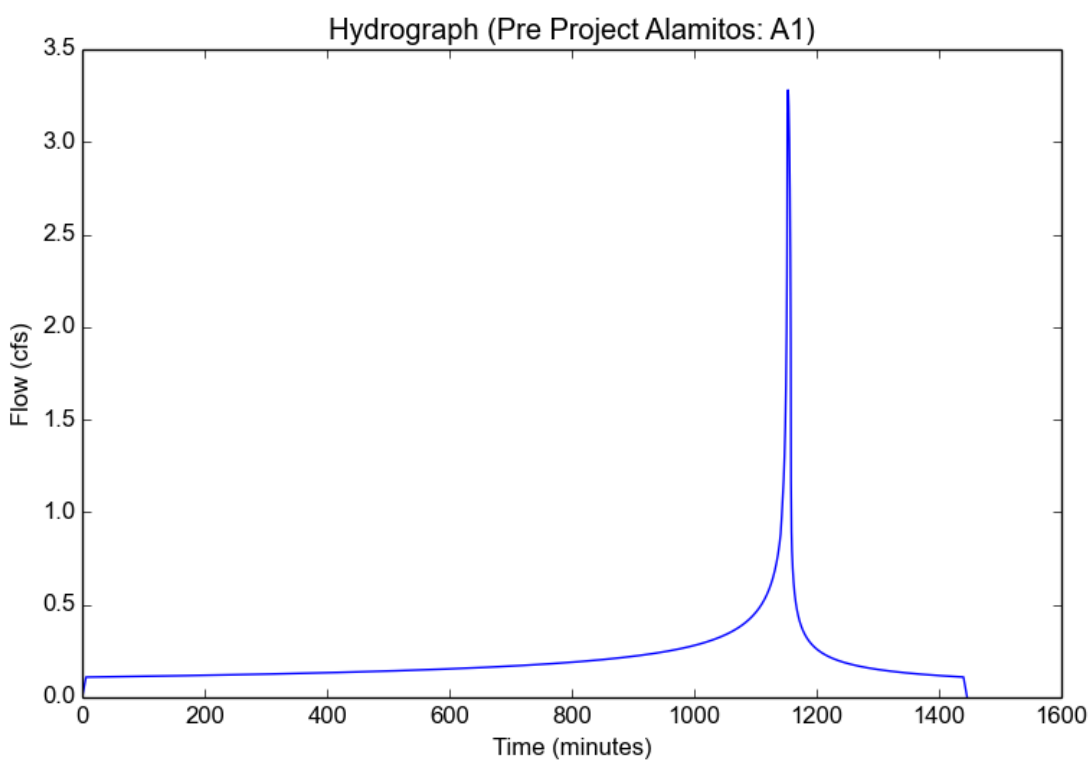
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Pre Project/Pre Project Alamitos - A1-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A1
Area (ac)	1.37
Flow Path Length (ft)	415.0
Flow Path Slope (vft/hft)	0.016
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.76
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	2.7929
Undeveloped Runoff Coefficient (Cu)	0.7221
Developed Runoff Coefficient (Cd)	0.8573
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	3.2803
Burned Peak Flow Rate (cfs)	3.2803
24-Hr Clear Runoff Volume (ac-ft)	0.4147
24-Hr Clear Runoff Volume (cu-ft)	18064.8432



Peak Flow Hydrologic Analysis

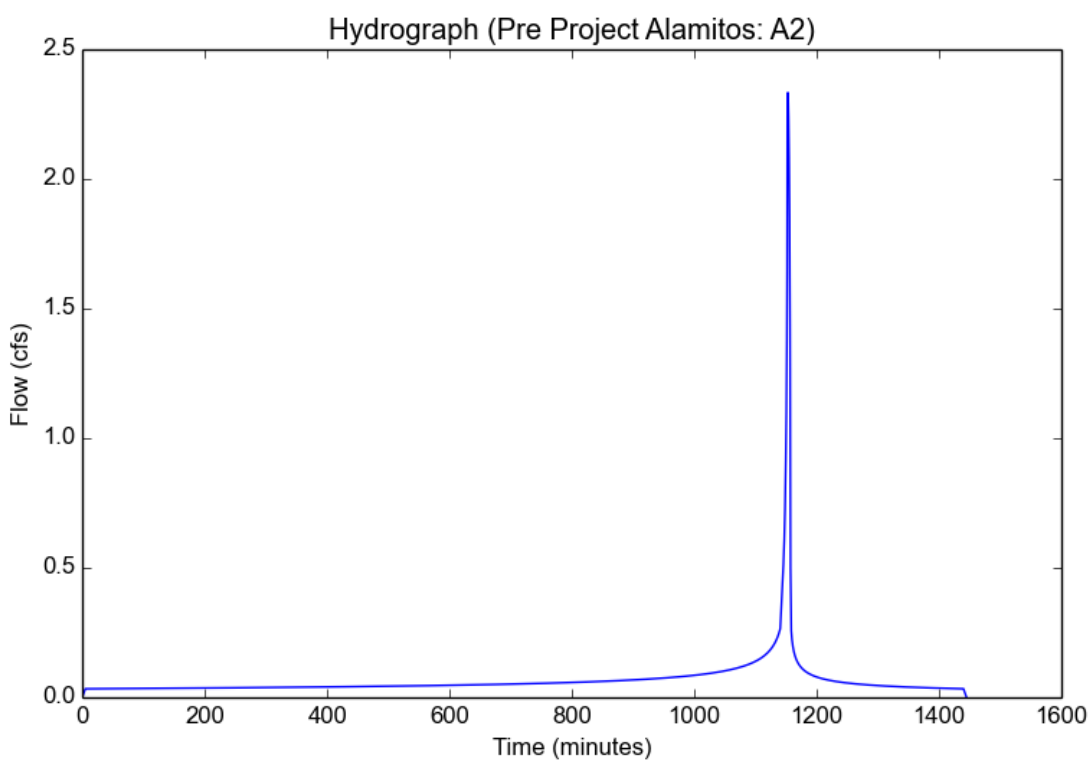
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Pre Project/Pre Project Alamitos - A2-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A2
Area (ac)	0.98
Flow Path Length (ft)	245.0
Flow Path Slope (vft/hft)	0.049
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.25
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.7827
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.3338
Burned Peak Flow Rate (cfs)	2.3338
24-Hr Clear Runoff Volume (ac-ft)	0.1371
24-Hr Clear Runoff Volume (cu-ft)	5972.0093



Peak Flow Hydrologic Analysis

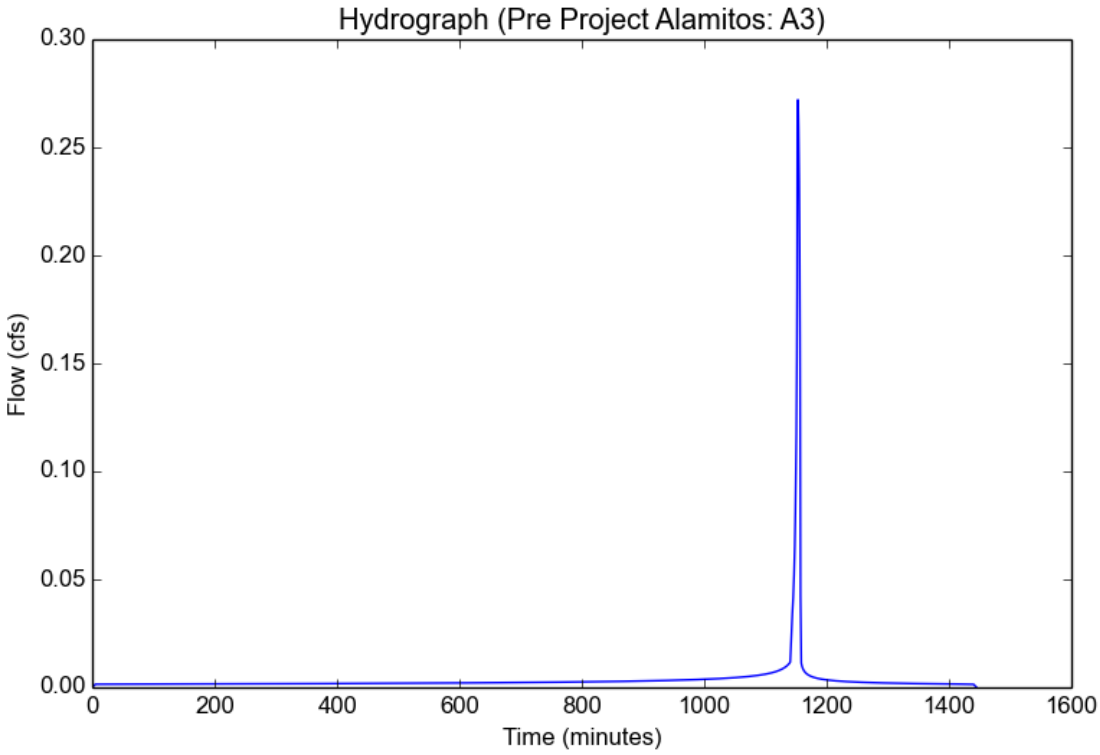
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Pre Project/Pre Project Alamitos - A3-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A3
Area (ac)	0.12
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.009
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.01
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.7451
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2721
Burned Peak Flow Rate (cfs)	0.2721
24-Hr Clear Runoff Volume (ac-ft)	0.0076
24-Hr Clear Runoff Volume (cu-ft)	330.7499



Peak Flow Hydrologic Analysis

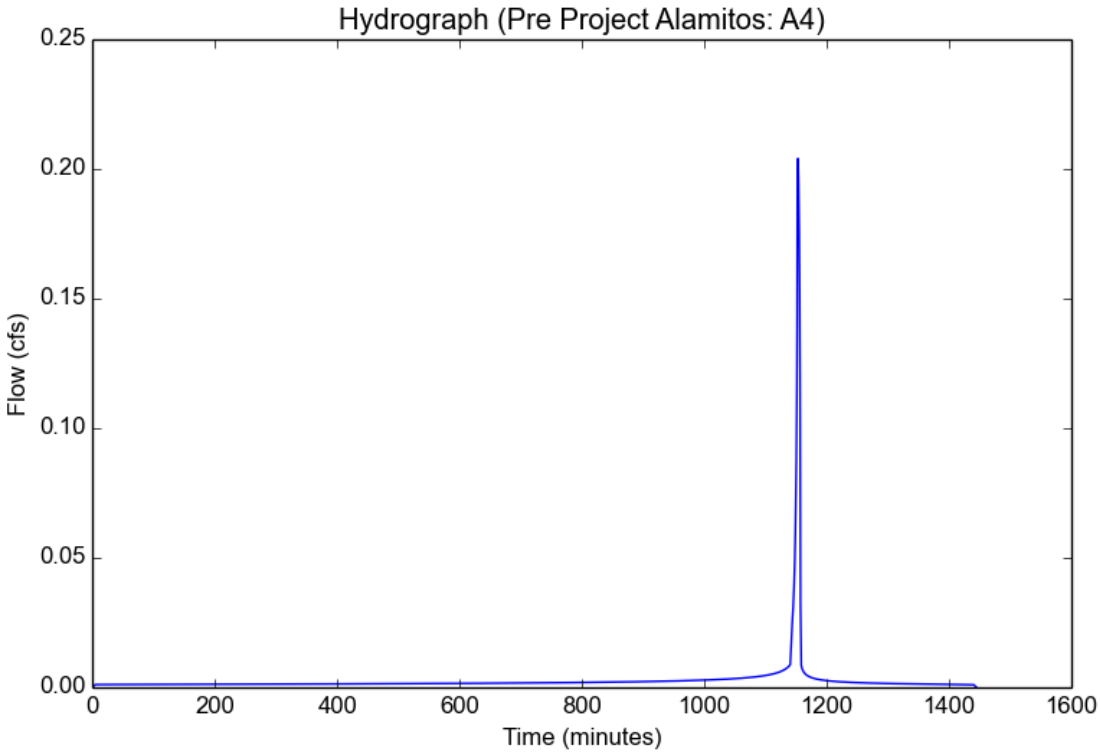
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Pre Project/Pre Project Alamitos - A4-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A4
Area (ac)	0.09
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.013
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.01
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.7451
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.204
Burned Peak Flow Rate (cfs)	0.204
24-Hr Clear Runoff Volume (ac-ft)	0.0057
24-Hr Clear Runoff Volume (cu-ft)	248.0624



Peak Flow Hydrologic Analysis

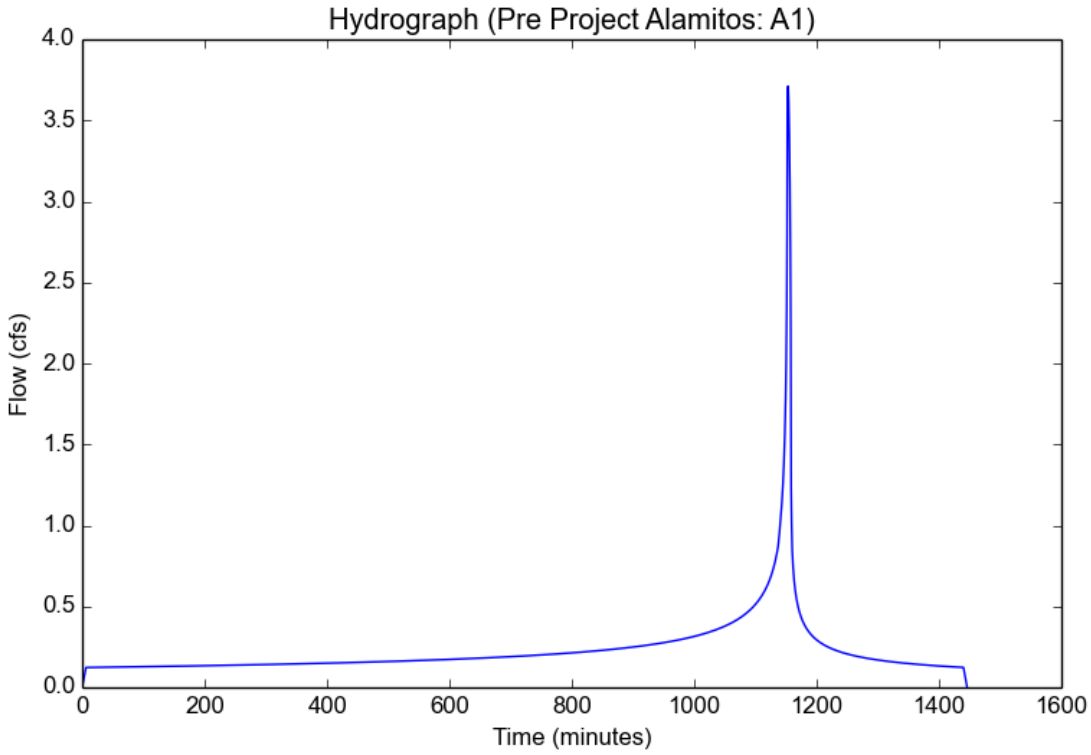
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Pre Project/Pre Project Alamitos - A1-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A1
Area (ac)	1.37
Flow Path Length (ft)	415.0
Flow Path Slope (vft/hft)	0.016
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.76
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.1337
Undeveloped Runoff Coefficient (Cu)	0.7513
Developed Runoff Coefficient (Cd)	0.8643
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	3.7106
Burned Peak Flow Rate (cfs)	3.7106
24-Hr Clear Runoff Volume (ac-ft)	0.4662
24-Hr Clear Runoff Volume (cu-ft)	20309.5851



Peak Flow Hydrologic Analysis

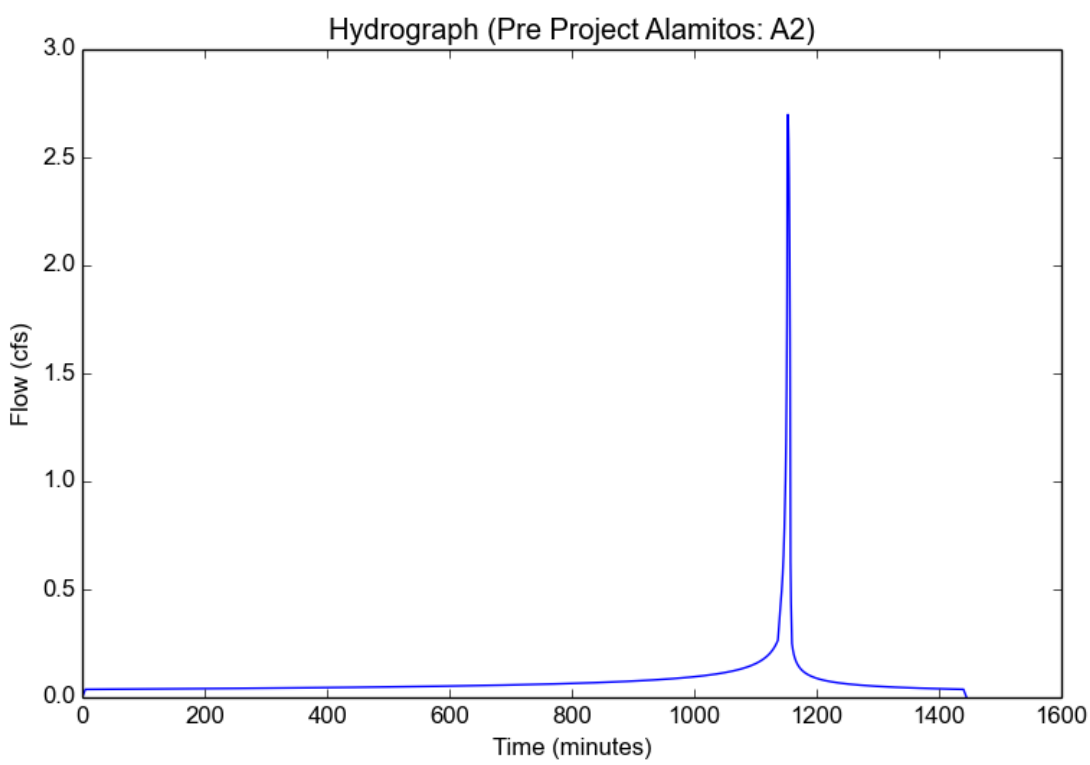
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Pre Project/Pre Project Alamitos - A2-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A2
Area (ac)	0.98
Flow Path Length (ft)	245.0
Flow Path Slope (vft/hft)	0.049
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.25
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.8065
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.6984
Burned Peak Flow Rate (cfs)	2.6984
24-Hr Clear Runoff Volume (ac-ft)	0.156
24-Hr Clear Runoff Volume (cu-ft)	6793.3847



Peak Flow Hydrologic Analysis

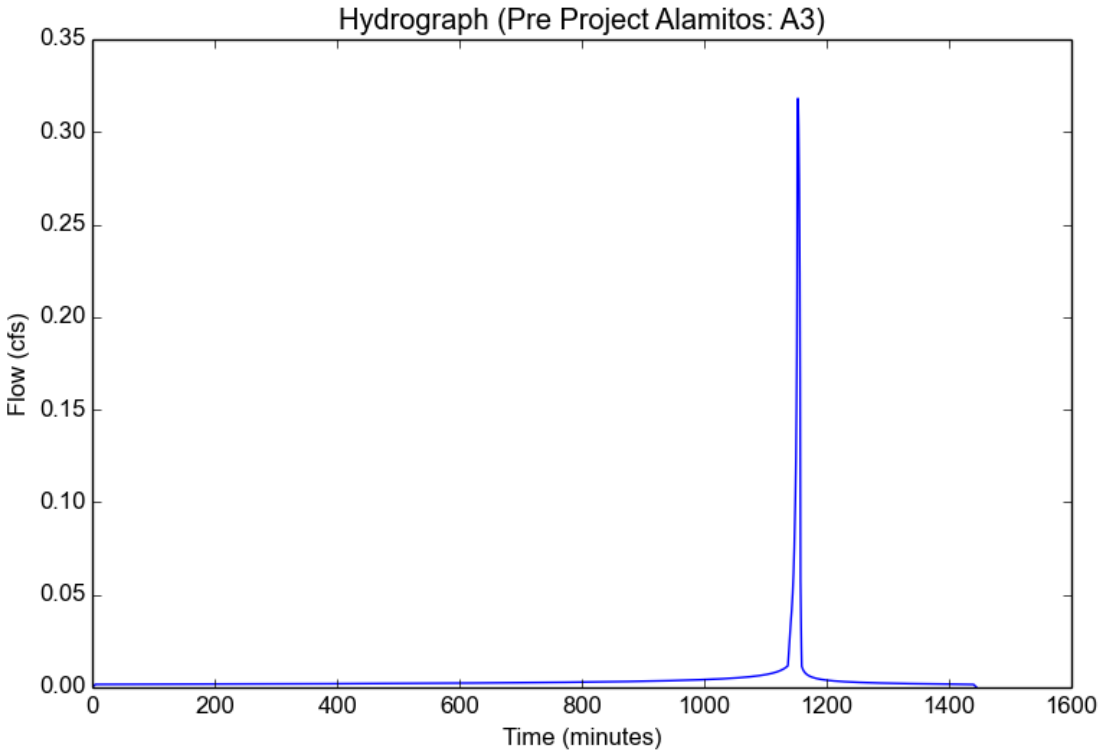
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Pre Project/Pre Project Alamitos - A2-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A3
Area (ac)	0.12
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.009
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.01
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.7766
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.3182
Burned Peak Flow Rate (cfs)	0.3182
24-Hr Clear Runoff Volume (ac-ft)	0.0089
24-Hr Clear Runoff Volume (cu-ft)	386.0993



Peak Flow Hydrologic Analysis

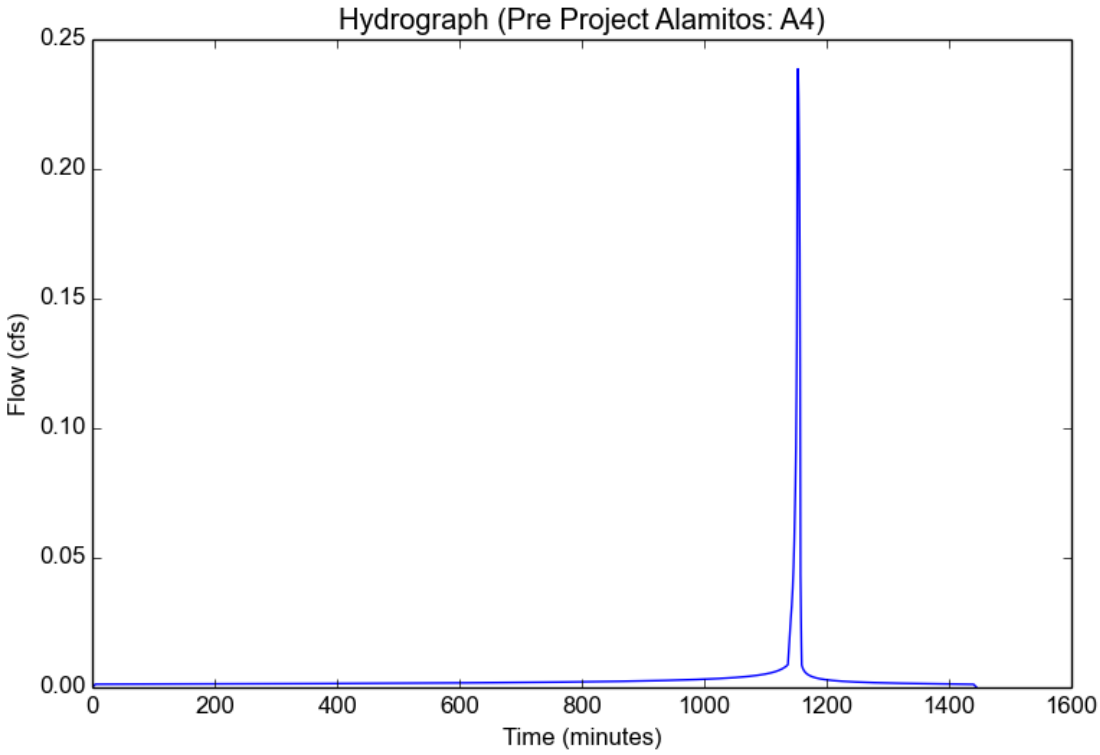
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Pre Project/Pre Project Alamitos - A4-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Pre Project Alamitos
Subarea ID	A4
Area (ac)	0.09
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.013
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.01
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.7766
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2386
Burned Peak Flow Rate (cfs)	0.2386
24-Hr Clear Runoff Volume (ac-ft)	0.0066
24-Hr Clear Runoff Volume (cu-ft)	289.5745



APPENDIX C

Proposed Condition Hydrology Calculations

Peak Flow Hydrologic Analysis

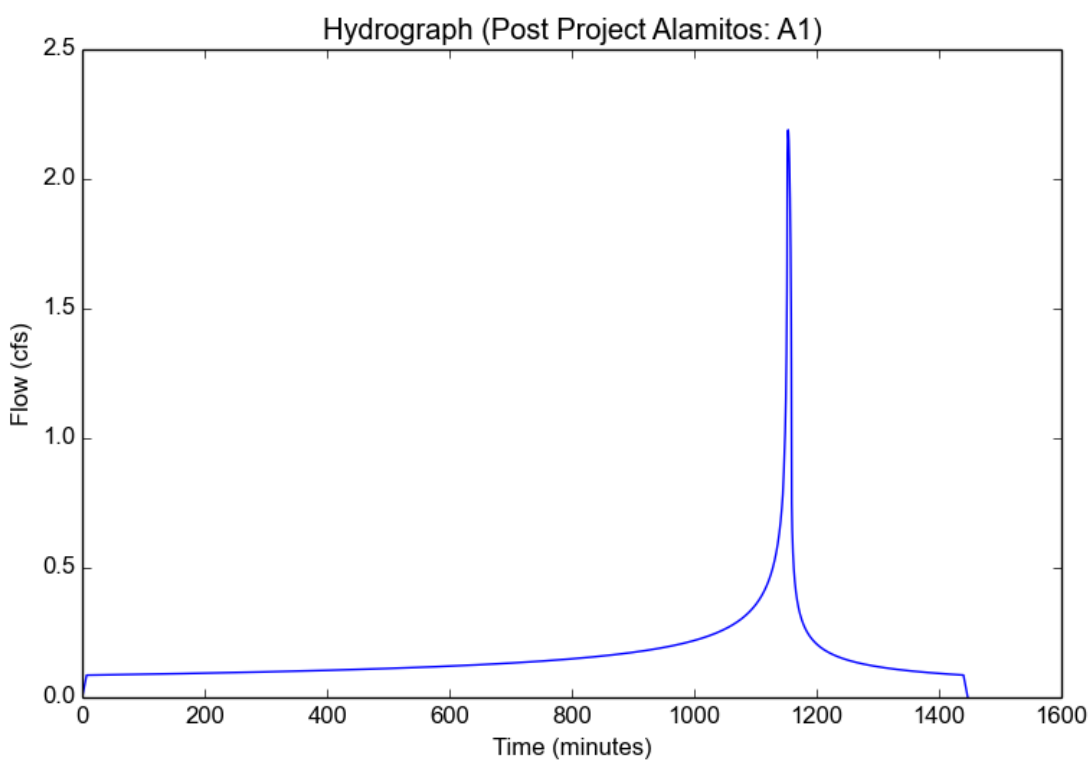
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Post Project/Post Project Alamitos - A1-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A1
Area (ac)	1.11
Flow Path Length (ft)	395.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.85
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.2808
Undeveloped Runoff Coefficient (Cu)	0.6656
Developed Runoff Coefficient (Cd)	0.8648
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	2.1895
Burned Peak Flow Rate (cfs)	2.1895
24-Hr Clear Runoff Volume (ac-ft)	0.3226
24-Hr Clear Runoff Volume (cu-ft)	14053.9438



Peak Flow Hydrologic Analysis

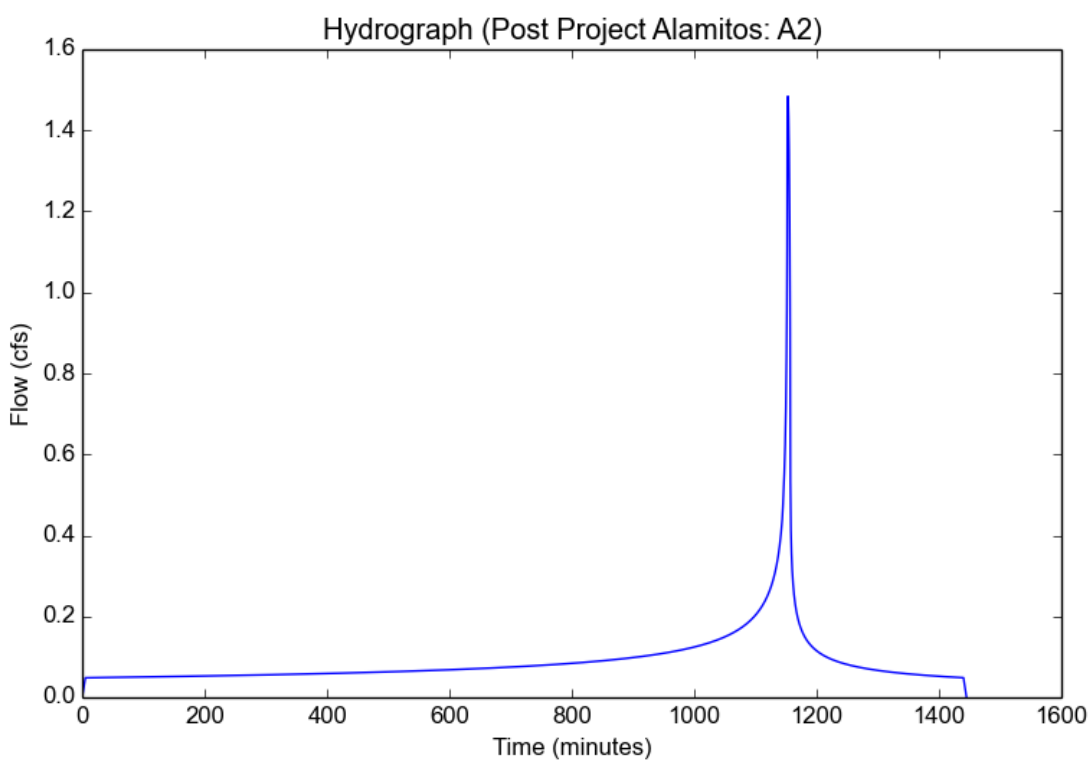
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Post Project/Post Project Alamitos - A2-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A2
Area (ac)	0.64
Flow Path Length (ft)	85.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.83
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.6716
Undeveloped Runoff Coefficient (Cu)	0.7117
Developed Runoff Coefficient (Cd)	0.868
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.4841
Burned Peak Flow Rate (cfs)	1.4841
24-Hr Clear Runoff Volume (ac-ft)	0.1824
24-Hr Clear Runoff Volume (cu-ft)	7946.3303



Peak Flow Hydrologic Analysis

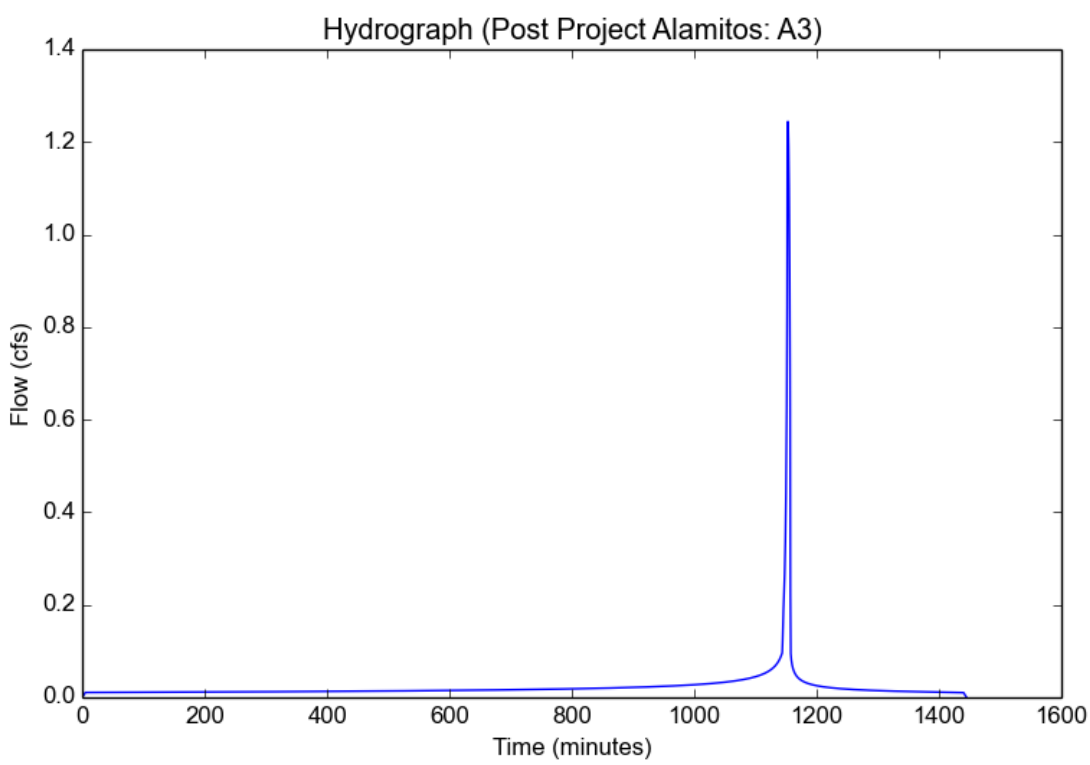
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Post Project/Post Project Alamitos - A3-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A3
Area (ac)	0.64
Flow Path Length (ft)	211.0
Flow Path Slope (vft/hft)	0.06
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.085
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.6716
Undeveloped Runoff Coefficient (Cu)	0.7117
Developed Runoff Coefficient (Cd)	0.7277
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.2443
Burned Peak Flow Rate (cfs)	1.2443
24-Hr Clear Runoff Volume (ac-ft)	0.0477
24-Hr Clear Runoff Volume (cu-ft)	2079.0665



Peak Flow Hydrologic Analysis

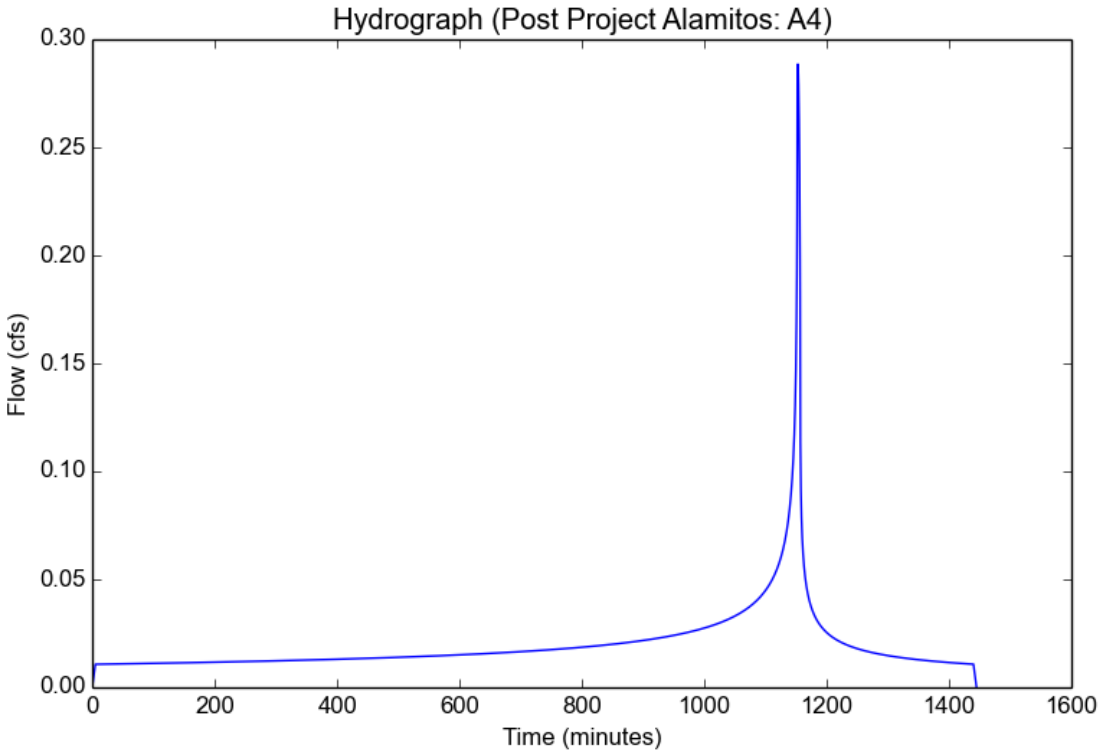
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Post Project/Post Project Alamitos - A4-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A4
Area (ac)	0.12
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.6716
Undeveloped Runoff Coefficient (Cu)	0.7117
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2885
Burned Peak Flow Rate (cfs)	0.2885
24-Hr Clear Runoff Volume (ac-ft)	0.04
24-Hr Clear Runoff Volume (cu-ft)	1740.9692



Peak Flow Hydrologic Analysis

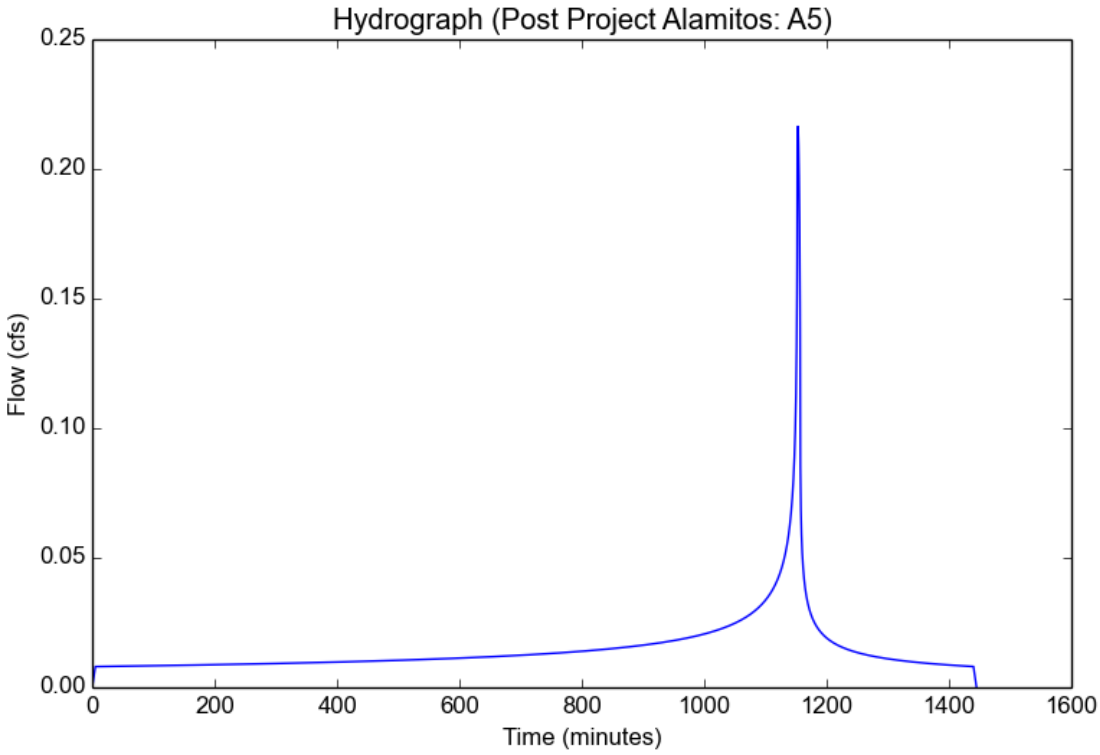
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/25 Year Storm/Post Project/Post Project Alamitos - A5-25YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A5
Area (ac)	0.09
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	4.4778
Peak Intensity (in/hr)	2.6716
Undeveloped Runoff Coefficient (Cu)	0.7117
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2164
Burned Peak Flow Rate (cfs)	0.2164
24-Hr Clear Runoff Volume (ac-ft)	0.03
24-Hr Clear Runoff Volume (cu-ft)	1305.7269



Peak Flow Hydrologic Analysis

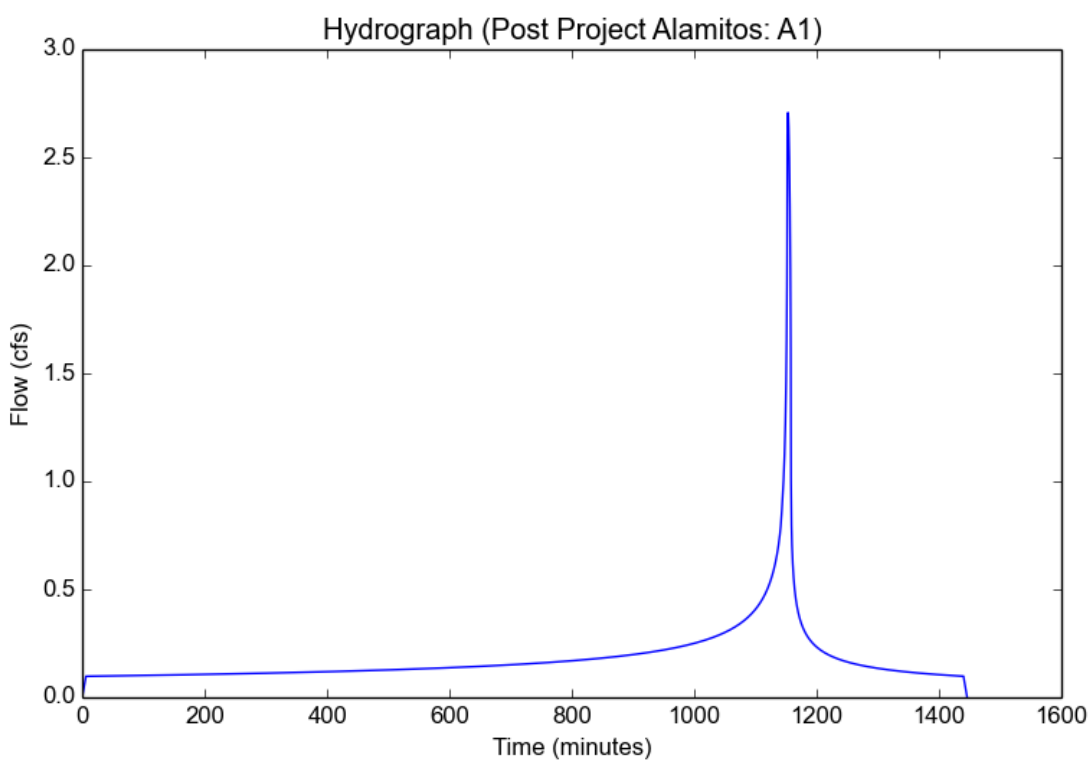
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Post Project/Post Project Alamitos - A1-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A1
Area (ac)	1.11
Flow Path Length (ft)	395.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.85
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	2.7929
Undeveloped Runoff Coefficient (Cu)	0.7221
Developed Runoff Coefficient (Cd)	0.8733
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	2.7074
Burned Peak Flow Rate (cfs)	2.7074
24-Hr Clear Runoff Volume (ac-ft)	0.3679
24-Hr Clear Runoff Volume (cu-ft)	16025.9174



Peak Flow Hydrologic Analysis

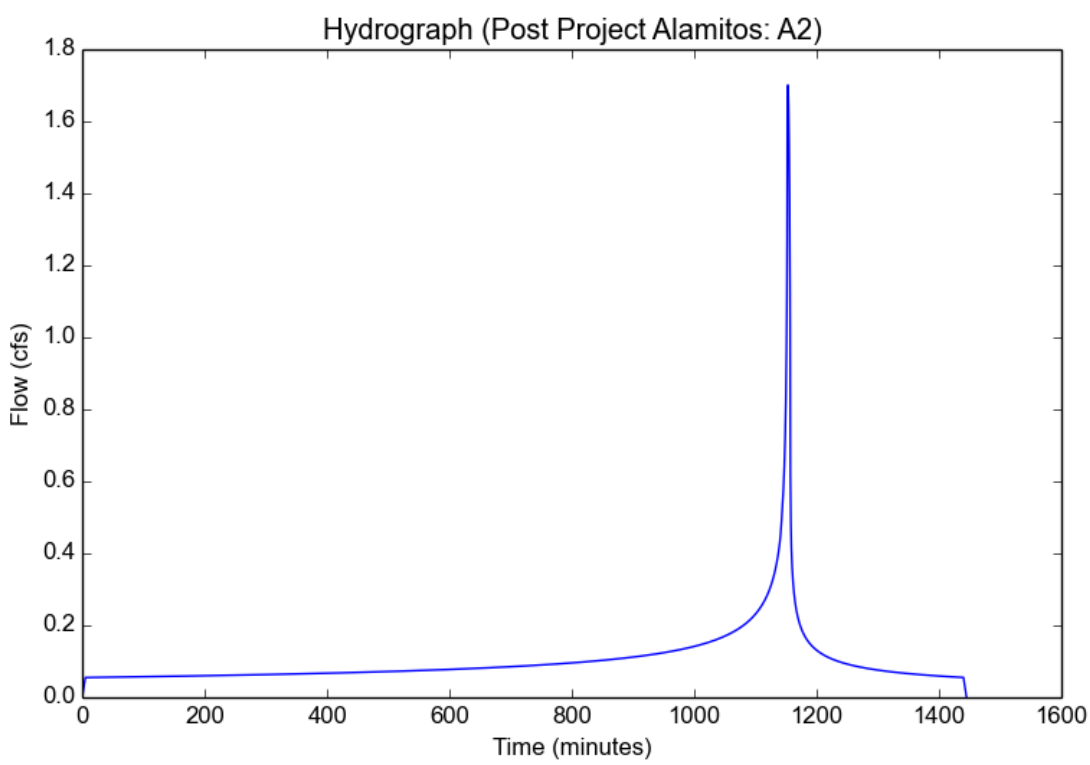
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Post Project/Post Project Alamitos - A2-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A2
Area (ac)	0.64
Flow Path Length (ft)	85.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.83
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.8734
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.7009
Burned Peak Flow Rate (cfs)	1.7009
24-Hr Clear Runoff Volume (ac-ft)	0.208
24-Hr Clear Runoff Volume (cu-ft)	9062.3008



Peak Flow Hydrologic Analysis

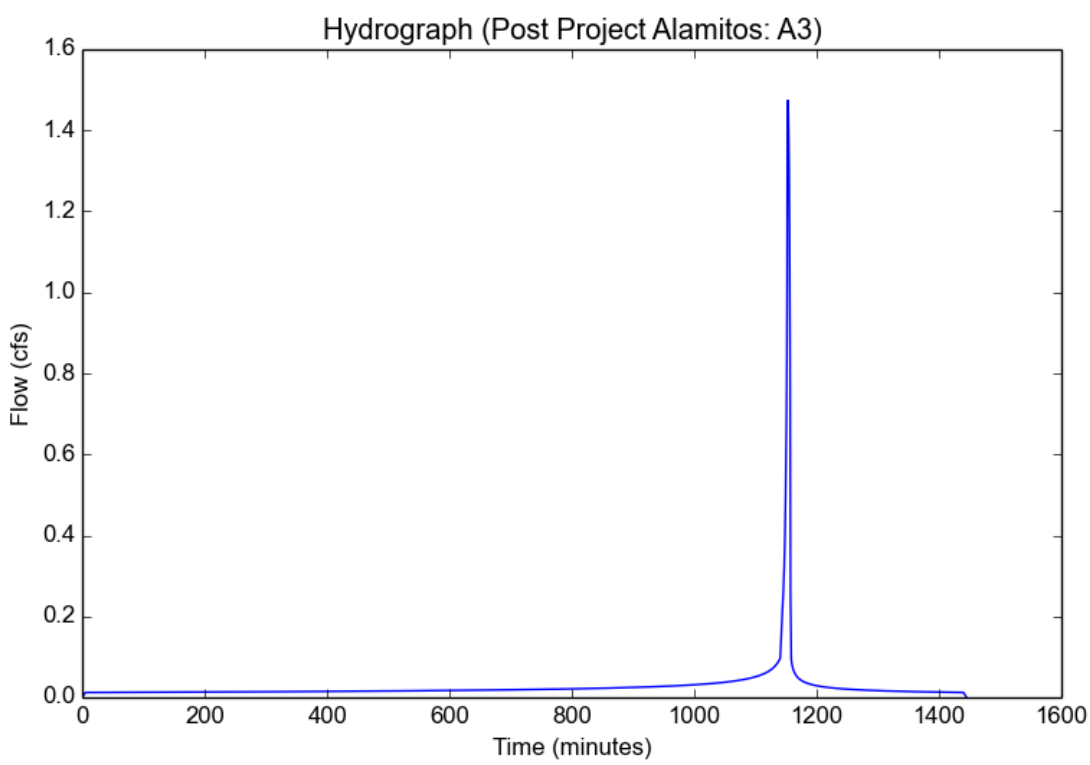
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Post Project/Post Project Alamitos - A3-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A3
Area (ac)	0.64
Flow Path Length (ft)	211.0
Flow Path Slope (vft/hft)	0.06
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.085
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.7568
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.4739
Burned Peak Flow Rate (cfs)	1.4739
24-Hr Clear Runoff Volume (ac-ft)	0.0558
24-Hr Clear Runoff Volume (cu-ft)	2431.5271



Peak Flow Hydrologic Analysis

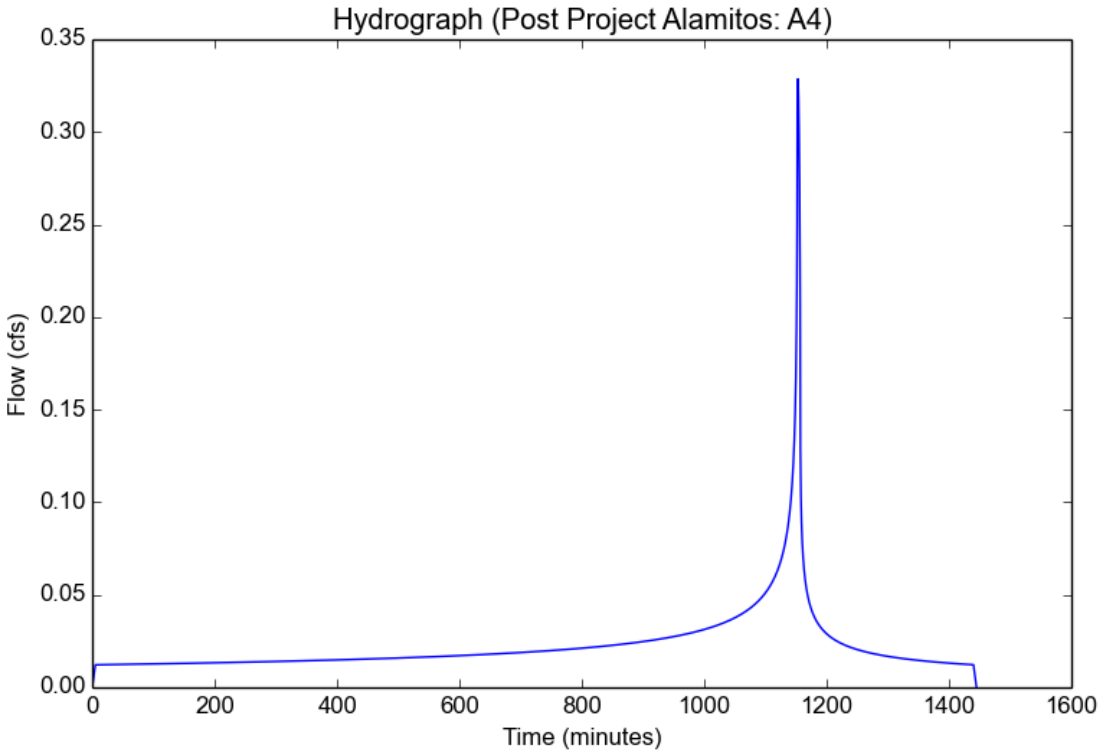
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Post Project/Post Project Alamitos - A4-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A4
Area (ac)	0.12
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.3286
Burned Peak Flow Rate (cfs)	0.3286
24-Hr Clear Runoff Volume (ac-ft)	0.0455
24-Hr Clear Runoff Volume (cu-ft)	1982.8806



Peak Flow Hydrologic Analysis

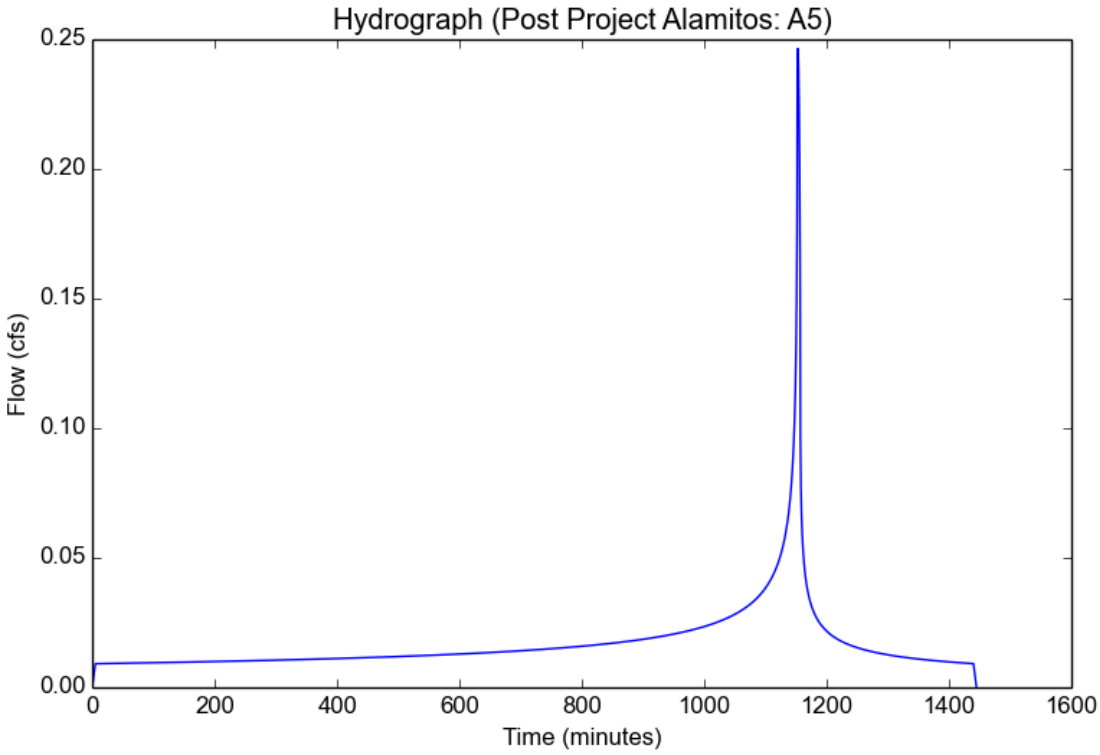
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/50 Year Storm/Post Project/Post Project Alamitos - A5-50YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A5
Area (ac)	0.09
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2465
Burned Peak Flow Rate (cfs)	0.2465
24-Hr Clear Runoff Volume (ac-ft)	0.0341
24-Hr Clear Runoff Volume (cu-ft)	1487.1605



Peak Flow Hydrologic Analysis

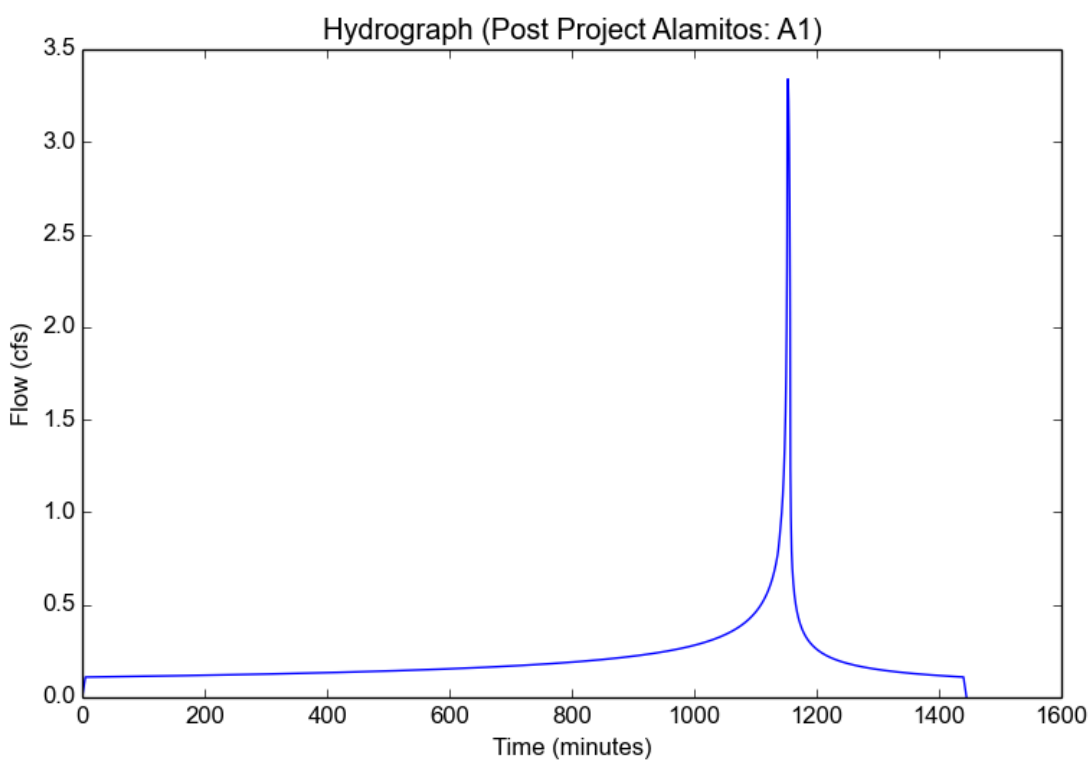
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Post Project/Post Project Alamitos - A1-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A1
Area (ac)	1.11
Flow Path Length (ft)	395.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.85
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.8813
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.3398
Burned Peak Flow Rate (cfs)	3.3398
24-Hr Clear Runoff Volume (ac-ft)	0.4133
24-Hr Clear Runoff Volume (cu-ft)	18002.3708



Peak Flow Hydrologic Analysis

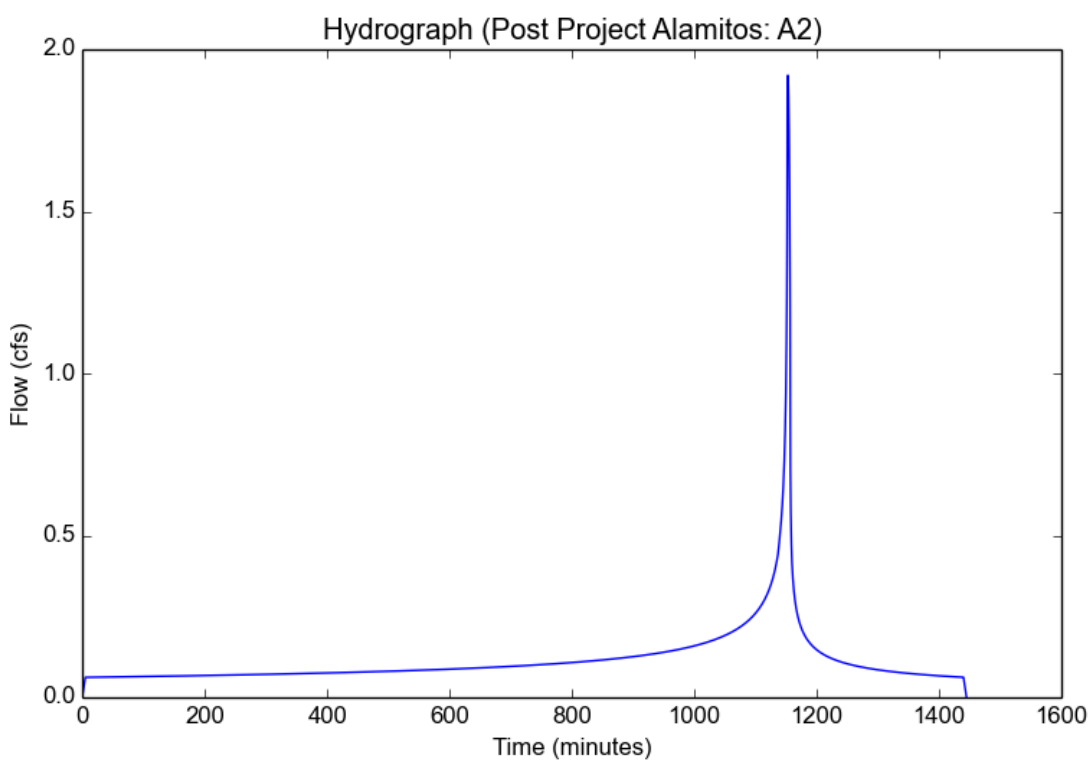
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Post Project/Post Project Alamitos - A2-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A2
Area (ac)	0.64
Flow Path Length (ft)	85.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.83
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.8788
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.9202
Burned Peak Flow Rate (cfs)	1.9202
24-Hr Clear Runoff Volume (ac-ft)	0.2337
24-Hr Clear Runoff Volume (cu-ft)	10181.637



Peak Flow Hydrologic Analysis

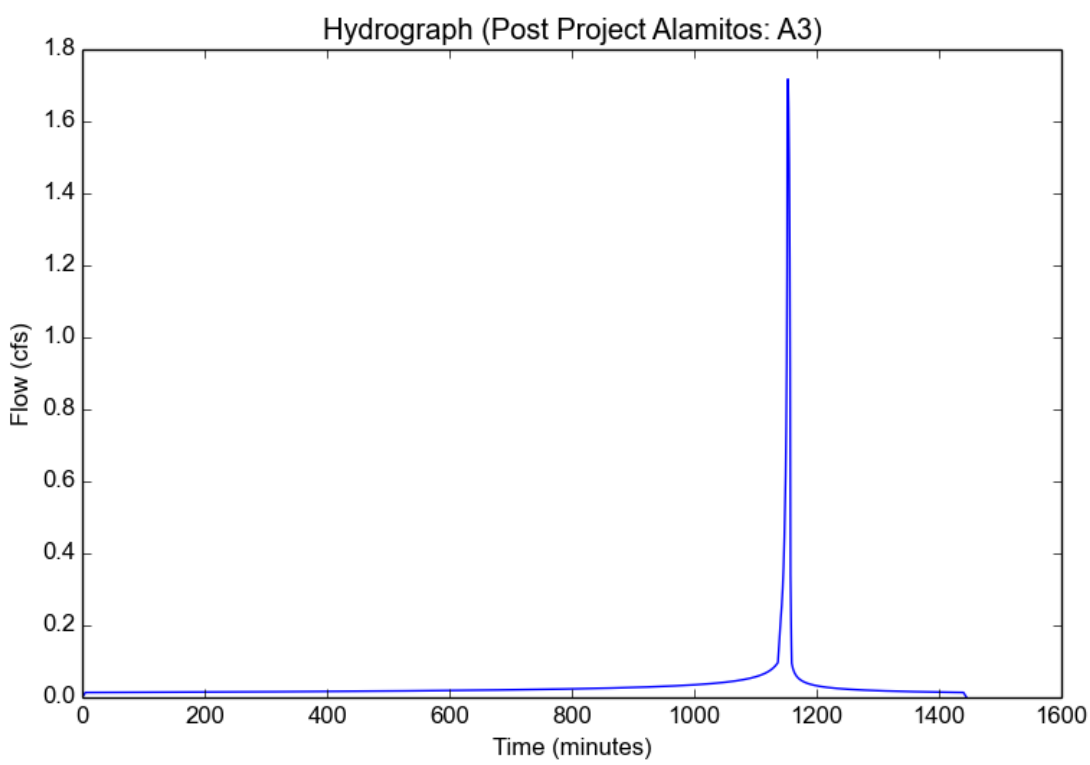
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Post Project/Post Project Alamitos - A3-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A3
Area (ac)	0.64
Flow Path Length (ft)	211.0
Flow Path Slope (vft/hft)	0.06
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.085
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.786
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.7173
Burned Peak Flow Rate (cfs)	1.7173
24-Hr Clear Runoff Volume (ac-ft)	0.0643
24-Hr Clear Runoff Volume (cu-ft)	2802.1026



Peak Flow Hydrologic Analysis

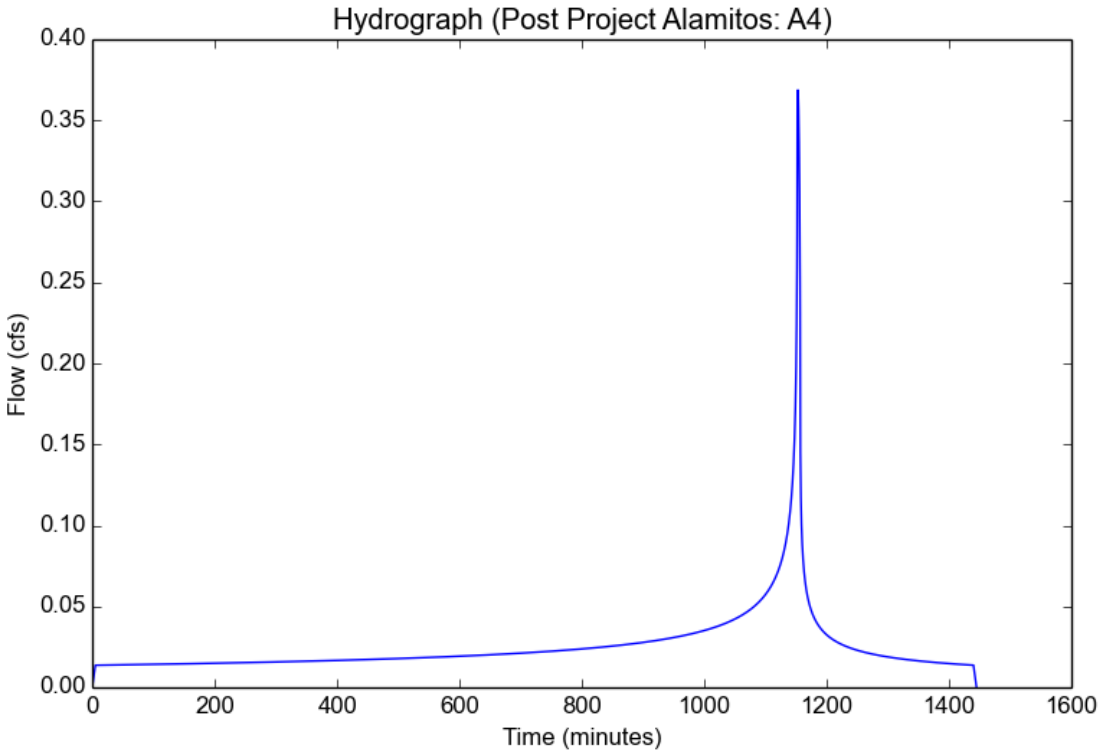
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Post Project/Post Project Alamitos - A4-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A4
Area (ac)	0.12
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.3687
Burned Peak Flow Rate (cfs)	0.3687
24-Hr Clear Runoff Volume (ac-ft)	0.0511
24-Hr Clear Runoff Volume (cu-ft)	2224.7921



Peak Flow Hydrologic Analysis

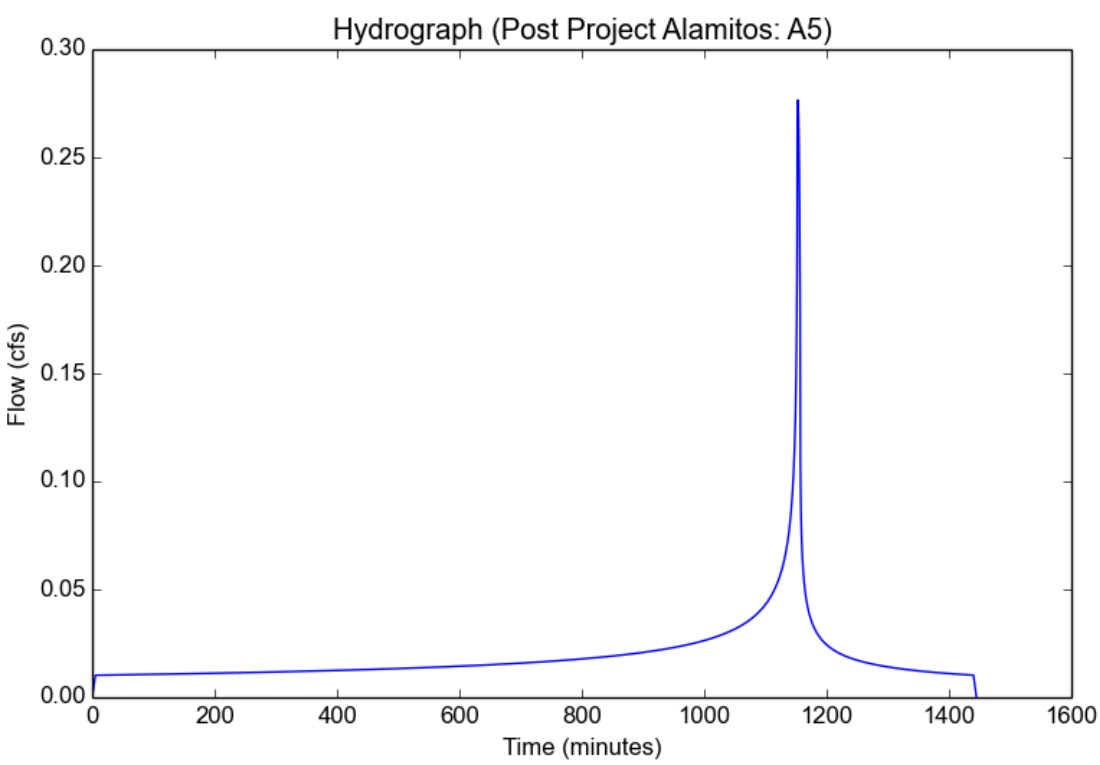
File location: H:/pdata/153541/CADD/Land/Design/Ryan/Runoff Calcs/100 Year Storm/Post Project/Post Project Alamitos - A5-100YR.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Post Project Alamitos
Subarea ID	A5
Area (ac)	0.09
Flow Path Length (ft)	15.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.1
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	5.7222
Peak Intensity (in/hr)	3.414
Undeveloped Runoff Coefficient (Cu)	0.7754
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2765
Burned Peak Flow Rate (cfs)	0.2765
24-Hr Clear Runoff Volume (ac-ft)	0.0383
24-Hr Clear Runoff Volume (cu-ft)	1668.594



APPENDIX D

Low Impact Development Plan

LOW IMPACT DEVELOPMENT PLAN (LID PLAN)

Project Name:

Alamitos Beach Concession Building

780 E. SHORELINE DRIVE, LONG BEACH, CA

Prepared for:

City of Long Beach Public Works

333 W Ocean Blvd.

Long Beach, CA, 90802

(562) 570-6383

Prepared by:

Michael Baker International

5 Hutton Centre Drive

Santa Ana, CA 92707

(949) 472-3505

Date Prepared: 7/28/17

Discretionary Permit(s) and Water Quality Conditions

The City of Long Beach is subject to waste discharge requirements for its Municipal Separate Storm Sewer System (MS4) discharges originating within its jurisdictional boundaries composed of storm water and non-storm water as set forth in Order No. R4-2014-0024.

Low Impact Development (LID) Plan

Development and redevelopment projects are required to incorporate three performance measures and practices into the design plan: conserve natural areas, protect slopes and channels, and provide storm drain system stenciling and signage.

Conserve Natural Areas

The area of disturbed soil was minimized to keep Marina Green Park in its existing condition. The existing trees located through the project site is to be protected in place wherever possible.

Protect Slopes and Channels

Slopes protection and stabilization will be put in place.

Provide Storm Drain System Stenciling and Signage

Storm drain system stenciling and signage is not applicable for this project.

Pollutants of Concern

The anticipated pollutants of concern for this project are suspended solids, total phosphorus, total nitrogen, total Kjedahl nitrogen, copper, lead, zinc, trash and debris, and oil and grease.

LID Stormwater Quality Design Volume

The City of Long Beach shall require the project to retain on-site the Stormwater Quality Design Volume (SWQDV). The storm depth used to calculate the SWQDV is determined as the greater of 0.75 inches or the 85th percentile, 24 hour rain event as determined from the Los Angeles County 85th percentile precipitation isohyetal map.

The SWQDV was calculated for each tributary area and summarized in the following table.

Tributary Area	Impervious Area (sq ft)	Pervious Area (sq ft)	Undeveloped Area (sq ft)	Catchment Area (sq ft)*	SWQDV (cu ft)
A-1	8,135	624		7,384	461
A-2	14,879	1,452		13,536	846
A-3	10,775	2,138	14,858	11,397	712
A-4	5,370			4,833	302
A-5	3,911			3,520	220

*Catchment Area = (Impervious Area x 0.9) + [(Pervious Area + Undeveloped Area) x 0.1]

Best Management Practices (BMPs)

BMPs shall be designed to manage and capture stormwater runoff to the maximum extent feasible with the use of infiltration, capture and use, biofiltration BMPs, or a combination. Per the Long Beach Low

Impact Development Best Management Practices Design Manual, infiltration BMPs shall be the first priority type of BMPs followed by capture and use then biofiltration BMPs. Biofiltration BMPs shall be sized to capture 1.5 times the volume that is not managed through infiltration or capture and use BMPs.

Infiltration BMPs

The use of infiltration BMPs is the preferred method of compliance and all attempts will be made to incorporate them where possible. The average infiltration rate for the material will be approximately 5 in/hr. Although average groundwater depth for the project site is approximately 10 feet, the geotechnical engineer determined that infiltration is feasible. The geotechnical engineer determined that the proposed infiltration BMPs will not negatively impact an existing unconfirmed aquifer and the groundwater is not known to be polluted. Infiltration BMPs will include depressed sand areas and utilize the beach as natural infiltration.

Subarea A-1 is composed of new parking stalls. The work in the parking lot excludes the area west of the new parking stalls as the activity there is considered maintenance under the MS4 permit. The parking lot area will drain in the northerly direction and into depressed sand areas within the median. Due to site constraints, the BMP cannot be sized to treat the full SWQDV of the tributary area. Fortunately, there are additional existing BMPs, also depressed sand areas, within the parking lot. The other BMPs were sized to provide treatment for this area already. There is capacity in those BMPs to capture the excess volume from this work area.

Subarea A-2 consist of the southern portion of the new concession building, playground and restroom. Downspouts will be added to the roof the buildings to ensure discharge is toward the beach.

Subareas A-4 and A-5 consist of a new bike path on the beach between the development and ocean. Runoff from these subareas will infiltrate in the sand.

A vegetated swale will be located behind A-3: the northern portion of the buildings. The swale will continue to wrap around the west side of the restroom. The swale will provide some biotreatment as runoff filters through the vegetation but its primary purpose is to convey flows to the basin located by the sidewalk. Any remaining volume that cannot be infiltrated by the basin will pond up and sheet flow across and infiltrate into the beach.

EXHIBIT 1

Existing Hydrology Map

PREPARED BY:

Michael Baker INTERNATIONAL

5 Hutton Centre Drive, Suite 500
Santa Ana, CA 92707
Phone: (949) 472-3505
MBAKERINTL.COM

EXISTING HYDROLOGY EXHIBIT
(ALAMITOS)

SCALE:	1"=40'
PROJECT NO.	153541
DATE:	7-27-2017

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EXHIBIT 2

Proposed Hydrology Map

(7.0± FG)

(23.5 FG)

A1
1.11

L=395'
S=2%

L=211'
S=6%

L=265'
S=1%

13.50 FG

A3
0.64

10.85 FG

L=85'
S=2%

A2
0.64

A5
0.09

FLOW PATH

15'

2%

A4
0.12

FLOW PATH

15'

2%

SCALE 1"=40'

40 20 0 40 80 120

SCALE: 1"=40'

PREPARED BY:

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PROPOSED HYDROLOGY EXHIBIT
(ALAMITOS)

SCALE: 1"=40'

PROJECT NO. 153541

DATE: 7-27-2017

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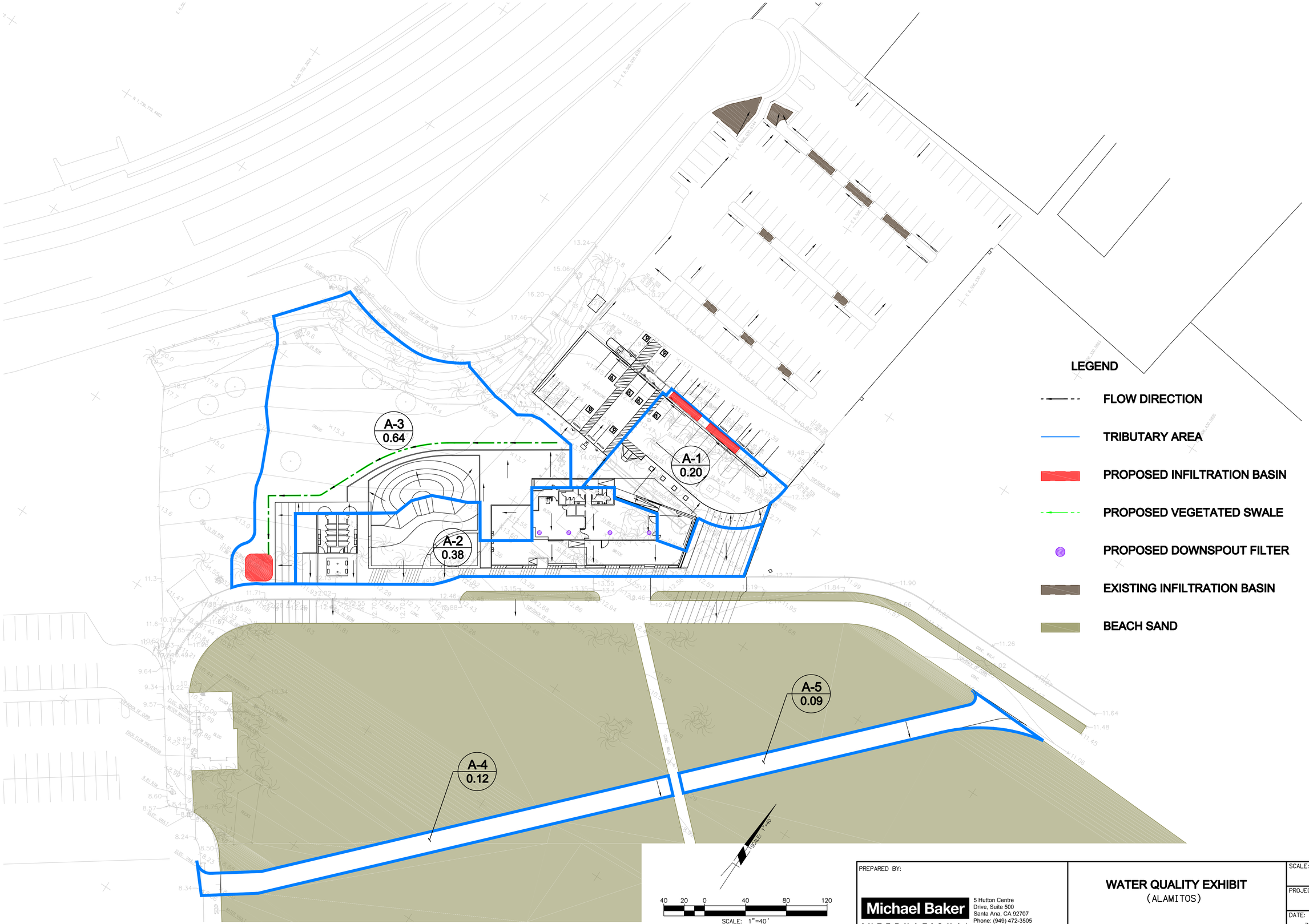
EXHIBIT 3

Water Quality Exhibit



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WATER QUALITY EXHIBIT
(ALAMITOS)

SCALE:	1"=40'
PROJECT NO.	153541
DATE:	7-27-2017

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