Appendix H

Hydrology and Water Quality Report

Hydrology Report for
Sand Canyon Country Club

VOLUME 1

County of Los Angeles

Hunsaker Project No:
0261-001-001
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Prepared for:

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1.0 INTRODUCTION

1.1 REPORT SUMMARY

The purpose of this report is to present the Final Hydrology Design for Sand Canyon Country Club Tr. 52004. The report analyzes existing and proposed rough graded conditions for the 25, 50-year, and 50-year Capital Storm.

A 24-Hour storm analysis based upon the Los Angeles County Rational and Modified Rational Methods of Hydrology was used for clear, burned, and burned and bulked conditions for the watershed(s).

This report is divided into several sections. Section 1 contains the introduction; Section 2 discusses the methodology used in the hydrologic analysis; Section 3 summarizes the design criteria used; Section 4 is a description the hydrologic model and brief description of each watershed and its land uses; Section 5 includes the conclusions and recommendations of this report, and Section 6 includes a list of the references used in the preparation of this report.

1.2 PROJECT DESCRIPTION

Sand Canyon Country Club consists of 75.5 acres and is located within a 1,634 square-mile Santa Clara River Basin. Tract 52004 includes the project site as well as existing residential and golf course areas. This hydrology study outlines the pre and post–development drainage for the site. This report addresses drainage from the upper limits of the project's drainage areas to the southerly edge of the Santa Clara River. The proposed project is composed of a park area, residential development, resort, hotel and golf course. It will also contain an existing pond. The site receives offsite water from a stream running roughly parallel to Live Oak Springs Canyon Road. The stream originates southeast of the project site in the Magic Mountain Wilderness Area. This brings the total acreage covered by this hydrology to approximately 750-acres.

The topography of the site contains moderate to steep sided ridges and some incised canyons. The project site drains mostly north or west. Flows ultimately drain into the Santa Clara River.

Land use within the watershed will contain developed and undeveloped areas. The development will consist of single and multi-family residential units, commercial (hotel and resort), as well as recreational facilities (tennis courts and golf course).

The proposed drainage watersheds generally follow the natural drainage courses. For this tract, debris control facilities have been located where natural terrain drains onto proposed development. Post-development storm water runoff from the site draining into existing offsite facilities will remain the same or higher compared to existing conditions during the capital storm event. Areas where the post-development runoff increases are located within the project site. Because overall post-development storm flows increase compared to pre-development flows, proposed on-site drainage facilities will be designed to accommodate storm flows from upstream areas and convey it to an acceptable outlet. Where runoff is conveyed to existing offsite drainage facilities, pre and post-development runoff rates and volumes are compared and are included in this report.

2. METHODOLOGY

The project site has been divided into four (4) watersheds in the existing and proposed conditions for analysis purposes. The total area of these watersheds including some offsite areas is approximately 175 acres. Each watershed was delineated using the proposed site grading for developed area and existing topography for undeveloped areas. The proposed drainage watersheds generally follow natural drainage courses. Each of the main watersheds was delineated into subareas of less than 40 acres, for the hydrology analysis. The Rational Method was used for drainage analysis; this method is found in the Los Angeles County 2006 Hydrology Manual.

The time of concentration (T_c) for each subarea was computed using the Los Angeles County approved Time of Concentration calculator. The calculator evaluates several hydrologic parameters such as soil type, land use, imperviousness, storm frequency, length and slope of each area to calculate a time of concentration. The data was used with the Los Angeles County HydroCalc software application, to determine peak flow rates for all storm events.

Using the times of concentrations for each subarea (acquired from the Time of Concentration calculator), the Rational Method was used to calculate the 50-Year 24-Hour peak runoff flow for each subarea. The undeveloped tributary areas were analyzed using a burned coefficient to calculate peak runoff rates. Unburned coefficients were used for all developed conditions as well as undeveloped conditions for storms other than the 50-year Capital Storm event. Existing golf course areas are considered developed and would require unburned coefficients.

The system is designed for the proposed condition as well as future conditions. The hydrological model only includes the existing offsite conditions.

The project's land use and imperviousness were determined from the Land Use and Imperviousness Table provided in the Los Angeles County Hydrology Manual. Soil types and rainfall corresponding to each subarea were obtained from the Hydrologic Maps in the Los Angeles County Hydrology Manual, Map: 1-H1.45.

The project site is located in two debris potential areas within the Santa Clara Basin, DPA-8 and DPA-9. Within the Santa Clara Watershed, DPA-8 and DPA-9 have bulking factors of 1.36 and 1.27 per square mile, for areas less than or equal to 0.1 $mi^{2.}$ The burned and bulked peak runoff rates were calculated by factoring the peak burned runoff rates by the appropriate bulking factor.

Two water quality/detention basins will be constructed, basin #1 will be south of Robinson Ranch and basin #2 near the intersection of "H" Drive and "I" Drive. Refer to proposed hydrology map in Appendix B. The debris production rate for Debris Potential Zones DPA-8 and DPA-9 are 35,000 cy / mi^2 and 16,500 cy / mi^2 respectively, for areas less than or equal to 0.1 mi^2.

3. DESIGN CRITERIA

Los Angeles County requires that several design criteria's be followed when using the Rational and Modified Rational Method to determine capital flood flow.

The 50-year and 24-hour rainfall isohyets used in the hydrologic calculations were obtained from the Los Angeles County Hydrology Manual's Hydrologic Maps. This ranged between 5.8" to 6.0". Other storm events were determined by factoring the 50-year isohyets.

The soil types within the project site were also determined from the hydrologic maps as 20 and 99.

The project was assumed to have 55% imperviousness in residential and commercial areas and 3% for golf course areas. Undeveloped areas within the project were assumed to have 3% imperviousness. Road areas within the project were assumed to have 99% imperviousness.

The project lies in two main debris potential areas in the Santa Clara Basin, DPA-8 and DPA-9. The respective debris and bulking factors are 35,000 cy / mi^2, 1.36 / mi^2; and 16,500 cy / mi^2, 1.27 / mi^2.

The design criteria used is summarized below:

Hydrology Method:	Los Angeles County Flood Control District Rational Method.
Hydrology Modeling Software	HydroCalc 0.3.1-beta
Design Storm:	SUSMP, 25, 50-Year (burned), Capital
50-Year Isohyet:	5.9"
Soil Types:	20 and 99
Land Use and Imperviousness:	Golf course (3%) Duplexes, triplexes and 2-or 3-unit condominiums and townhouses (55%) Roads (99%)
Debris Potential Zone:	DPA-8 (35,000 cy / mi^2); area $\leq$ 0.1 mi^2 DPA-9 (16,500 cy / mi^2); area $\leq$ 0.1 mi^2
Peak Bulking Factor:	1.36 / mi^2; DPA-8 (area $\leq$ 0.1 mi^2) 1.27 / mi^2; DPA-9 (area $\leq$ 0.1 mi^2)

4. RATIONAL METHOD HYDROLOGY WATERSHEDS

The hydrology analysis was based on the Los Angeles design criteria for the Rational Method. Drainage areas were determined and the corresponding sub-areas delineated based on the existing topography and proposed grading for the project site.

Following is a brief description of the existing and proposed watersheds. The results of the hydrologic modeling can be found in this report on Appendix A.

PROPOSED PROJECT

Existing Condition

The project was delineated into four (4) existing watersheds as described below.

Watershed 100 (East of the Intersection of Sand Canyon Road and Robinson Ranch Road)

Watershed 100 drains approximately 91-acres to the west into an existing Los Angeles County Department of Public Works debris basin per PD048476.

Watershed 200 (Southwest of the Intersection of Oak Springs Canyon Road and Pashley Street)

Watershed 200 is located southwest of the intersection of Oak Springs Canyon Road and Pashley Street and consists of 15-acres of natural area, which drains north into the Santa Clara River.

Watershed 300 (Southeast of the Intersection of Oak Springs Canyon Road and Pashley Street)

Watershed 300 is located southeast of the intersection of Oak Springs Canyon Road and Pashley Street and consists of 26-acres of natural area, which drains north toward Santa Clara River.

Watershed 400 (West and South of the existing Sand Canyon Country Club parking lot)

Watershed 400 is located west and south of an existing parking lot belonging to Sand Canyon Country Club. This watershed drains approximately 14-acres into the Santa Clara River.

Proposed Condition

In the proposed condition, the project was delineated into four (4) main watersheds. All undeveloped area runoff was calculated with burned runoff coefficients for the 50-year, 24-hour design storm.

Watershed 100 (East of the Intersection of Sand Canyon Road and Robinson Ranch Road)

The proposed watershed 100 includes approximately 103-acres of tributary area that will be draining toward to the existing Los Angeles County Public Works Department debris basin PD048476. This watershed consists of approximately 43-acres of offsite area and approximately 40-acres of onsite commercial and mufti-family development. One water quality basin and one water quality/detention basin will be constructed in this watershed.

Watershed 200 (Southwest of the Intersection of Oak Springs Canyon Road and Pashley Street)

Similar to existing watershed 200, the 11-acres tributary area drains toward the Santa Clara River.

Watershed 300 (Southeast of the Intersection of Oak Springs Canyon Road and Pashley Street)

Similar to existing watersheds 300, the 17-acres tributary area drains toward the Santa Clara River.

Watershed 400 (West and South of existing Sand Canyon Country Club parking lot)

Watershed 400 drains to existing ponds and will ultimately drain north. The tributary area is approximately 16 acres. The ponds in watershed 400 will be privately maintained.

5. WATER QUALITY

L.A.C.D.P.W. is responsible for the planning and operation of roads, building safety, flood control, and sewage. It is required by L.A.C.D.P.W. to quantify how much impact the proposed condition will have on the existing condition.

In the proposed condition, two water quality/detention basins will be constructed in watershed 100. Water quality /detention basin #2 will detain flow from a small oak tree preserve (1.6 ac). It will then go to the debris basin found in PD048475 which is maintained by L.A.C.D.P.W. Water quality/detention basin #1 will also be constructed in proposed watershed 100. Over time water will build up in basin #1 and overflow towards the same existing debris basin from PD048475. Water quality/detention basin #1 will also pick up offsite water from the south. An existing stream goes through this water quality/detention basin and conveys the overflow to the debris basin. The size of this water quality/detention basin #1 is 3.44 ac-ft. These facilities are shown in proposed hydrology map in Appendix B. Flows ultimately travel to the Santa Clarita River, but pass through the existing debris basin first.

6. CONCLUSIONS & RECOMMENDATIONS

Based upon the hydrologic analysis performed, the developed project condition will result in onsite and offsite impacts. There are increases in runoff to the existing debris basin per PD048476.

See a summary of the results for runoff rates on Table 1. Detailed calculations can be found in the Appendix A. Existing and proposed hydrology maps can be found in Appendix B.

Table 1 - Runoff Summary

				50 year	Capital	Debris Volume (c.y.)
Watershed 100 (East of the Intersection of Sand Canyon Road and Robinson Ranch Road)	**Existing (100 Watershed)**		**Q (cfs)**	146.7	156.3	804
	Area (ac)	90.6	**q (cfs/ac)**	1.6		
	Proposed (100 Watershed)		**Q (cfs)**	187.0	195.6	611
	Area (ac)	103.5	**q (cfs/ac)**	1.8		
	Delta		**Q (cfs)**	40.3	39.3	
	Area (ac)	12.9	**q (cfs/ac)**	0.2		

				50 year	Capital	Debris Volume (c.y.)
Watershed 200 (Southwest of the Intersection of Oak Springs Canyon Road and Pashley Street)	**Existing (200 Watershed)**		**Q (cfs)**	31.9	43.4	788
	Area (ac)	15.0	**q (cfs/ac)**	2.1		
	Proposed (200 Watershed)		**Q (cfs)**	26.5	34.9	265
	Area (ac)	11.4	**q (cfs/ac)**	2.3		
	Delta		**Q (cfs)**	-5.4	-8.5	
	Area (ac)	-3.6	**q (cfs/ac)**	0.2		

				50 year	Capital	Debris Volume (c.y.)
Watershed 300 (Southeast of the Intersection of Oak Springs Canyon Road and Pashley Street)	**Existing (300 Watershed)**		**Q (cfs)**	46.6	59.6	1335
	Area (ac)	26.3	**q (cfs/ac)**	1.8		
	Proposed (300 Watershed)		**Q (cfs)**	33.4	44.6	425
	Area (ac)	17.0	**q (cfs/ac)**	2.0		
	Delta		**Q (cfs)**	-13.2	-15.0	
	Area (ac)	-9.3	**q (cfs/ac)**	0.2		

Table 1 - Runoff Summary (Cont,)

				50 year	Capital	Debris Volume (c.y.)
Watershed 400 (West and South of the existing Sand Canyon Country Club parking lot)	**Existing (400 Watershed)**		**Q (cfs)**	47.2	48.0	21
	Area (ac)	17.4	**q (cfs/ac)**	2.7		
	Proposed (400 Watershed)		**Q (cfs)**	46.4	47.2	21
	Area (ac)	16.4	**q (cfs/ac)**	2.8		
	Delta		**Q (cfs)**	-0.8	-0.8	
	Area (ac)	-1.0	**q (cfs/ac)**	0.1		

Table 2 – Water Quality/Detention Summary

Basin #1

	Ac-ft
LID Req Volume	1.67
Biofiltration Req Volume (150% of LID Red Volume)	2.51
Detention (Subarae 101-104)	0.27
Total Req. Volume (Biofiltration Vol + Detention)	2.78
Provided Volume	4.21

Basin #2

	Ac-ft
LID Req Volume	0.21
Biofiltration Req Volume (150% of LID Red Volume)	0.32
Detention (Subarea 106)	0.01
Total Req. Volume (Biofiltration Vol + Detention)	0.33
Provided Volume	0.39

Existing Debris Basin Per PD 048475

Subarea	Tributary Area (ac)	Qpm (cfs)
105A	0.3	0.1
105B	1.1	0.2

7. REFERENCES

i. Los Angeles County Department of Public Works Hydrology Manual, January 2006

ii. Los Angeles County Department of Public Works Sedimentation Manual, March 2006

A. Rational Method Hydrology

1. Existing Hydrologic Results for 50-yr Storm Event

Peak Flow Hydrologic Analysis

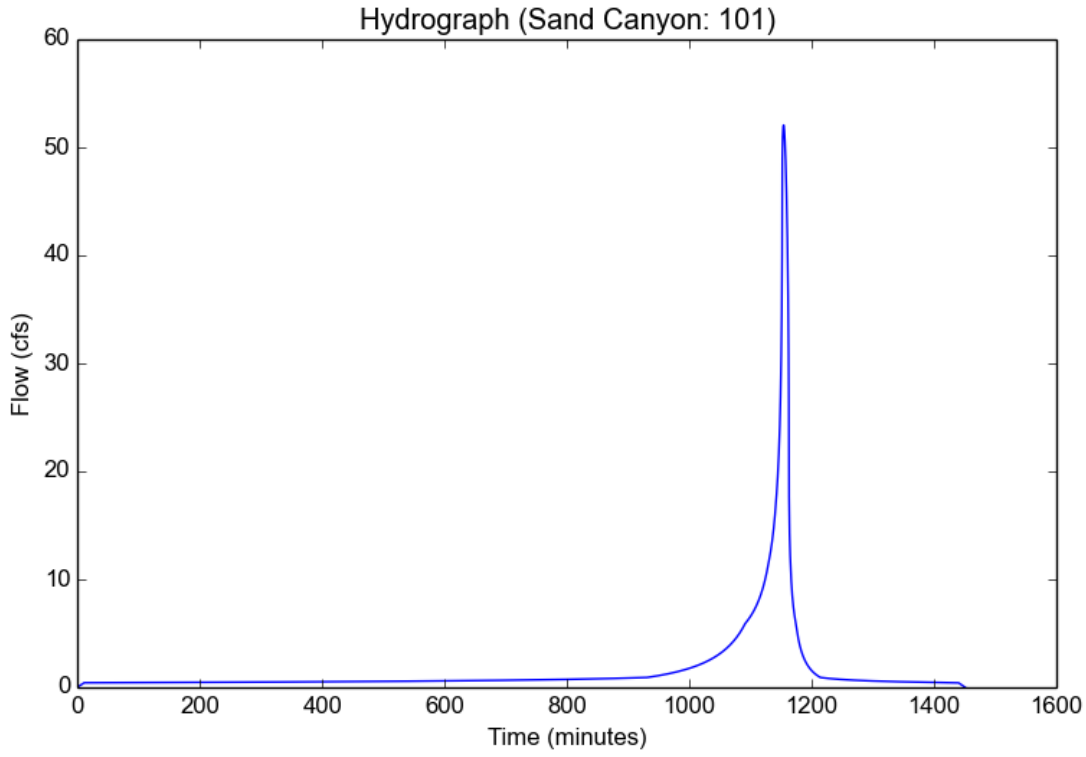
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Existing Hyodology Calc/Existing Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	101
Area (ac)	26.5
Flow Path Length (ft)	1830.0
Flow Path Slope (vft/hft)	0.1
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.4301
Undeveloped Runoff Coefficient (Cu)	0.8057
Developed Runoff Coefficient (Cd)	0.8085
Time of Concentration (min)	11.0
Clear Peak Flow Rate (cfs)	52.0656
Burned Peak Flow Rate (cfs)	53.6656
24-Hr Clear Runoff Volume (ac-ft)	3.415
24-Hr Clear Runoff Volume (cu-ft)	148757.6328



Peak Flow Hydrologic Analysis

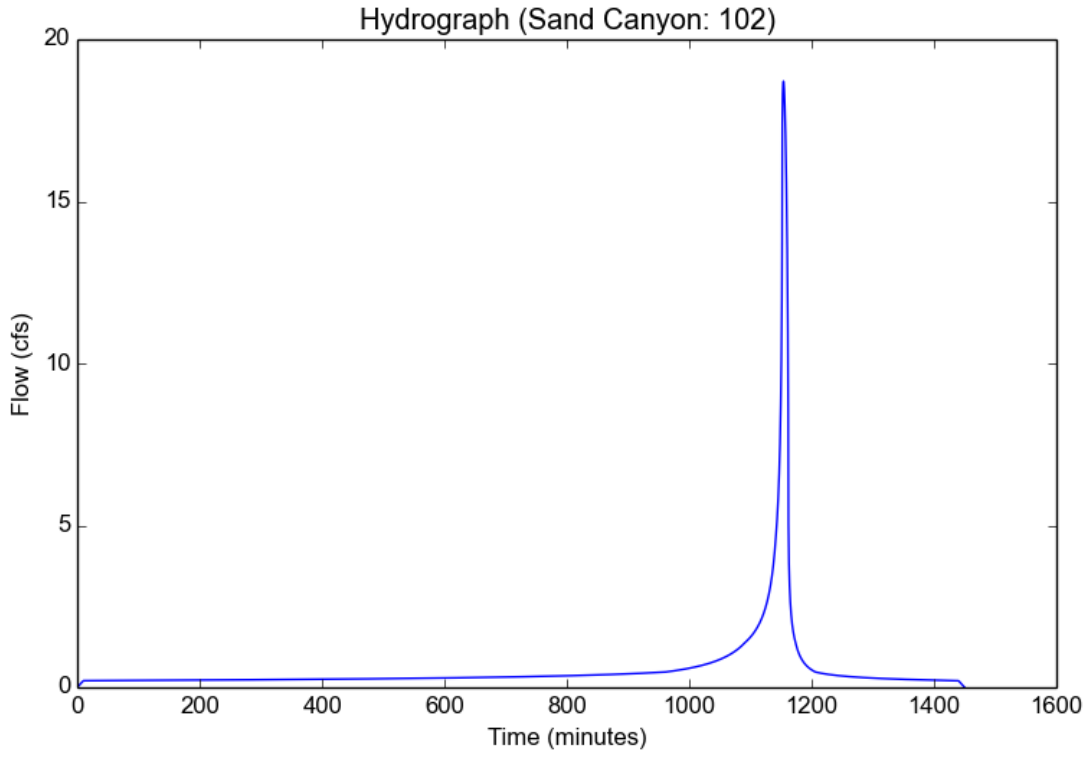
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Existing Hyodology Calc/Existing Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	102
Area (ac)	12.8
Flow Path Length (ft)	962.0
Flow Path Slope (vft/hft)	0.07
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	20
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.5414
Undeveloped Runoff Coefficient (Cu)	0.5651
Developed Runoff Coefficient (Cd)	0.5751
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	18.7086
Burned Peak Flow Rate (cfs)	20.5151
24-Hr Clear Runoff Volume (ac-ft)	1.1675
24-Hr Clear Runoff Volume (cu-ft)	50857.3535



Peak Flow Hydrologic Analysis

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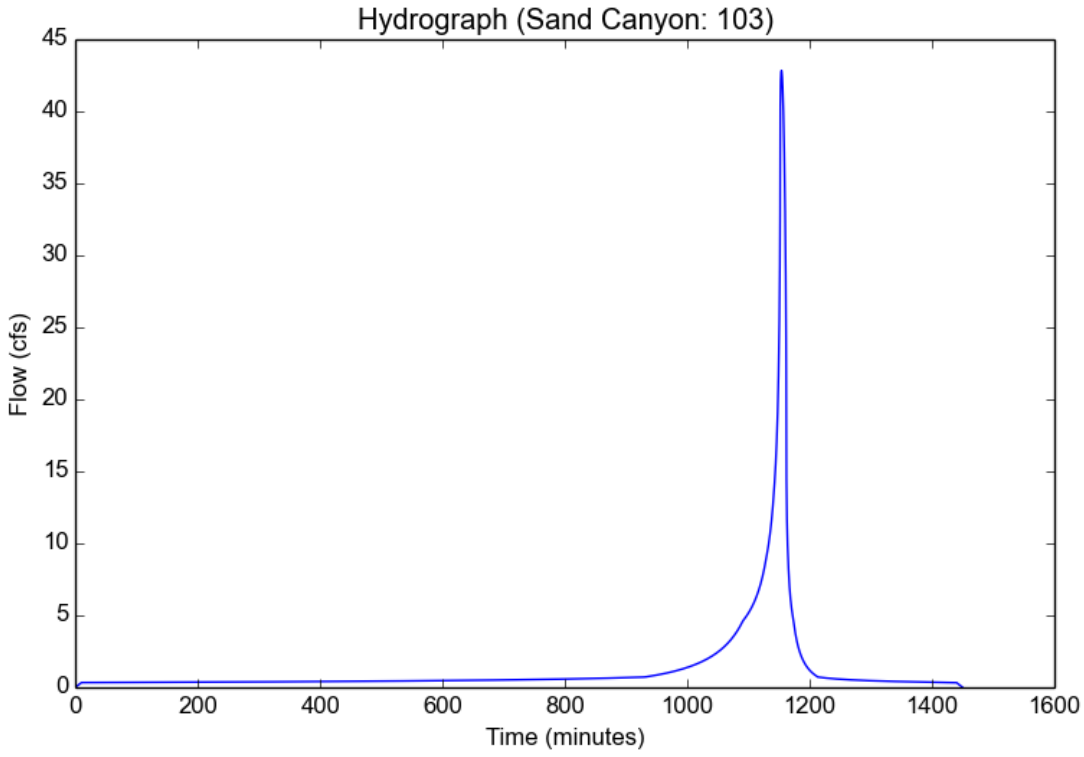
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	103
Area (ac)	20.7
Flow Path Length (ft)	1653.0
Flow Path Slope (vft/hft)	0.12
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.5414
Undeveloped Runoff Coefficient (Cu)	0.8116
Developed Runoff Coefficient (Cd)	0.8143
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	42.8358
Burned Peak Flow Rate (cfs)	44.1129
24-Hr Clear Runoff Volume (ac-ft)	2.6684
24-Hr Clear Runoff Volume (cu-ft)	116235.583



Peak Flow Hydrologic Analysis

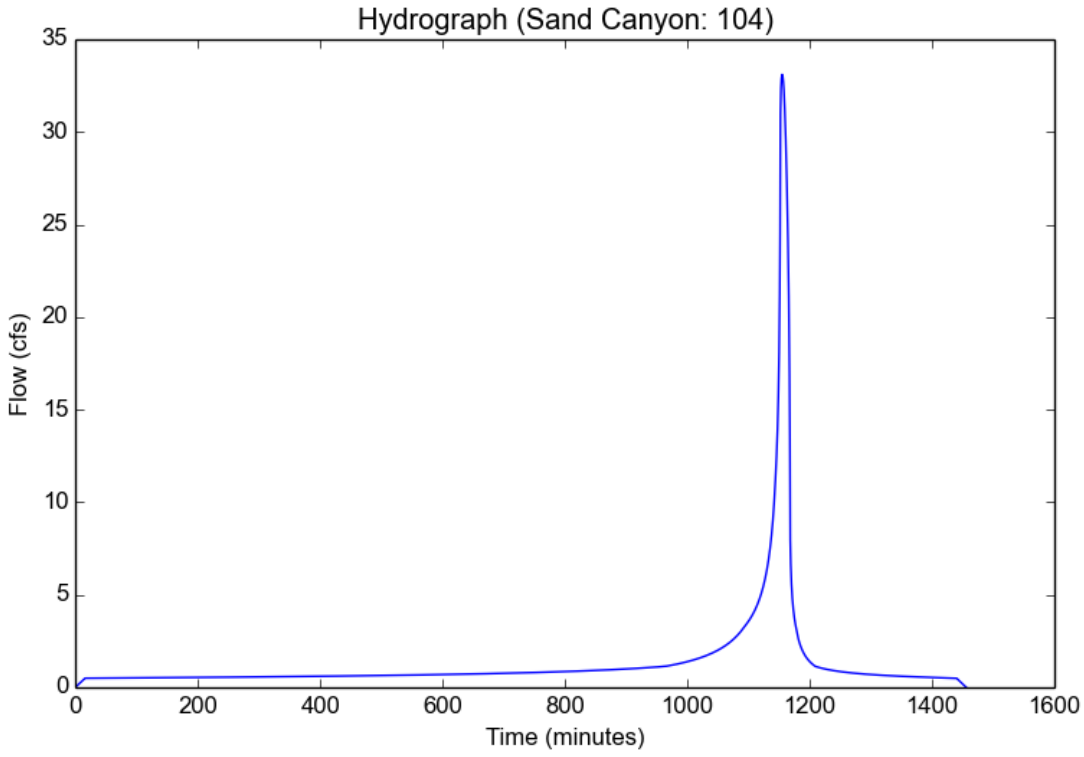
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Existing Hyodology Calc/Existing Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	104
Area (ac)	30.6
Flow Path Length (ft)	1884.0
Flow Path Slope (vft/hft)	0.08
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	20
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.0377
Undeveloped Runoff Coefficient (Cu)	0.5195
Developed Runoff Coefficient (Cd)	0.5309
Time of Concentration (min)	16.0
Clear Peak Flow Rate (cfs)	33.104
Burned Peak Flow Rate (cfs)	36.7876
24-Hr Clear Runoff Volume (ac-ft)	2.7734
24-Hr Clear Runoff Volume (cu-ft)	120807.9883



Peak Flow Hydrologic Analysis

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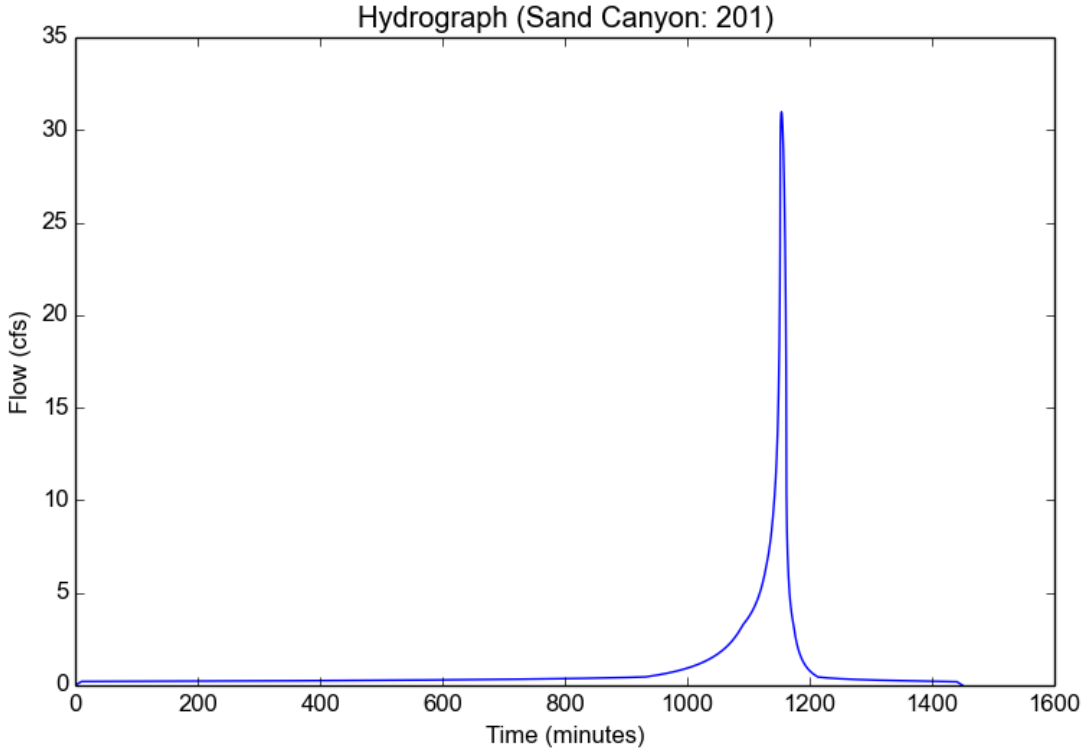
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	201
Area (ac)	15.0
Flow Path Length (ft)	1504.0
Flow Path Slope (vft/hft)	0.1
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.01
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.5414
Undeveloped Runoff Coefficient (Cu)	0.8116
Developed Runoff Coefficient (Cd)	0.8125
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	30.973
Burned Peak Flow Rate (cfs)	31.9073
24-Hr Clear Runoff Volume (ac-ft)	1.8378
24-Hr Clear Runoff Volume (cu-ft)	80053.1848



Peak Flow Hydrologic Analysis

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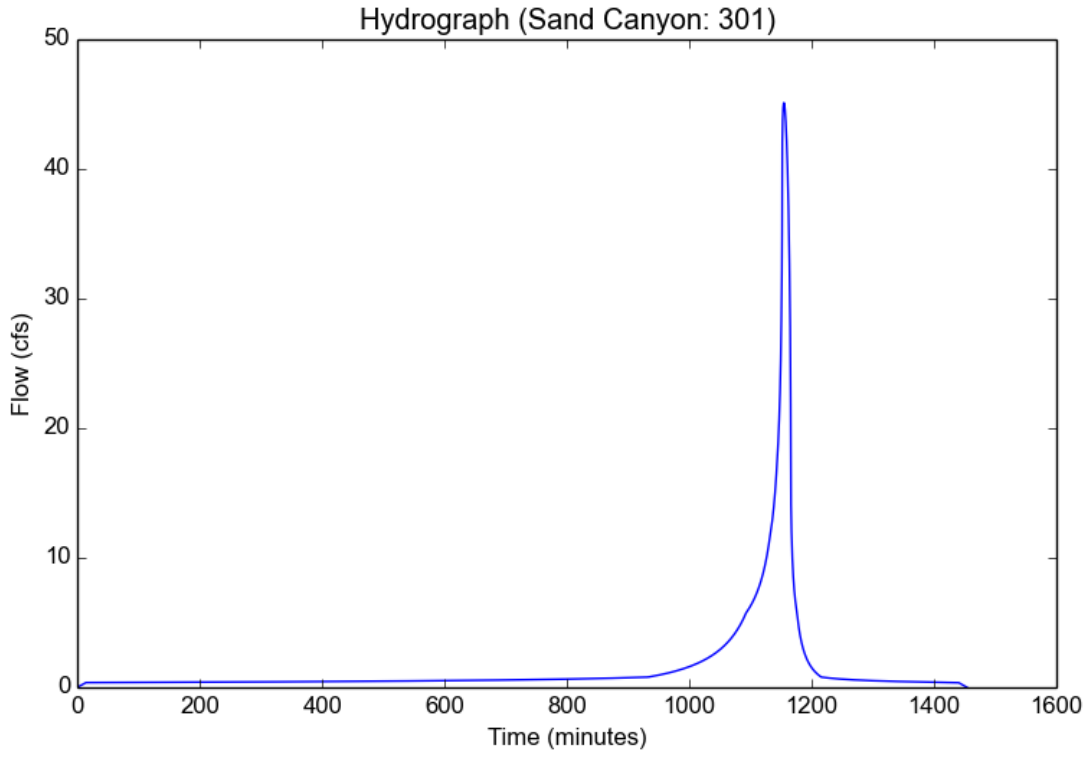
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	301
Area (ac)	26.3
Flow Path Length (ft)	2145.0
Flow Path Slope (vft/hft)	0.05
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.01
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.1697
Undeveloped Runoff Coefficient (Cu)	0.7895
Developed Runoff Coefficient (Cd)	0.7906
Time of Concentration (min)	14.0
Clear Peak Flow Rate (cfs)	45.1111
Burned Peak Flow Rate (cfs)	46.6325
24-Hr Clear Runoff Volume (ac-ft)	3.2186
24-Hr Clear Runoff Volume (cu-ft)	140201.0194



Peak Flow Hydrologic Analysis

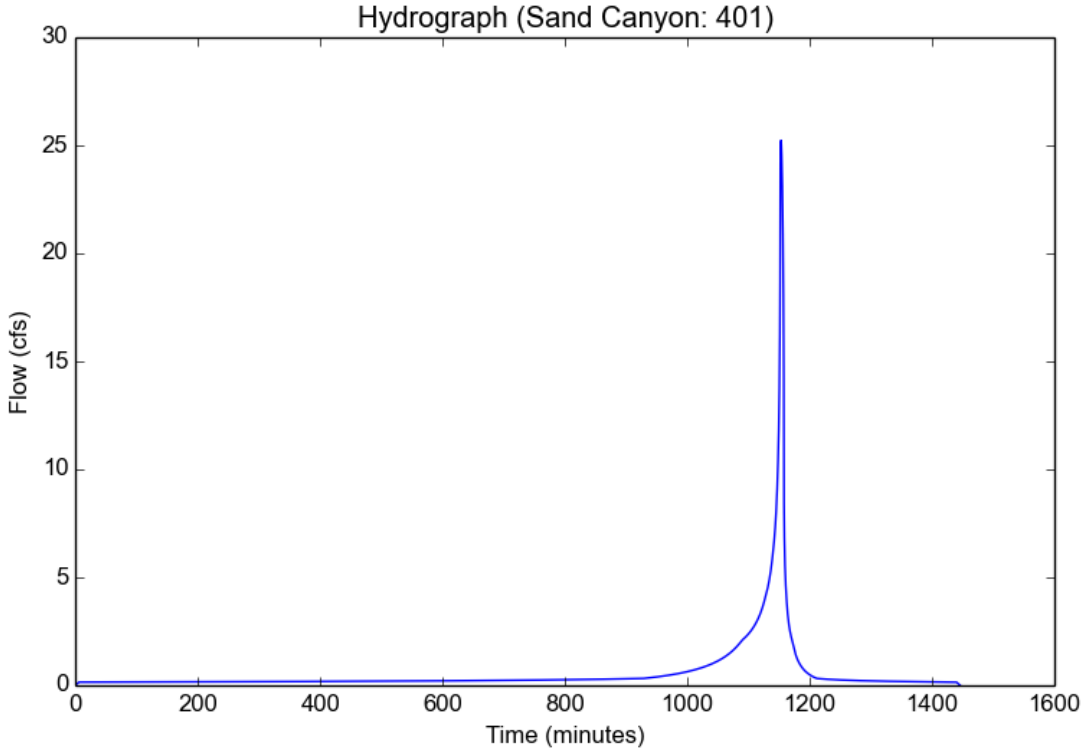
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Existing Hyodology Calc/Existing Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	401
Area (ac)	9.3
Flow Path Length (ft)	683.0
Flow Path Slope (vft/hft)	0.08
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	3.231
Undeveloped Runoff Coefficient (Cu)	0.8377
Developed Runoff Coefficient (Cd)	0.8396
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	25.2283
Burned Peak Flow Rate (cfs)	25.8827
24-Hr Clear Runoff Volume (ac-ft)	1.1996
24-Hr Clear Runoff Volume (cu-ft)	52253.8561



Peak Flow Hydrologic Analysis

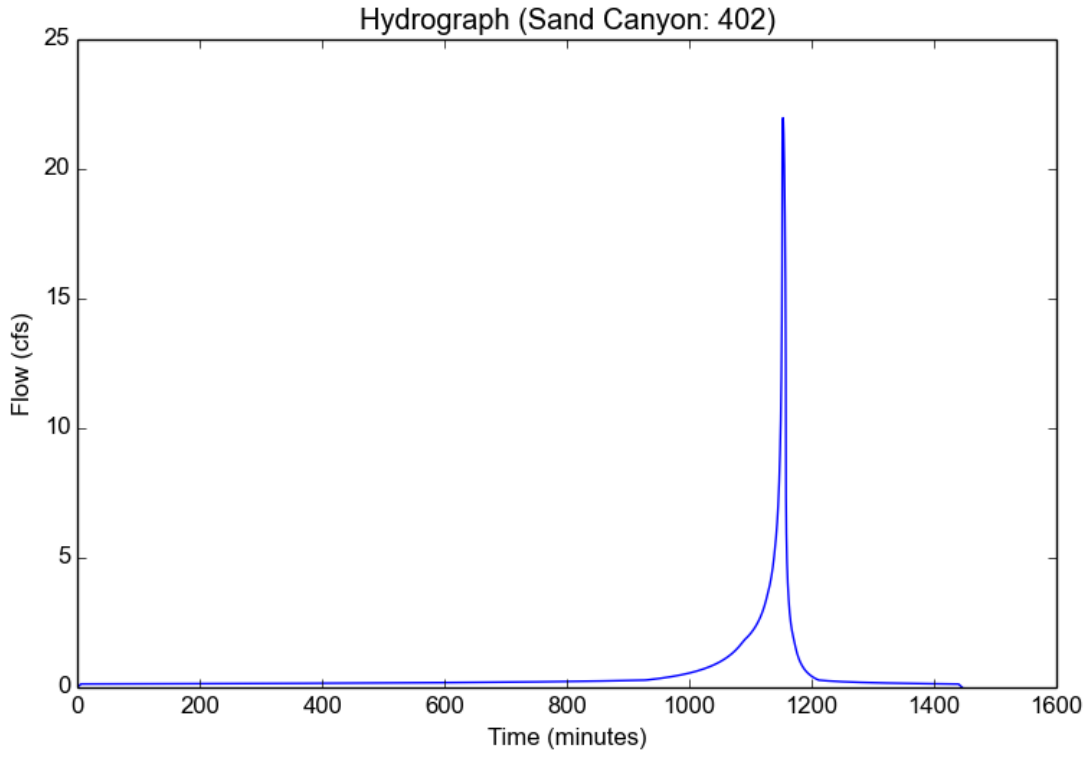
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Existing Hyodology Calc/Existing Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	402
Area (ac)	8.1
Flow Path Length (ft)	572.0
Flow Path Slope (vft/hft)	0.06
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	3.231
Undeveloped Runoff Coefficient (Cu)	0.8377
Developed Runoff Coefficient (Cd)	0.8396
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	21.973
Burned Peak Flow Rate (cfs)	22.543
24-Hr Clear Runoff Volume (ac-ft)	1.0448
24-Hr Clear Runoff Volume (cu-ft)	45511.423



2. Proposed Hydrologic Results for 50-yr Storm Event

Peak Flow Hydrologic Analysis

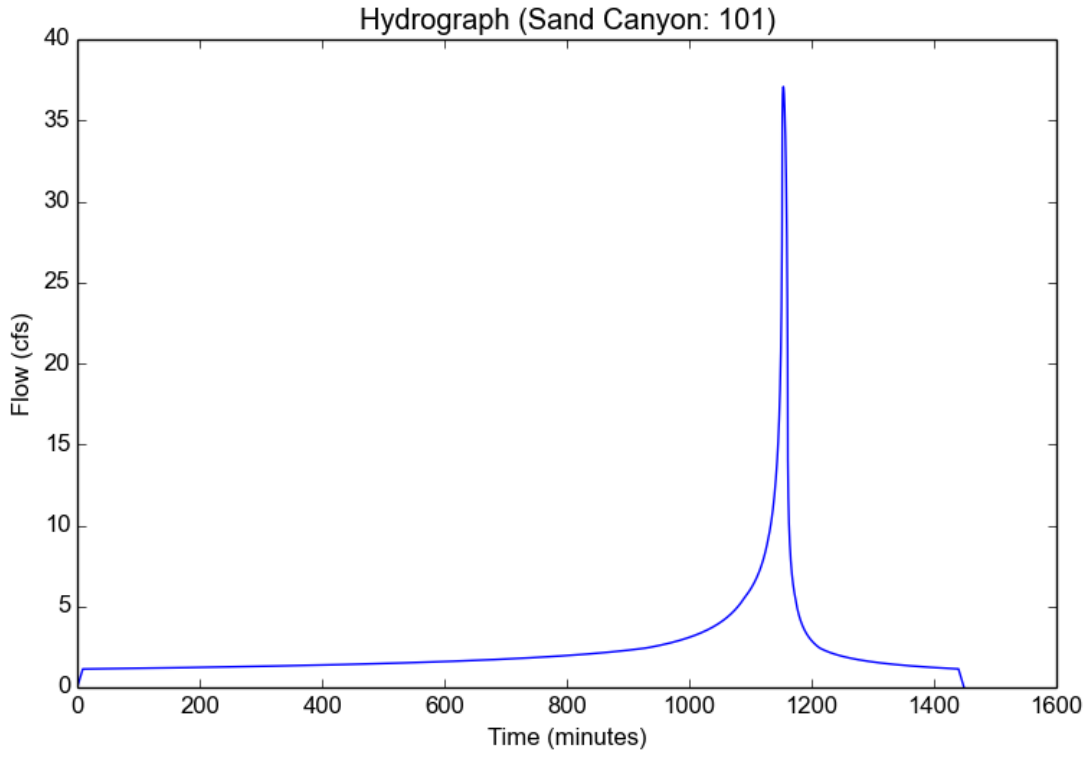
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	101
Area (ac)	16.1
Flow Path Length (ft)	871.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.55
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.6704
Undeveloped Runoff Coefficient (Cu)	0.8165
Developed Runoff Coefficient (Cd)	0.8624
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	37.0786
Burned Peak Flow Rate (cfs)	37.858
24-Hr Clear Runoff Volume (ac-ft)	4.7506
24-Hr Clear Runoff Volume (cu-ft)	206934.9914



Peak Flow Hydrologic Analysis

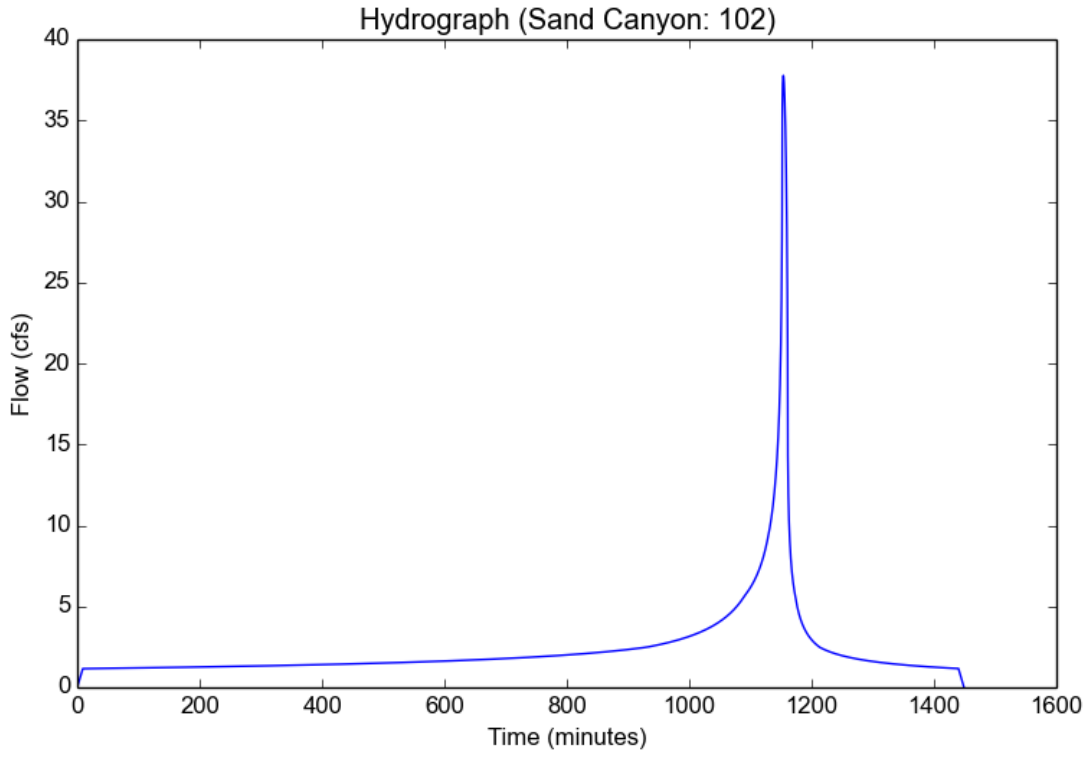
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	102
Area (ac)	16.4
Flow Path Length (ft)	1232.0
Flow Path Slope (vft/hft)	0.07
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.55
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.6704
Undeveloped Runoff Coefficient (Cu)	0.8165
Developed Runoff Coefficient (Cd)	0.8624
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	37.7695
Burned Peak Flow Rate (cfs)	38.5634
24-Hr Clear Runoff Volume (ac-ft)	4.8391
24-Hr Clear Runoff Volume (cu-ft)	210790.9229



Peak Flow Hydrologic Analysis

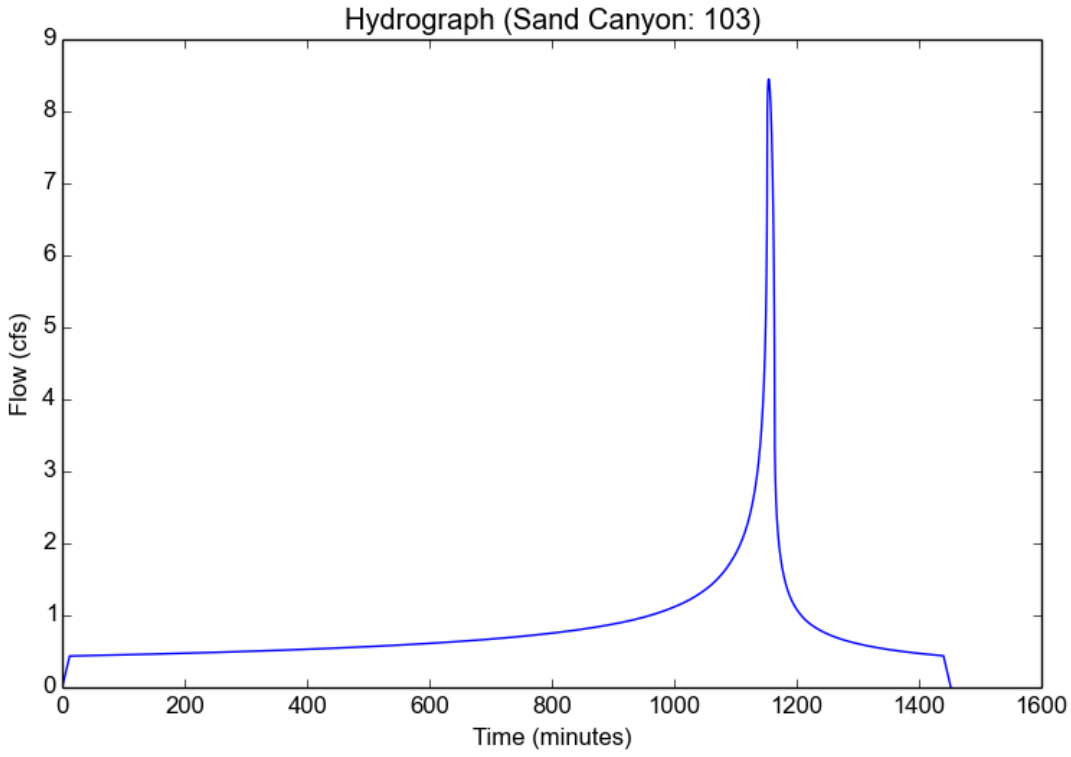
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	103
Area (ac)	4.07
Flow Path Length (ft)	1971.0
Flow Path Slope (vft/hft)	0.08
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.9
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.3327
Undeveloped Runoff Coefficient (Cu)	0.7996
Developed Runoff Coefficient (Cd)	0.89
Time of Concentration (min)	12.0
Clear Peak Flow Rate (cfs)	8.4493
Burned Peak Flow Rate (cfs)	8.584
24-Hr Clear Runoff Volume (ac-ft)	1.656
24-Hr Clear Runoff Volume (cu-ft)	72136.0716



Peak Flow Hydrologic Analysis

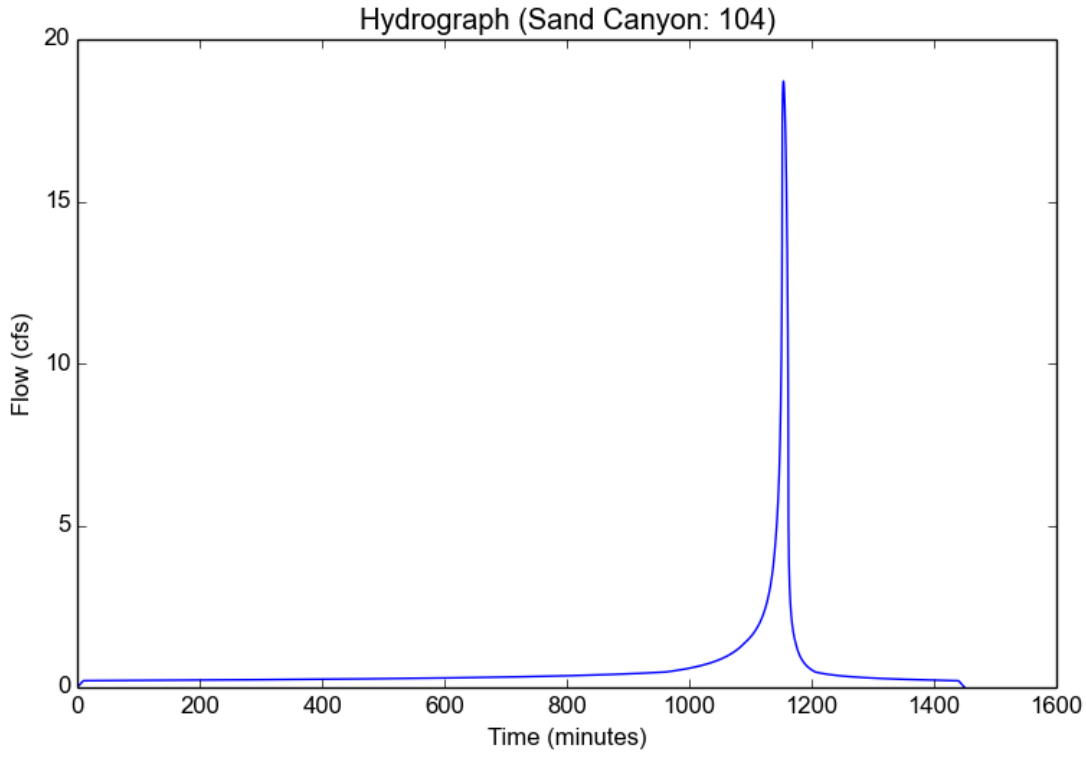
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	104
Area (ac)	12.8
Flow Path Length (ft)	962.0
Flow Path Slope (vft/hft)	0.07
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	20
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.5414
Undeveloped Runoff Coefficient (Cu)	0.5651
Developed Runoff Coefficient (Cd)	0.5751
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	18.7086
Burned Peak Flow Rate (cfs)	20.5151
24-Hr Clear Runoff Volume (ac-ft)	1.1675
24-Hr Clear Runoff Volume (cu-ft)	50857.3535



Peak Flow Hydrologic Analysis

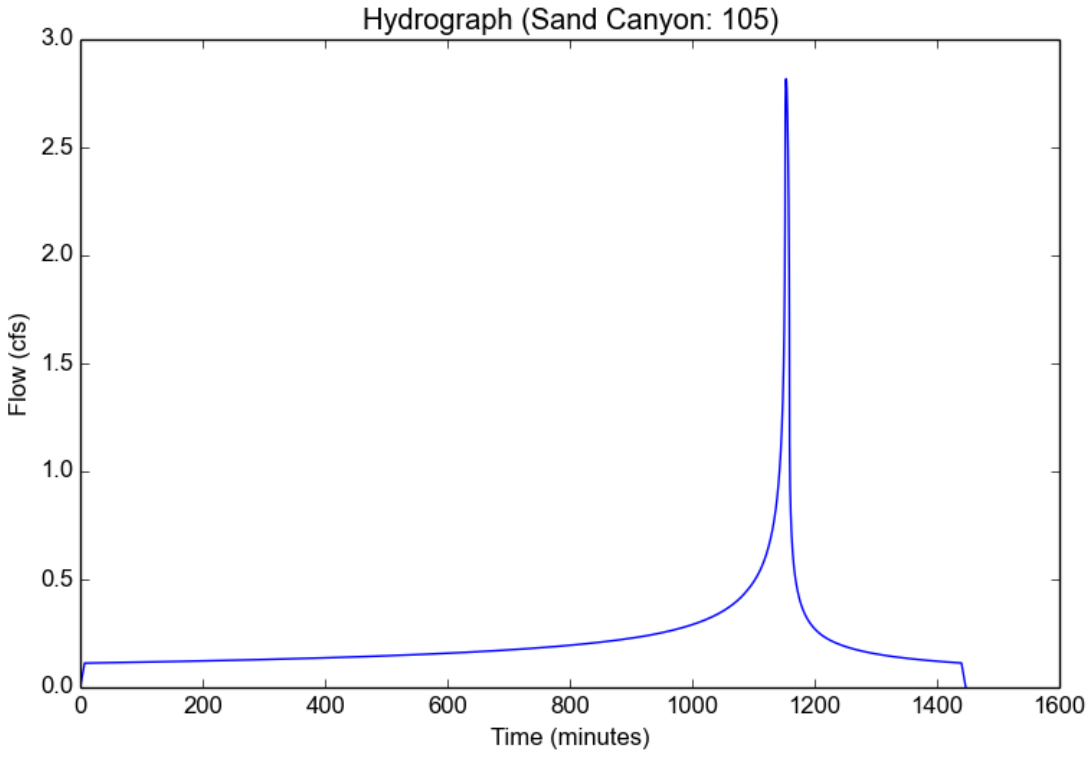
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	105
Area (ac)	1.05
Flow Path Length (ft)	670.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.9
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	3.0052
Undeveloped Runoff Coefficient (Cu)	0.8292
Developed Runoff Coefficient (Cd)	0.8929
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	2.8176
Burned Peak Flow Rate (cfs)	2.8629
24-Hr Clear Runoff Volume (ac-ft)	0.4272
24-Hr Clear Runoff Volume (cu-ft)	18610.6108



Peak Flow Hydrologic Analysis

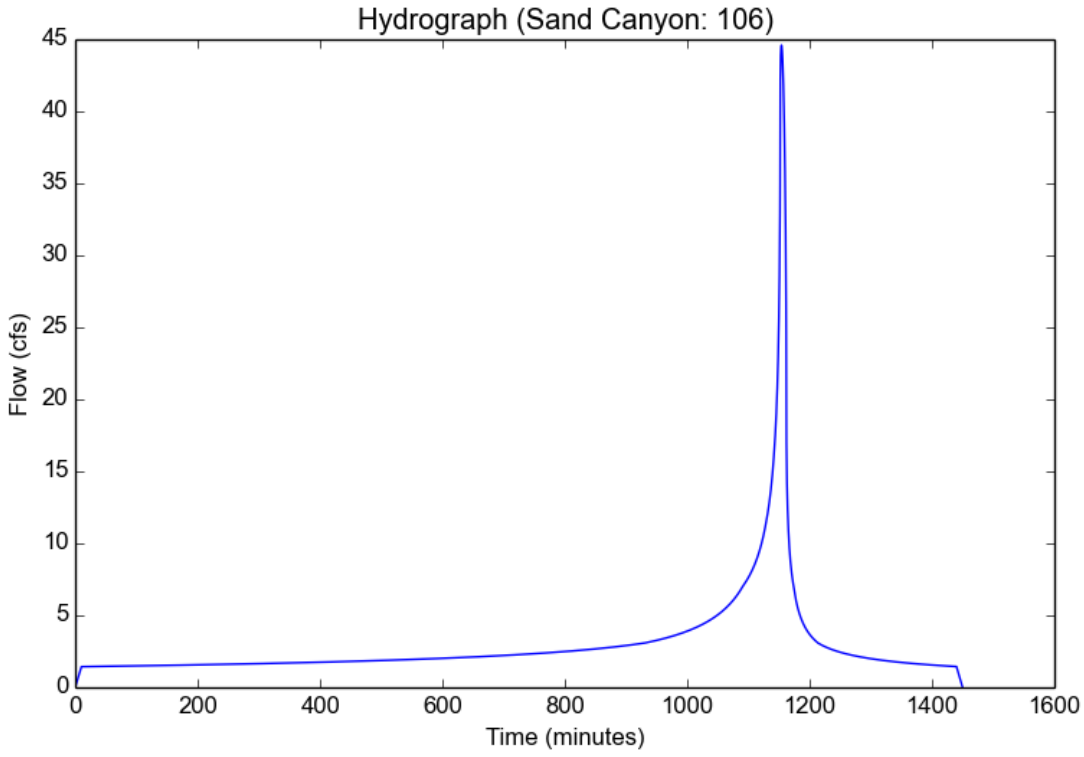
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	106
Area (ac)	20.4
Flow Path Length (ft)	1592.0
Flow Path Slope (vft/hft)	0.11
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.55
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.5414
Undeveloped Runoff Coefficient (Cu)	0.8116
Developed Runoff Coefficient (Cd)	0.8602
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	44.5978
Burned Peak Flow Rate (cfs)	45.545
24-Hr Clear Runoff Volume (ac-ft)	6.0192
24-Hr Clear Runoff Volume (cu-ft)	262196.6366



Peak Flow Hydrologic Analysis

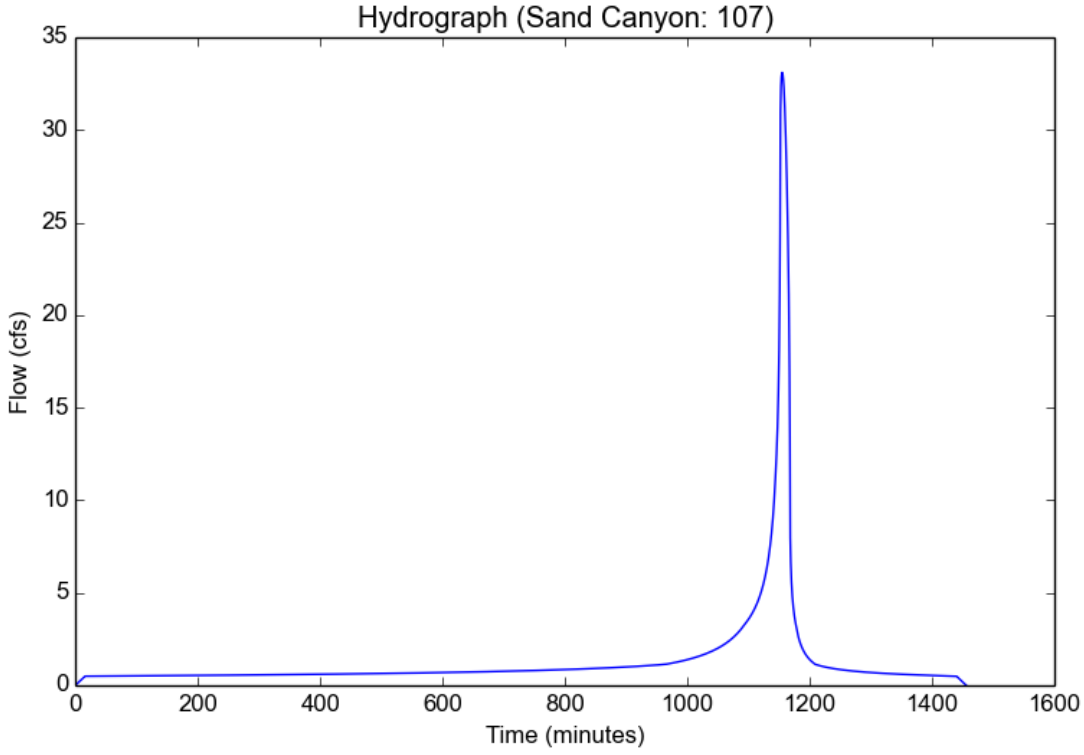
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	107
Area (ac)	30.6
Flow Path Length (ft)	1884.0
Flow Path Slope (vft/hft)	0.08
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	20
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.0377
Undeveloped Runoff Coefficient (Cu)	0.5195
Developed Runoff Coefficient (Cd)	0.5309
Time of Concentration (min)	16.0
Clear Peak Flow Rate (cfs)	33.104
Burned Peak Flow Rate (cfs)	36.7876
24-Hr Clear Runoff Volume (ac-ft)	2.7734
24-Hr Clear Runoff Volume (cu-ft)	120807.9883



Peak Flow Hydrologic Analysis

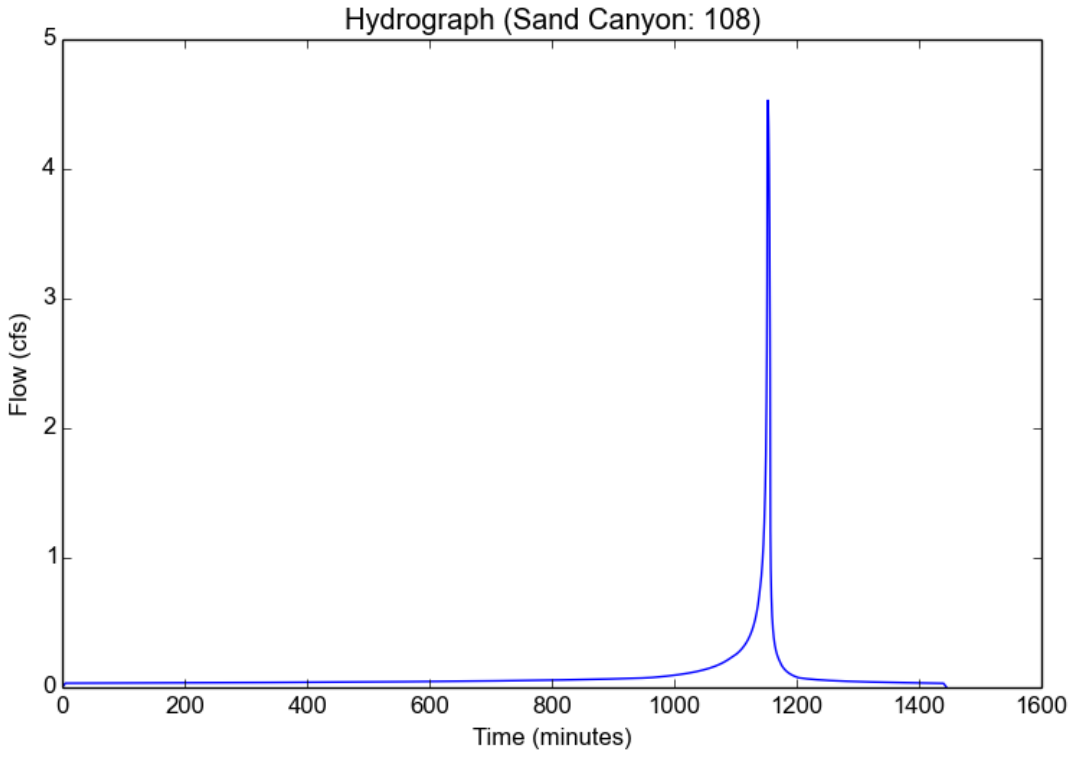
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	108
Area (ac)	2.0
Flow Path Length (ft)	379.0
Flow Path Slope (vft/hft)	0.1
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	20
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	3.5201
Undeveloped Runoff Coefficient (Cu)	0.6354
Developed Runoff Coefficient (Cd)	0.6433
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	4.5291
Burned Peak Flow Rate (cfs)	4.8745
24-Hr Clear Runoff Volume (ac-ft)	0.1838
24-Hr Clear Runoff Volume (cu-ft)	8006.0921



Peak Flow Hydrologic Analysis

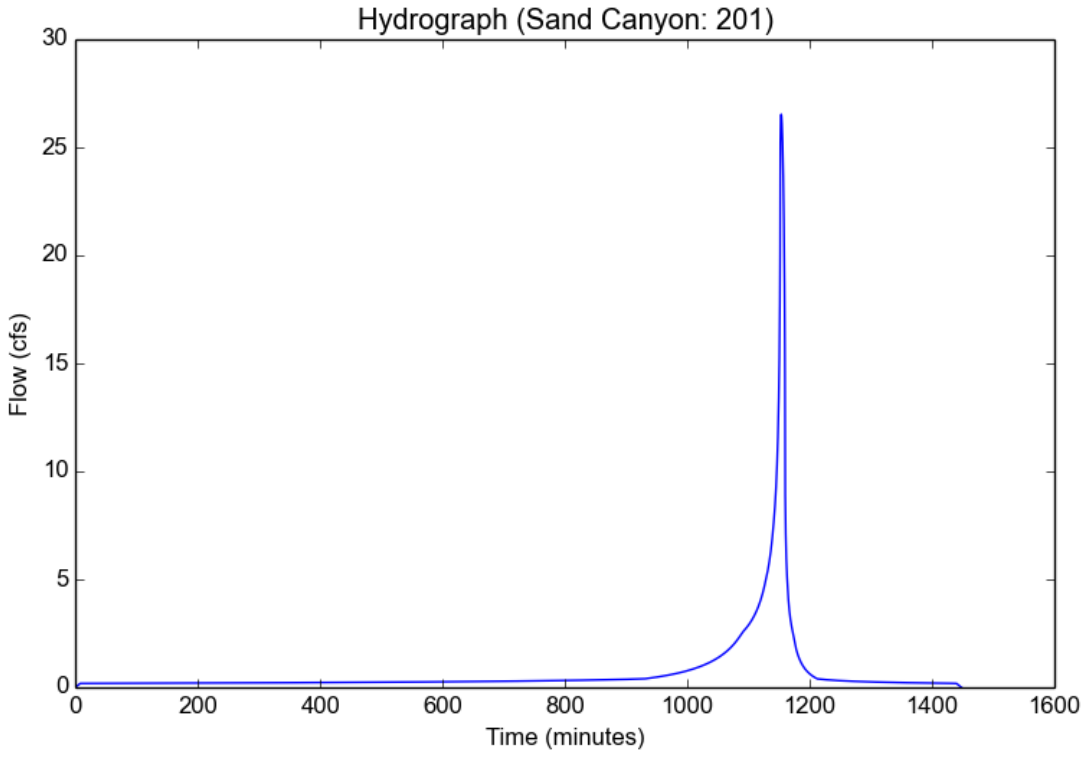
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	201
Area (ac)	11.4
Flow Path Length (ft)	1056.0
Flow Path Slope (vft/hft)	0.1
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.8224
Undeveloped Runoff Coefficient (Cu)	0.8222
Developed Runoff Coefficient (Cd)	0.8246
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	26.5312
Burned Peak Flow Rate (cfs)	27.2815
24-Hr Clear Runoff Volume (ac-ft)	1.4699
24-Hr Clear Runoff Volume (cu-ft)	64028.2803



Peak Flow Hydrologic Analysis

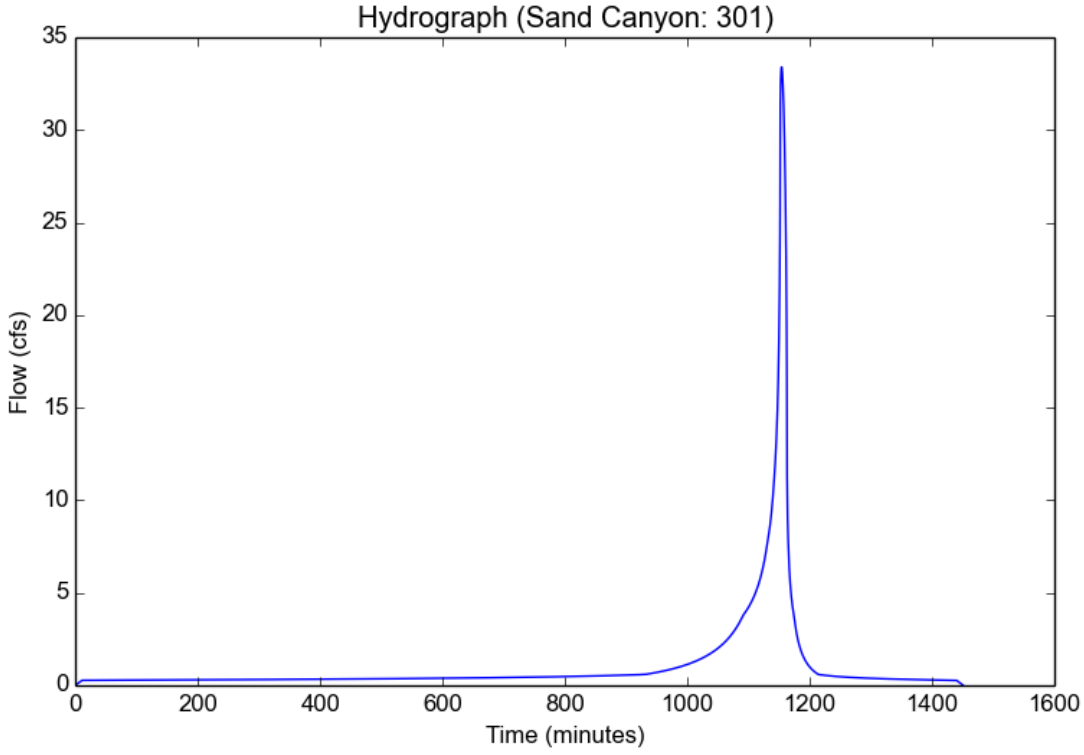
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	301
Area (ac)	17.0
Flow Path Length (ft)	1513.0
Flow Path Slope (vft/hft)	0.07
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	2.4301
Undeveloped Runoff Coefficient (Cu)	0.8057
Developed Runoff Coefficient (Cd)	0.8085
Time of Concentration (min)	11.0
Clear Peak Flow Rate (cfs)	33.4006
Burned Peak Flow Rate (cfs)	34.427
24-Hr Clear Runoff Volume (ac-ft)	2.1908
24-Hr Clear Runoff Volume (cu-ft)	95429.4248



Peak Flow Hydrologic Analysis

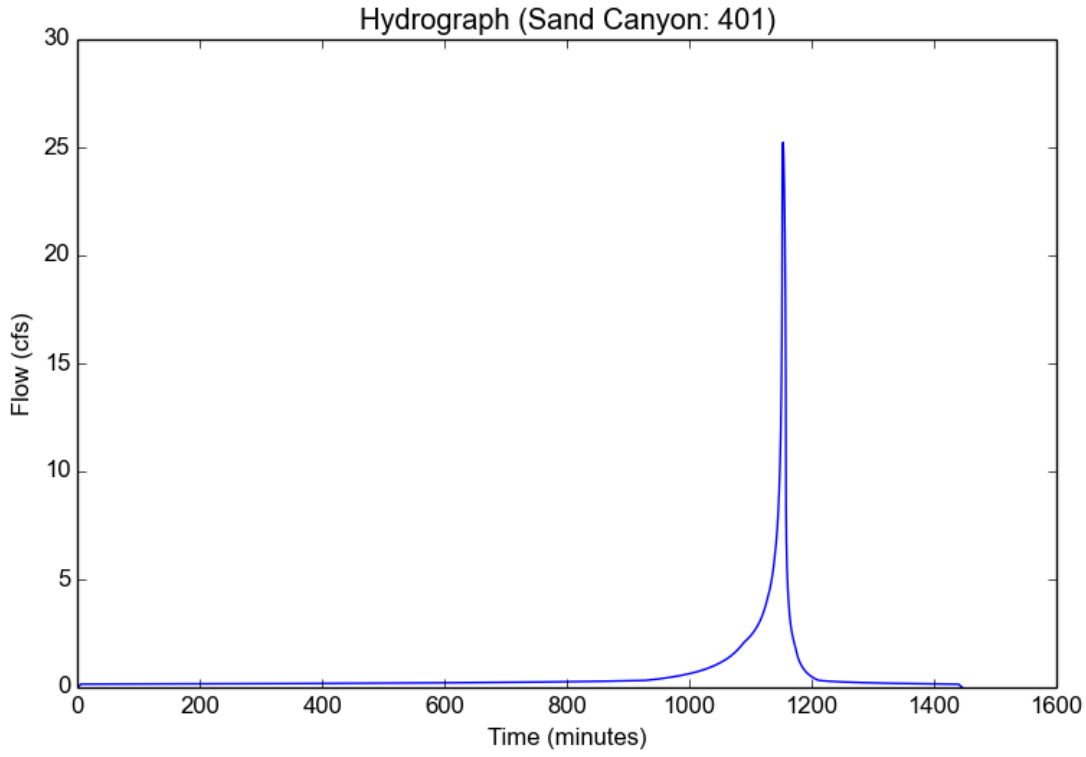
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	401
Area (ac)	9.3
Flow Path Length (ft)	683.0
Flow Path Slope (vft/hft)	0.08
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	3.231
Undeveloped Runoff Coefficient (Cu)	0.8377
Developed Runoff Coefficient (Cd)	0.8396
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	25.2283
Burned Peak Flow Rate (cfs)	25.8827
24-Hr Clear Runoff Volume (ac-ft)	1.1996
24-Hr Clear Runoff Volume (cu-ft)	52253.8561



Peak Flow Hydrologic Analysis

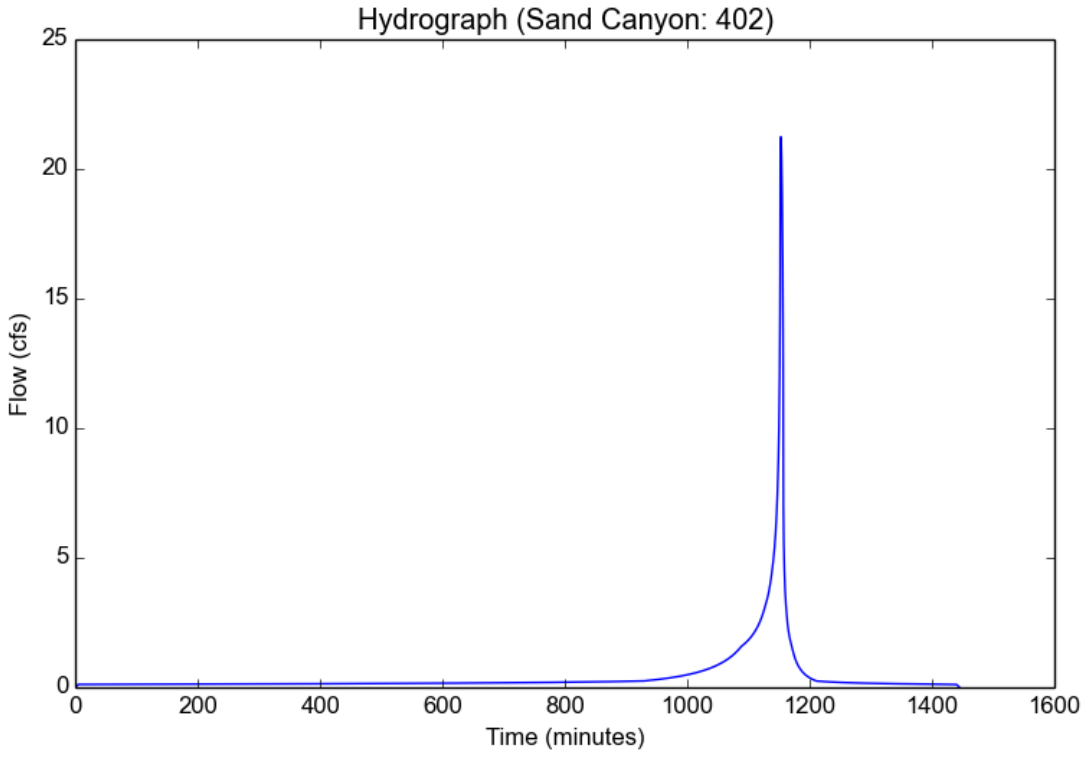
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Prop Hydrology Calc/PROP Sand Canyon Report.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	402
Area (ac)	7.1
Flow Path Length (ft)	515.0
Flow Path Slope (vft/hft)	0.07
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.03
Soil Type	99
Design Storm Frequency	50-yr
Fire Factor	0.34
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.9
Peak Intensity (in/hr)	3.5201
Undeveloped Runoff Coefficient (Cu)	0.8483
Developed Runoff Coefficient (Cd)	0.8499
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	21.2401
Burned Peak Flow Rate (cfs)	21.7563
24-Hr Clear Runoff Volume (ac-ft)	0.9162
24-Hr Clear Runoff Volume (cu-ft)	39907.6035



3. LID Hydrologic Results

Peak Flow Hydrologic Analysis

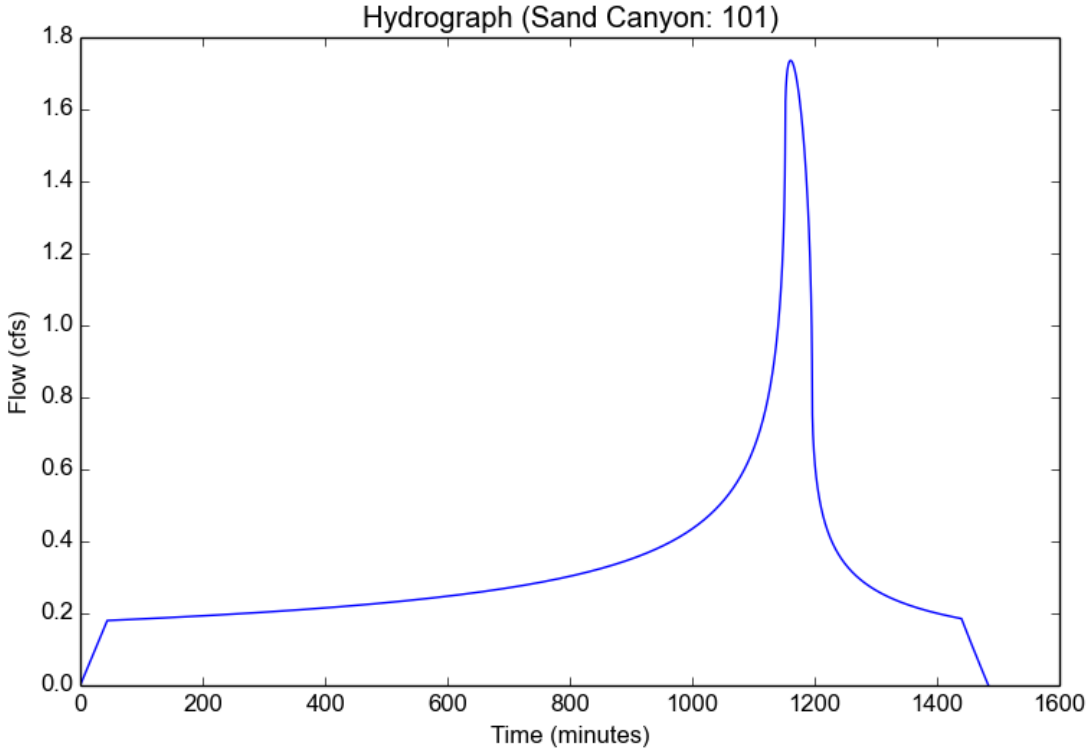
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Water Quality/WQ Sand Canyon Report_ LID.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	101
Area (ac)	16.1
Flow Path Length (ft)	871.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	0.93
Percent Impervious	0.55
Soil Type	99
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.93
Peak Intensity (in/hr)	0.1997
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.54
Time of Concentration (min)	44.0
Clear Peak Flow Rate (cfs)	1.7358
Burned Peak Flow Rate (cfs)	1.7358
24-Hr Clear Runoff Volume (ac-ft)	0.6682
24-Hr Clear Runoff Volume (cu-ft)	29108.2375



Peak Flow Hydrologic Analysis

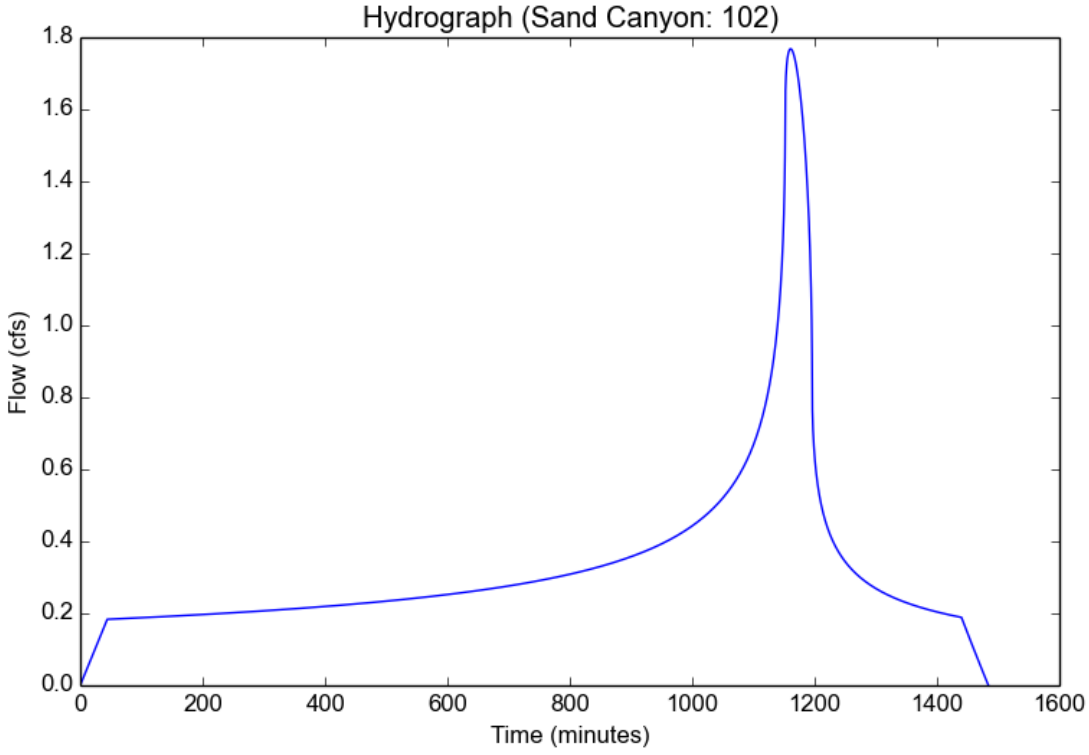
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Water Quality/WQ Sand Canyon Report_ LID.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	102
Area (ac)	16.4
Flow Path Length (ft)	1232.0
Flow Path Slope (vft/hft)	0.07
85th Percentile Rainfall Depth (in)	0.93
Percent Impervious	0.55
Soil Type	99
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.93
Peak Intensity (in/hr)	0.1997
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.54
Time of Concentration (min)	44.0
Clear Peak Flow Rate (cfs)	1.7681
Burned Peak Flow Rate (cfs)	1.7681
24-Hr Clear Runoff Volume (ac-ft)	0.6807
24-Hr Clear Runoff Volume (cu-ft)	29650.627



Peak Flow Hydrologic Analysis

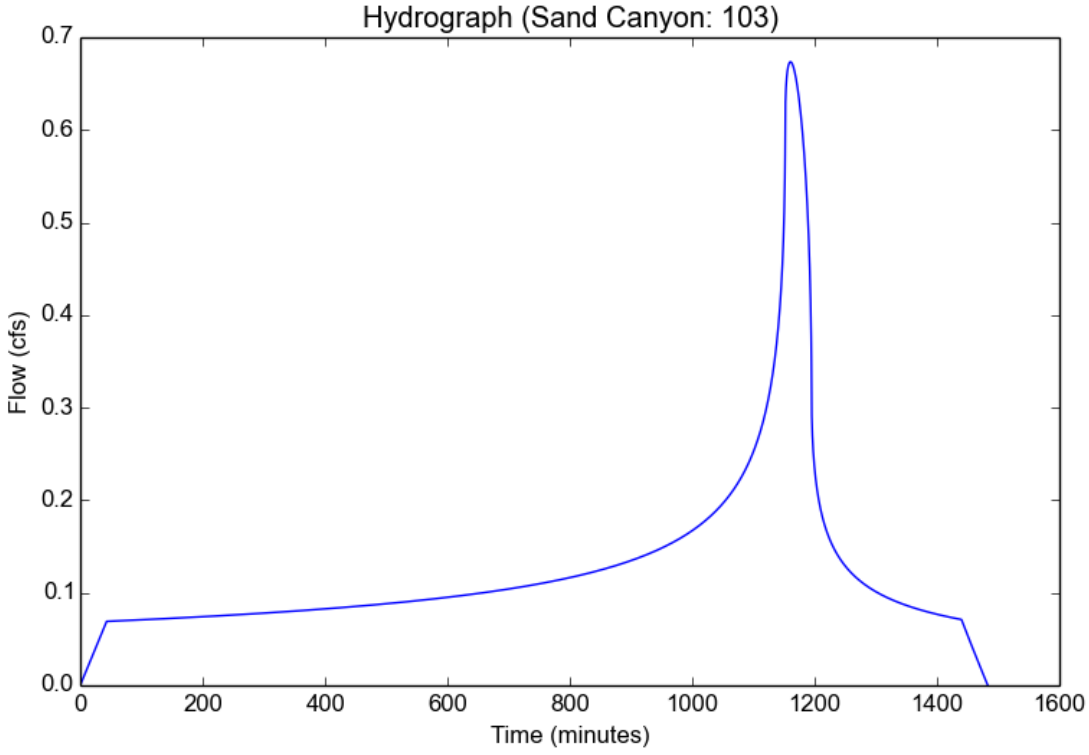
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Water Quality/WQ Sand Canyon Report_ LID.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	103
Area (ac)	4.07
Flow Path Length (ft)	1971.0
Flow Path Slope (vft/hft)	0.08
85th Percentile Rainfall Depth (in)	0.93
Percent Impervious	0.9
Soil Type	99
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.93
Peak Intensity (in/hr)	0.2018
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.82
Time of Concentration (min)	43.0
Clear Peak Flow Rate (cfs)	0.6736
Burned Peak Flow Rate (cfs)	0.6736
24-Hr Clear Runoff Volume (ac-ft)	0.2565
24-Hr Clear Runoff Volume (cu-ft)	11173.881



Peak Flow Hydrologic Analysis

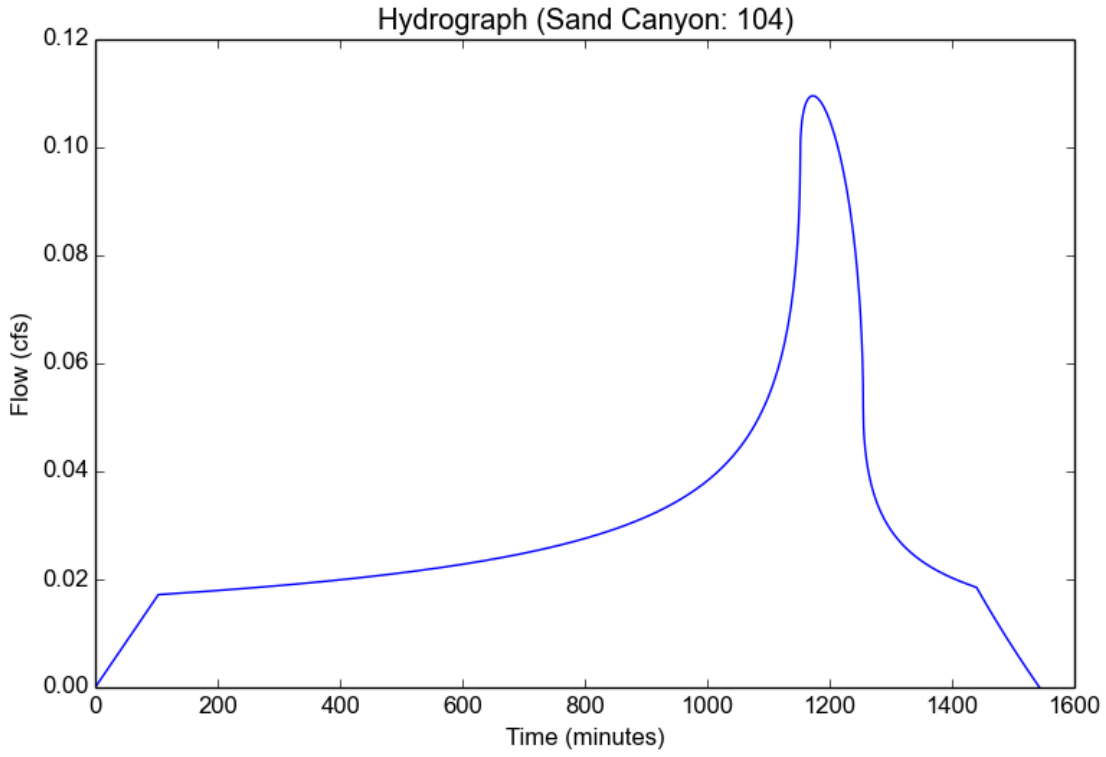
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Water Quality/WQ Sand Canyon Report_ LID.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	104
Area (ac)	6.6
Flow Path Length (ft)	962.0
Flow Path Slope (vft/hft)	0.07
85th Percentile Rainfall Depth (in)	0.93
Percent Impervious	0.03
Soil Type	20
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.93
Peak Intensity (in/hr)	0.1339
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.124
Time of Concentration (min)	103.0
Clear Peak Flow Rate (cfs)	0.1096
Burned Peak Flow Rate (cfs)	0.1096
24-Hr Clear Runoff Volume (ac-ft)	0.0629
24-Hr Clear Runoff Volume (cu-ft)	2740.3926



Peak Flow Hydrologic Analysis

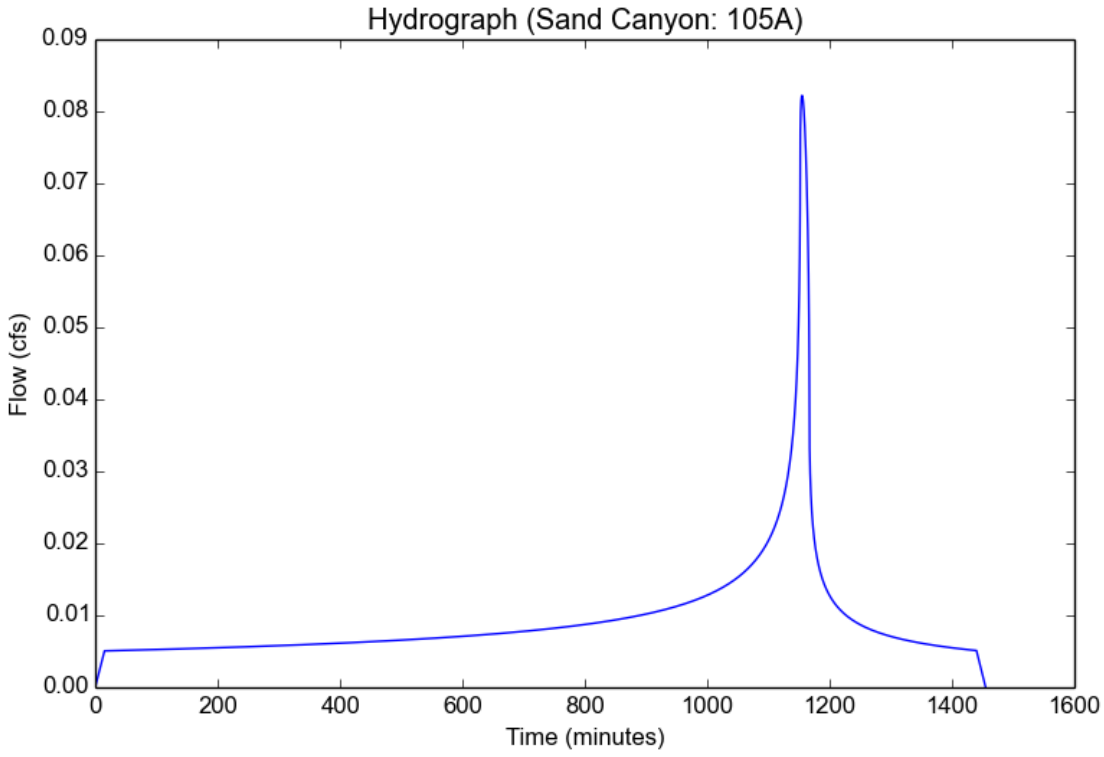
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Water Quality/WQ Sand Canyon Report_ LID.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	105A
Area (ac)	0.3
Flow Path Length (ft)	320.0
Flow Path Slope (vft/hft)	0.05
85th Percentile Rainfall Depth (in)	0.93
Percent Impervious	0.9
Soil Type	99
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.93
Peak Intensity (in/hr)	0.3311
Undeveloped Runoff Coefficient (Cu)	0.1772
Developed Runoff Coefficient (Cd)	0.8277
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.0822
Burned Peak Flow Rate (cfs)	0.0822
24-Hr Clear Runoff Volume (ac-ft)	0.0189
24-Hr Clear Runoff Volume (cu-ft)	823.9652



Peak Flow Hydrologic Analysis

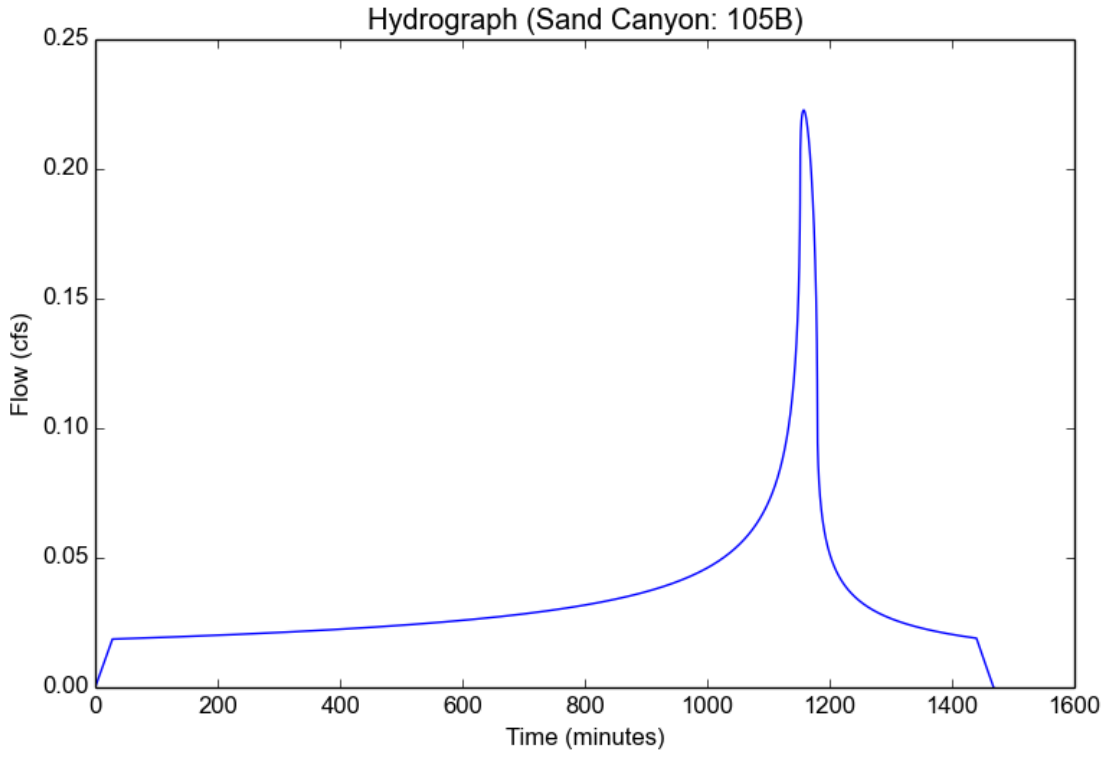
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Water Quality/WQ Sand Canyon Report_ LID.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	105B
Area (ac)	1.1
Flow Path Length (ft)	670.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	0.93
Percent Impervious	0.9
Soil Type	99
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.93
Peak Intensity (in/hr)	0.2469
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.82
Time of Concentration (min)	28.0
Clear Peak Flow Rate (cfs)	0.2227
Burned Peak Flow Rate (cfs)	0.2227
24-Hr Clear Runoff Volume (ac-ft)	0.0693
24-Hr Clear Runoff Volume (cu-ft)	3019.9262



Peak Flow Hydrologic Analysis

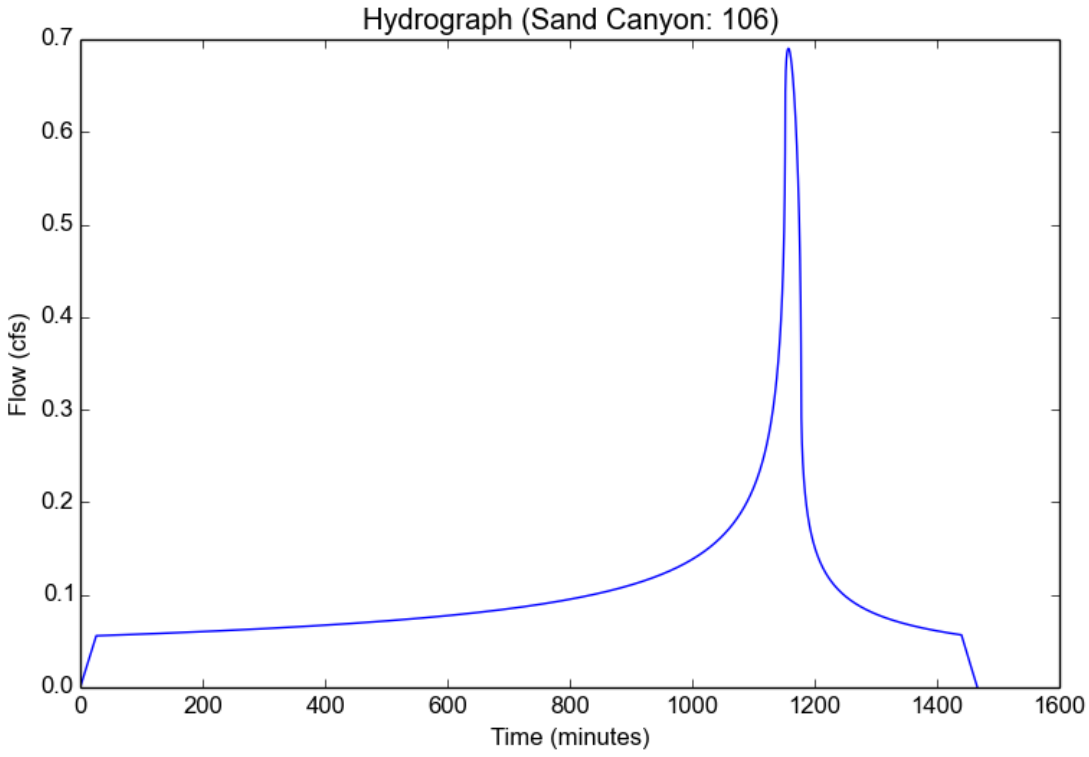
File location: G:/Sand Canyon Resort/Storm/Hydrology/Design Backup/Water Quality/WQ Sand Canyon Report_ LID.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Sand Canyon
Subarea ID	106
Area (ac)	5.0
Flow Path Length (ft)	472.0
Flow Path Slope (vft/hft)	0.04
85th Percentile Rainfall Depth (in)	0.93
Percent Impervious	0.55
Soil Type	99
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.93
Peak Intensity (in/hr)	0.2557
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.54
Time of Concentration (min)	26.0
Clear Peak Flow Rate (cfs)	0.6903
Burned Peak Flow Rate (cfs)	0.6903
24-Hr Clear Runoff Volume (ac-ft)	0.2075
24-Hr Clear Runoff Volume (cu-ft)	9039.6778



4. Existing Debris Production Calculation

EXISTING WATERSHED DEBRIS PRODUCTION CALCULATION

EXISTING WATERSHED 100

Using eq 3.3.5 of sedimentation manual (March 2006)

$$DP = DPR_{1(A_1+A_2)}\ (A_1 - A_{d_1})\left(\frac{A_1 - A_{d_1}}{A_1 + A_2}\right) + DPR_{1(A_1-A_{d_1})}\ (A_1 - A_{d_1})\left(\frac{A_2 + A_{d_1}}{A_1 + A_2}\right) +$$

$$DPR_{2(A_1+A_2)}\ (A_2 - A_{d_2})\left(\frac{A_2 - A_{d_2}}{A_1 + A_2}\right) + DPR_{2(A_2-A_{d_2})}\ (A_2 - A_{d_2})\left(\frac{A_1 + A_{d_2}}{A_1 + A_2}\right)$$

AREA OF DPA 8	0.06	SQ MI
AREA OF DPA 9	0.07	SQ MI
AREA OF DEVELOPED DPA 8	0.04	SQ MI
AREA OF DEVELOPED DPA 9	0.07	SQ MI
$DPA_{8(A8+A9)}$	30000	C.Y./SQ MI
$DPA_{8(A8-Ad8)}$	35000	C.Y./SQ MI
$DPA_{9(A8+A9)}$	14000	C.Y./SQ MI
$DPA_{9(A9-Ad9)}$	16500	C.Y./SQ MI
DEBRIS PRODUCTION	804	C.Y.

EXISTING WATERSHED 200

Using eq 3.3.1 of sedimentation manual (March 2006)

$$DP = DPR_{(A)} \times A$$

AREA 201	0.02	SQ MI
DPR OF WATERSHED 200	35000	C.Y./SQ MI
DEBRIS PRODUCTION	788	C.Y.

EXISTING WATERSHED 300

Using eq 3.3.3 of sedimentation manual (March 2006)

$$DP = DPR_{(A)} \times A_u \left(\frac{A_u}{A}\right) + DPR_{(A_u)} \times A_u \left(\frac{A_d}{A}\right)$$

AREA 301	0.04	SQ MI
Dev AREA 301	0.001	SQ MI
Undev area 301	0.038	SQ MI
DPR OF WATERSHED 300	35000	C.Y./SQ MI
DEBRIS PRODUCTION	1335	C.Y.

EXISTING WATERSHED 400

Using eq 3.3.3 of sedimentation manual (March 2006)

$$DP = DPR_{(A)} \times A_u \left(\frac{A_u}{A}\right) + DPR_{(A_u)} \times A_u \left(\frac{A_d}{A}\right)$$

AREA 400	0.03	SQ MI
Dev AREA 400	0.025	SQ MI
Undev area 400	0.001	SQ MI
DPR OF WATERSHED 400	16500	C.Y./SQ MI
DEBRIS PRODUCTION	21	C.Y.

5. Proposed Debris Production Calculation

PROPOSED WATERSHED DEBRIS PRODUCTION CALCULATION

PROPOSED WATERSHED 100

$$DP = DPR_{1(A_1+A_2)}\ (A_1 - A_{d_1})\left(\frac{A_1 - A_{d_1}}{A_1 + A_2}\right) + DPR_{1(A_1-A_{d_1})}\ (A_1 - A_{d_1})\left(\frac{A_2 + A_{d_1}}{A_1 + A_2}\right) +$$

$$DPR_{2(A_1+A_2)}\ (A_2 - A_{d_2})\left(\frac{A_2 - A_{d_2}}{A_1 + A_2}\right) + DPR_{2(A_2-A_{d_2})}\ (A_2 - A_{d_2})\left(\frac{A_1 + A_{d_2}}{A_1 + A_2}\right)$$

AREA OF DPA 8	0.08	SQ MI
AREA OF DPA 9	0.07	SQ MI
AREA OF DEVELOPED DPA 8	0.06	SQ MI
AREA OF DEVELOPED DPA 9	0.07	SQ MI
$DPA_{8(A8+A9)}$	28000	C.Y./SQ MI
$DPA_{8(A8-Ad8)}$	35000	C.Y./SQ MI
$DPA_{9(A8+A9)}$	13000	C.Y./SQ MI
$DPA_{9(A9-Ad9)}$	16500	C.Y./SQ MI
DEBRIS PRODUCTION	611	C.Y.

PROPOSED WATERSHED 200

Using eq 3.3.3 of sedimentation manual (March 2006)

$$DP = DPR_{(A)} \times A_u\left(\frac{A_u}{A}\right) + DPR_{(A_u)} \times A_u\left(\frac{A_d}{A}\right)$$

AREA 201	0.02	SQ MI
Dev AREA 201	0.0023	SQ MI
Undev area 201	0.0154	SQ MI
DPR OF WATERSHED 200	16500	C.Y./SQ MI
DEBRIS PRODUCTION	265	C.Y.

PROPOSED WATERSHED 300								
Using eq 3.3.3 of sedimentation manual (March 2006)								
$DP = DPR_{(A)} \times A_u \left(\frac{A_u}{A}\right) + DPR_{(A_u)} \times A_u \left(\frac{A_d}{A}\right)$								
AREA 301			0.03	SQ MI				
Dev AREA 301			0.0019	SQ MI				
Undev area 301			0.0248	SQ MI				
DPR OF WATERSHED 300			16500	C.Y./SQ MI				
DEBRIS PRODUCTION			425	C.Y.				
PROPOSED WATERSHED 400								
Using eq 3.3.3 of sedimentation manual (March 2006)								
$DP = DPR_{(A)} \times A_u \left(\frac{A_u}{A}\right) + DPR_{(A_u)} \times A_u \left(\frac{A_d}{A}\right)$								
AREA 400			0.03	SQ MI				
Dev AREA 400			0.0243	SQ MI				
Undev area 400			0.0013	SQ MI				
DPR OF WATERSHED 400			16500	C.Y./SQ MI				
DEBRIS PRODUCTION			21	C.Y.				

6. Existing Bulk Flow Calculations

EXISTING WATERSHED CAPITAL FLOW CALCULATION

EXISTING WATERSHED 100

REFER TO EQUATION 3.4.5 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006

$$Q_B = BF_{1(A_1+A_2)}\left(\frac{Q\ (A_1 - A_{d1})}{A_1 + A_2}\right)\left(\frac{A_1 - A_{d1}}{A_1 + A_2}\right) +$$

$$BF_{1(A_1-A_{d1})}\left(\frac{Q\ (A_1 - A_{d1})}{A_1 + A_2}\right)\left(\frac{A_2 + A_{d1}}{A_1 + A_2}\right) + \left(\frac{Q\ (A_{d1})}{A_1 + A_2}\right) +$$

$$BF_{2(A_1+A_2)}\left(\frac{Q\ (A_2 - A_{d2})}{A_1 + A_2}\right)\left(\frac{A_2 - A_{d2}}{A_1 + A_2}\right) +$$

$$BF_{2(A_2-A_{d2})}\left(\frac{Q\ (A_2 - A_{d2})}{A_1 + A_2}\right)\left(\frac{(A_1 + A_{d2})}{A_1 + A_2}\right) + \left(\frac{Q\ (A_{d2})}{A_1 + A_2}\right)$$

Q=CLEAR DISCHARGE	146.71	CFS
BF FOR A_t ON LINE DPA 8	1.34	unitless
BF FOR A_{u8} ON LINE DPA 8	1.36	unitless
BF FOR A_t ON LINE DPA 9	1.25	unitless
BF FOR A_{u9} ON LINE DPA 9	1.27	unitless
AREA DPA 8, A_8	0.06	SQ MI
AREA DPA 9, A_9	0.07	SQ MI
SUM OF WATERSHED 100, A_t	0.14	SQ MI
Dev AREA DPA 8	0.04	SQ MI
Dev AREA DPA 9	0.07	SQ MI
Q=	156.3	CFS

EXISTING WATERSHED 200

REFER TO EQUATION 3.4.1 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006

$$Q_B = BF_{(A)} \times Q_{(A)}$$

Q=BURNED DISCHARGE	31.91	CFS
BF 201=the bulking factor for subarea 201.	1.36	unitless
AREA 201 15 AC	0.02	SQ MI
Q=	43.4	CFS

EXISTING WATERSHED 300

REFER TO EQUATION 3.4.3 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006

$$Q_B = BF_{(A)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_u}{A}\right) + BF_{(A_u)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_d}{A}\right) + \left(\frac{Q_{(A)}\ A_d}{A}\right)$$

Q=BURNED DISCHARGE		46.63	CFS
BF 301=the bulking factor for subarea 301.		1.36	unitless
AREA 301	26.3 AC	0.04	SQ MI
Dev AREA 301		0.0013	SQ MI
Undev area 301		0.0387	SQ MI
	Q=	59.6	CFS

EXISTING WATERSHED 400

REFER TO EQUATION 3.4.3 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006

$$Q_B = BF_{(A)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_u}{A}\right) + BF_{(A_u)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_d}{A}\right) + \left(\frac{Q_{(A)}\ A_d}{A}\right)$$

Q=CLEAR DISCHARGE		47.20	CFS
BF 400=the bulking factor for subarea 401 & 402.		1.36	unitless
AREA 400	17.4 AC	0.03	SQ MI
Dev AREA 400		0.0259	SQ MI
Undev area 400		0.0013	SQ MI
	Q=	48.0	CFS

7. Proposed Bulk Flow Calculations

PROPOSED WATERSHED CAPITAL FLOW CALCULATION

PROPOSED WATERSHED 100

REFER TO EQUATION 3.4.5 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006

$$Q_B = BF_{1(A_1+A_2)}\left(\frac{Q\ (A_1 - A_{d1})}{A_1 + A_2}\right)\left(\frac{A_1 - A_{d1}}{A_1 + A_2}\right) +$$
$$BF_{1(A_1-A_{d1})}\left(\frac{Q\ (A_1 - A_{d1})}{A_1 + A_2}\right)\left(\frac{A_2 + A_{d1}}{A_1 + A_2}\right) + \left(\frac{Q\ (A_{d1})}{A_1 + A_2}\right) +$$
$$BF_{2(A_1+A_2)}\left(\frac{Q\ (A_2 - A_{d2})}{A_1 + A_2}\right)\left(\frac{A_2 - A_{d2}}{A_1 + A_2}\right) +$$
$$BF_{2(A_2-A_{d2})}\left(\frac{Q\ (A_2 - A_{d2})}{A_1 + A_2}\right)\left(\frac{(A_1 + A_{d2})}{A_1 + A_2}\right) + \left(\frac{Q\ (A_{d2})}{A_1 + A_2}\right)$$

Q=BURNED DISCHARGE					187.00	CFS
BF FOR A_t ON LINE DPA 8					1.34	unitless
BF FOR A_{u8} ON LINE DPA 8					1.36	unitless
BF FOR A_t ON LINE DPA 9					1.25	unitless
BF FOR A_{u9} ON LINE DPA 9					1.27	unitless
AREA DPA 8, A_8					0.08	SQ MI
AREA DPA 9, A_9					0.07	SQ MI
SUM OF WATERSHED 100, A_t					0.15	SQ MI
Dev AREA DPA 8					0.06	SQ MI
Dev AREA DPA 9					0.07	SQ MI
				Q=	195.6	CFS

PROPOSED WATERSHED 200

REFER TO EQUATION 3.4.3 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006

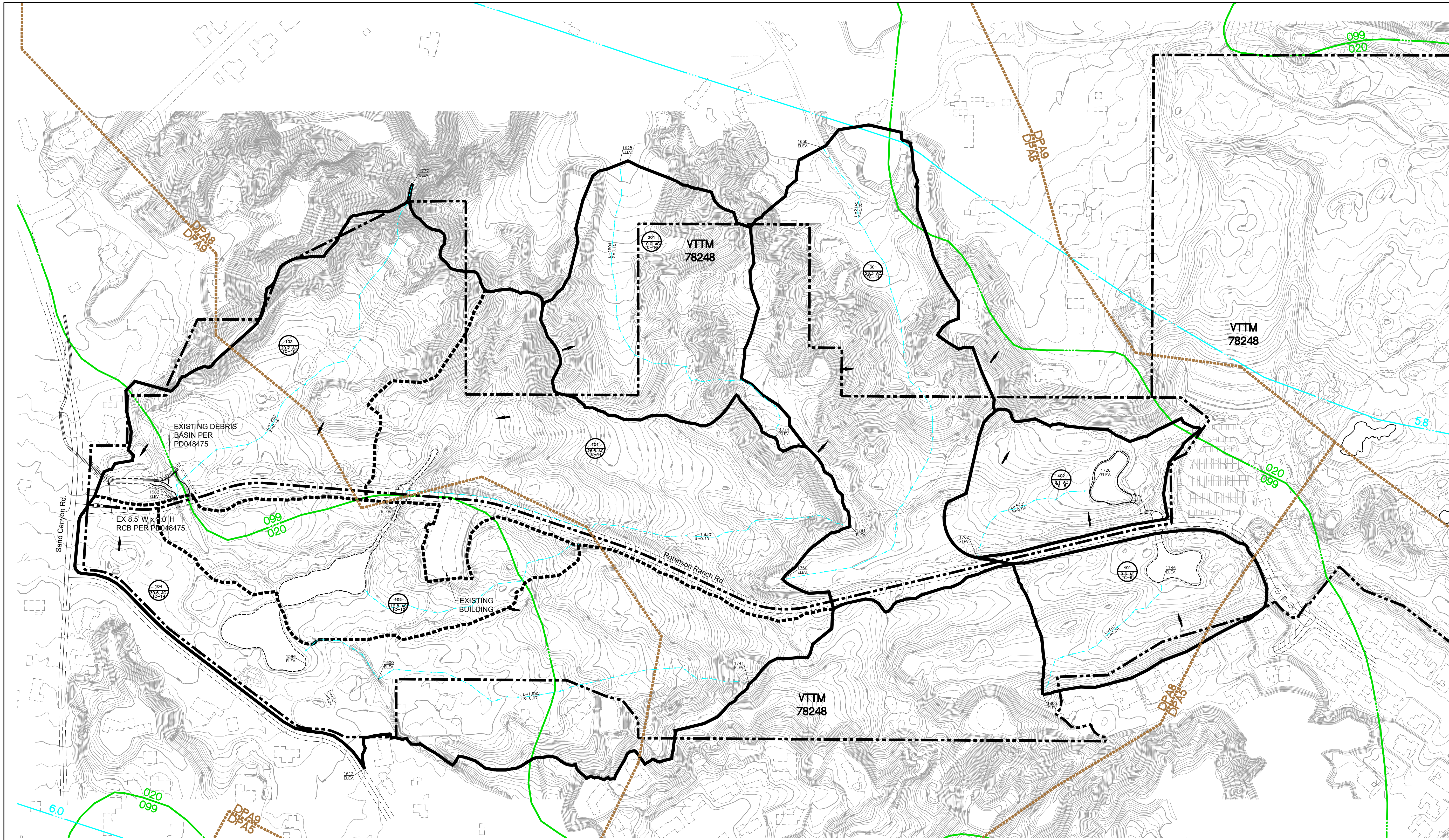
$$Q_B = BF_{(A)}\ x\left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_u}{A}\right) + BF_{(A_u)}\ x\left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_d}{A}\right) + \left(\frac{Q_{(A)}\ A_d}{A}\right)$$

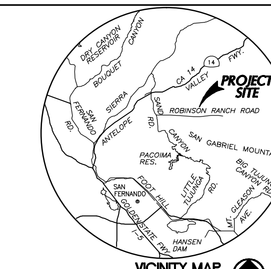
Q=CLEAR DISCHARGE					26.50	CFS
BF 201=the bulking factor for subarea 201.					1.36	unitless
AREA 201		11.3	AC		0.02	SQ MI
Dev AREA 201					0.0023	SQ MI
Undev area 201					0.0154	SQ MI

					Q=	34.9	CFS
PROPOSED WATERSHED 300							
REFER TO EQUATION 3.4.3 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006							
$Q_B = BF_{(A)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_u}{A}\right) + BF_{(A_u)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_d}{A}\right) + \left(\frac{Q_{(A)}\ A_d}{A}\right)$							
Q=CLEAR DISCHARGE						33.40	CFS
BF 301=the bulking factor for subarea 301.						1.36	unitless
AREA 301		17.1	AC			0.03	SQ MI
Dev AREA 301						0.0019	SQ MI
Undev area 301						0.0248	SQ MI
					Q=	44.6	CFS
PROPOSED WATERSHED 400							
REFER TO EQUATION 3.4.3 IN SEDIMENTATION MANUAL-2nd EDITION MARCH 2006							
$Q_B = BF_{(A)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_u}{A}\right) + BF_{(A_u)} \times \left(\frac{Q_{(A)}\ A_u}{A}\right)\left(\frac{A_d}{A}\right) + \left(\frac{Q_{(A)}\ A_d}{A}\right)$							
Q=CLEAR DISCHARGE						46.40	CFS
BF 400=the bulking factor for subarea 401 & 402.						1.36	unitless
AREA 400		16.4	AC			0.03	SQ MI
Dev AREA 400						0.0243	SQ MI
Undev area 400						0.0013	SQ MI
					Q=	47.2	CFS

B. Hydrological Maps

1. Existing Hydrology Map





VICINITY MAP
NOT TO SCALE

NORTH

LEGEND:

(line)	VTTM 61105 BOUNDARY
(line)	PROPOSED DRAINAGE AREA BOUNDARY
(line)	PROPOSED DRAINAGE SUB-AREA BOUNDARY
(arrow)	FLOW PATH
(line)	TIME OF CONCENTRATION PATH
950	PROPOSED CONTOUR
(line)	DAYLIGHT LINE
7.6	50 YEAR ISOHYET
DPA8 / DPA5	DEBRIS POTENTIAL AREA (DPA)
097 / 020	SOIL CLASSIFICATION BOUNDARY

408A / 19.9 AC / Tc=6: SUBAREA NO.; SUBAREA AREA – (Acres); SUBAREA TC

DRAINAGE DESIGN CRITERIA:

1. 50-YR, 24-HR ISOHYETS: 5.8 & 6.0
2. SOIL TYPES: 20 & 99
3. DESIGN STORMS: 50-YR, 24-HR
4. PERCENT IMPERVIOUS VALUES:
   GOLF COURSE – 3%
   DUPLEXES, TRIPLEXES AND 2-OR 3-UNIT CONDOMINIUMS AND TOWNHOUSES – 55%
5. DPA = 8, 35,000 CY PER SQ MI
6. BULK FACTOR = 1.36
7. DPA = 9, 16,500 CY PER SQ MI
8. BULK FACTOR = 1.27

NORTH
FEET 100' 0 100' 200'
INCHES 1/2 0 1 2

DESIGNED: GK					
DRAFTED: GK					
CHECKED: WL	NO.		REVISIONS	DATE	BY

OWNER DEVELOPER:
SAND CANYON COUNTRY CLUB
27734 SAND CANYON ROAD
SANTA CLARITA, CA, 91387
TELEPHONE: (213) 700-6883
OWNER: STEVE KIM

REGISTERED PROFESSIONAL ENGINEER
JASON H. FUKUMITSU
No. 40695
CIVIL
STATE OF CALIFORNIA

PLANS PREPARED BY:
HUNSAKER & ASSOCIATES
LOS ANGELES, INC.
PLANNING ▪ ENGINEERING ▪ SURVEYING
26074 Avenue Hall, Ste 23 ▪ Valencia, CA 91355
PH: (661) 294-2211 ▪ FX: (661) 294-9890

JASON H. FUKUMITSU DATE

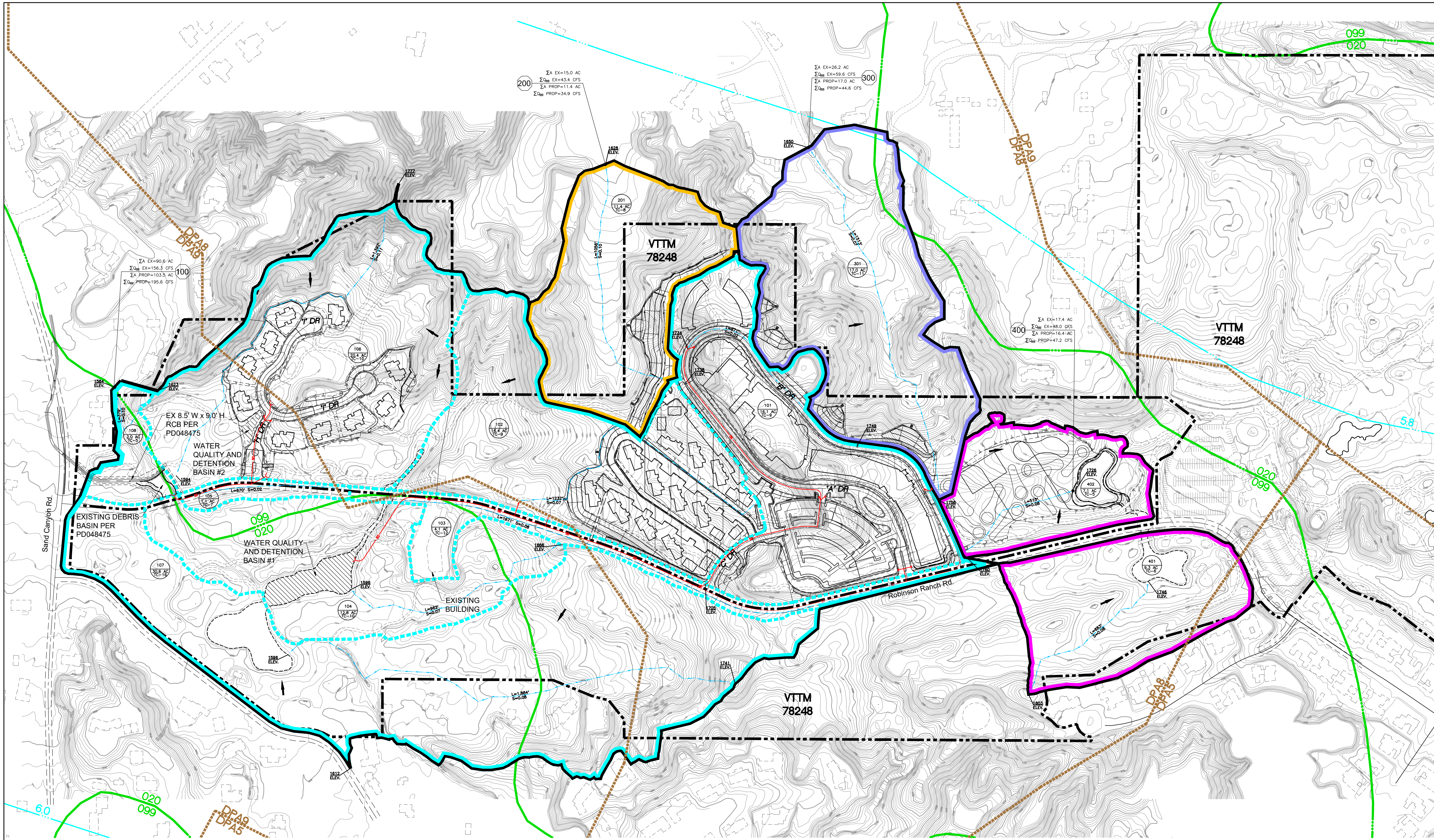
SAND CANYON
EXISTING HYDROLOGY MAP
VTTM 78248

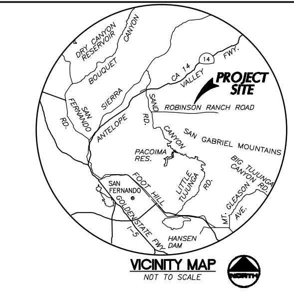
IN THE CITY OF SANTA CLARITA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

SCALE: 1" = 100'
DATE: 03/09/2018
JOB No. 0261-001-001
SHEET 1 OF 1 SHEETS

G:\Sand Canyon Resort\Storm\Hydrology\HSC011-01_Existing Hydrology Exhibit.dwg Plotted on Mar 28, 2018-2:02pm by gregoryk

2. Proposed Hydrology Map





LEGEND:

- VTTM 78248 BOUNDARY
- PROPOSED DRAINAGE AREA BOUNDARY
- WATERSHED BOUNDARY
- PROPOSED DRAINAGE SUB-AREA BOUNDARY
- TIME OF CONCENTRATION PATH
- PROPOSED CONTOUR
- DAYLIGHT LINE
- STORM DRAIN
- FLOW PATH
- 7.6 — 50 YEAR ISOHYET
- DPA8 / DPA5 — DEBRIS POTENTIAL AREA (DPA)
- 097 / 020 — SOIL CLASSIFICATION BOUNDARY
- 408A — SUBAREA NO.; SUBAREA AREA – (Acres); SUBAREA TC
- 300 — WATERSHED OUTLET NODE

Subarea	Soil Type	% Imp	Area (Ac)	ΣAREA (Ac)	50-Yr Isohyet (in)	50-Yr Tc (min)	Q50 (cfs)	ΣQBB (cfs)
101	99	0.55	16.1	16.1	5.9	9	37.1	195.6
102	99	0.55	16.4	32.5	5.9	9	37.8	
103	99	0.9	4.1	36.6	5.9	12	8.4	
104	20	0.03	12.8	49.4	5.9	10	18.7	
105	99	0.9	1.1	50.5	5.9	7	2.8	
106	99	0.55	20.4	70.9	5.9	10	44.6	
107	20	0.03	30.6	101.5	5.9	16	33.1	
108	20	0.03	2.0	103.5	5.9	5	4.5	
201	99	0.03	11.4	11.4	5.9	8	26.5	34.9
301	99	0.03	17.0	17.0	5.9	11	33.4	44.6
401	99	0.03	9.3	9.3	5.9	6	25.2	47.2
402	99	0.03	7.1	16.4	5.9	5	21.2	

DRAINAGE DESIGN CRITERIA:

1. 50-YR, 24-HR ISOHYETS: 5.8 & 6.0
2. SOIL TYPES: 20 & 99
3. DESIGN STORMS: 50-YR, 24-HR
4. PERCENT IMPERVIOUS VALUES:
   GOLF COURSE – 3%
   DUPLEXES, TRIPLEXES AND 2-OR 3-UNIT CONDOMINIUMS AND TOWNHOUSES – 55%
   ROADS – 99%
5. DPA = 8, 35,000 CY PER SQ MI
6. BULK FACTOR = 1.36
7. DPA = 9, 16,500 CY PER SQ MI
8. BULK FACTOR = 1.27

NORTH

FEET 100' 50' 0 100' 200'
INCHES 1 1/2 0 1 2

DESIGNED: GK	NO.	REVISIONS	DATE	BY
DRAFTED: GK				
CHECKED: WL				

OWNER DEVELOPER:
SAND CANYON COUNTRY CLUB
27734 SAND CANYON ROAD
SANTA CLARITA, CA, 91387
TELEPHONE: (213) 700-6883
OWNER: STEVE KIM

REGISTERED PROFESSIONAL ENGINEER JASON H. FUKUMITSU No. 40695 CIVIL STATE OF CALIFORNIA

PLANS PREPARED BY:
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26074 Avenue Hall, Ste 23 ▪ Valencia, CA 91355
PH: (661) 294-2211 ▪ FX: (661) 294-9890
JASON H. FUKUMITSU DATE

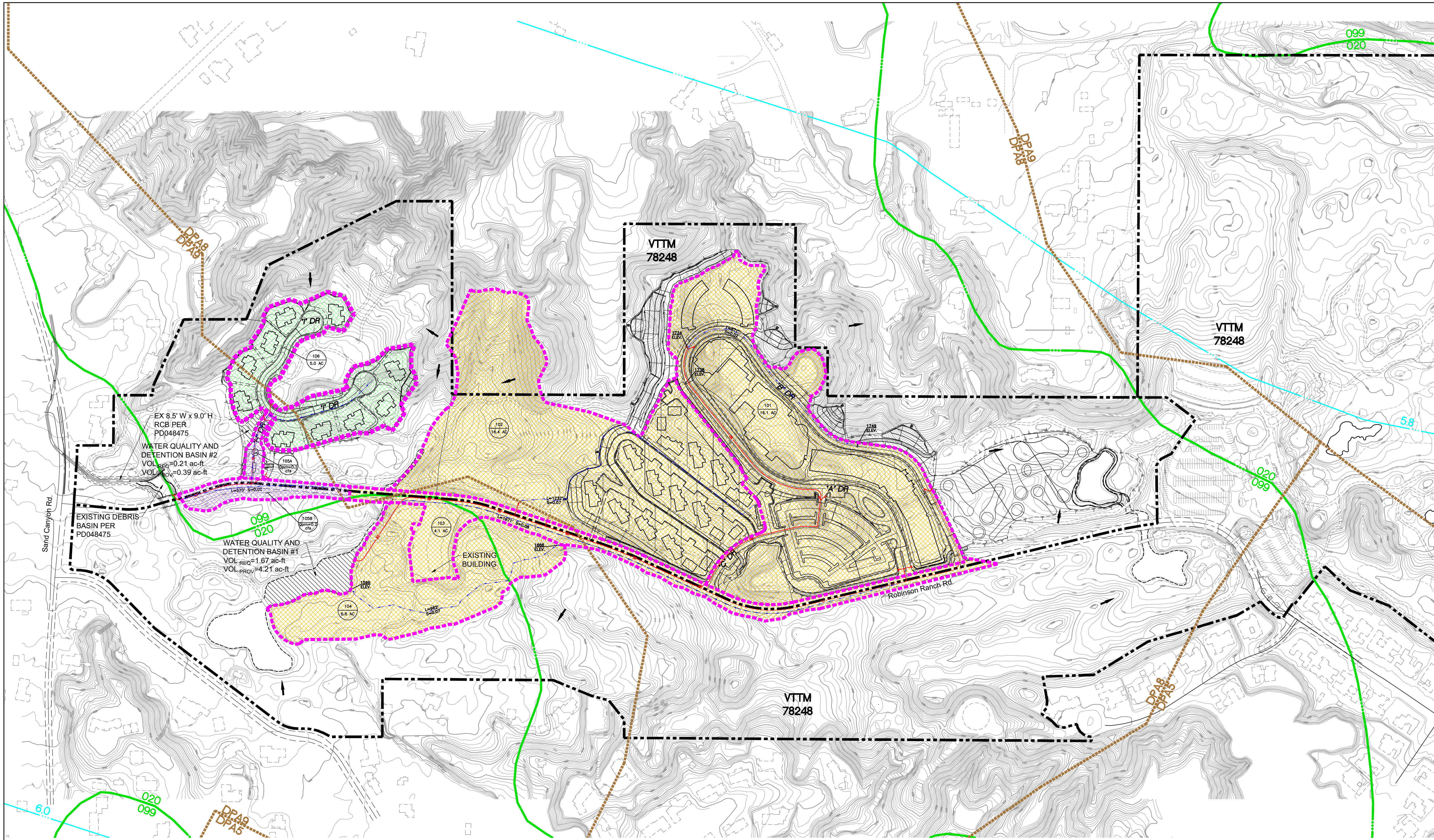
SAND CANYON PROPOSED HYDROLOGY MAP VTTM 78248

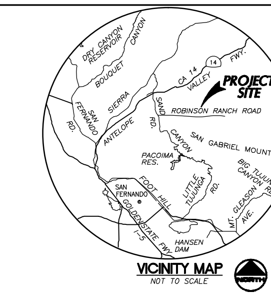
IN THE CITY OF SANTA CLARITA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

SCALE: 1" = 100'
DATE: 08/30/2018
JOB No. 0261-001-001
SHEET 1 OF 1 SHEETS

G:\Sand Canyon Resort\Storm\Hydrology\HSC010-01_Proposed Hydrology.dwg

3. Water Quality LID Exhibit





LEGEND:

- VTTM 78248 BOUNDARY
- WATER QUALITY TREATMENT BOUNDARY
- TIME OF CONCENTRATION PATH
- PROPOSED CONTOUR
- DAYLIGHT LINE
- STORM DRAIN
- FLOW PATH
- 7.6 — 50 YEAR ISOHYET
- DPA8 / DPA5 — DEBRIS POTENTIAL AREA (DPA)
- 097 / 020 — SOIL CLASSIFICATION BOUNDARY
- WATER QUALITY TREATMENT AREA
- SUBAREA NO. / SUBAREA Qpm – (cfs)
- SUBAREA NO. / SUBAREA AREA – (Acres)

Basin #1

	Ac-ft
LID Req Volume	1.67
Biofiltration Req Volume (150% of LID Red Volume)	2.51
Detention (Watershed 100)	0.27
Total Req. Volume (Biofiltration Vol + Detention)	2.78
Provided Volume	4.21

Basin #2

	Ac-ft
LID Req Volume	0.21
Biofiltration Req Volume (150% of LID Red Volume)	0.32
Detention (Watershed 100)	0.01
Total Req. Volume (Biofiltration Vol + Detention)	0.33
Provided Volume	0.39

Subarea	Tributary Area (ac)	Qpm (cfs)
105A	0.3	0.1
105B	1.1	0.2

NORTH

FEET 100' 50' 0 100' 200'
INCHES 1/2 0 1 2

DESIGNED: HS
DRAFTED: HS
CHECKED: WL

NO.		REVISIONS	DATE	BY

OWNER DEVELOPER:
SAND CANYON COUNTRY CLUB
27734 SAND CANYON ROAD
SANTA CLARITA, CA, 91387
TELEPHONE: (213) 700-6883
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REGISTERED PROFESSIONAL ENGINEER JASON H. FUKUMITSU No. 40695 CIVIL STATE OF CALIFORNIA

PLANS PREPARED BY:
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26074 Avenue Hall, Ste 23 ▪ Valencia, CA 91355
PH: (661) 294-2211 ▪ FX: (661) 294-9890
JASON H. FUKUMITSU DATE

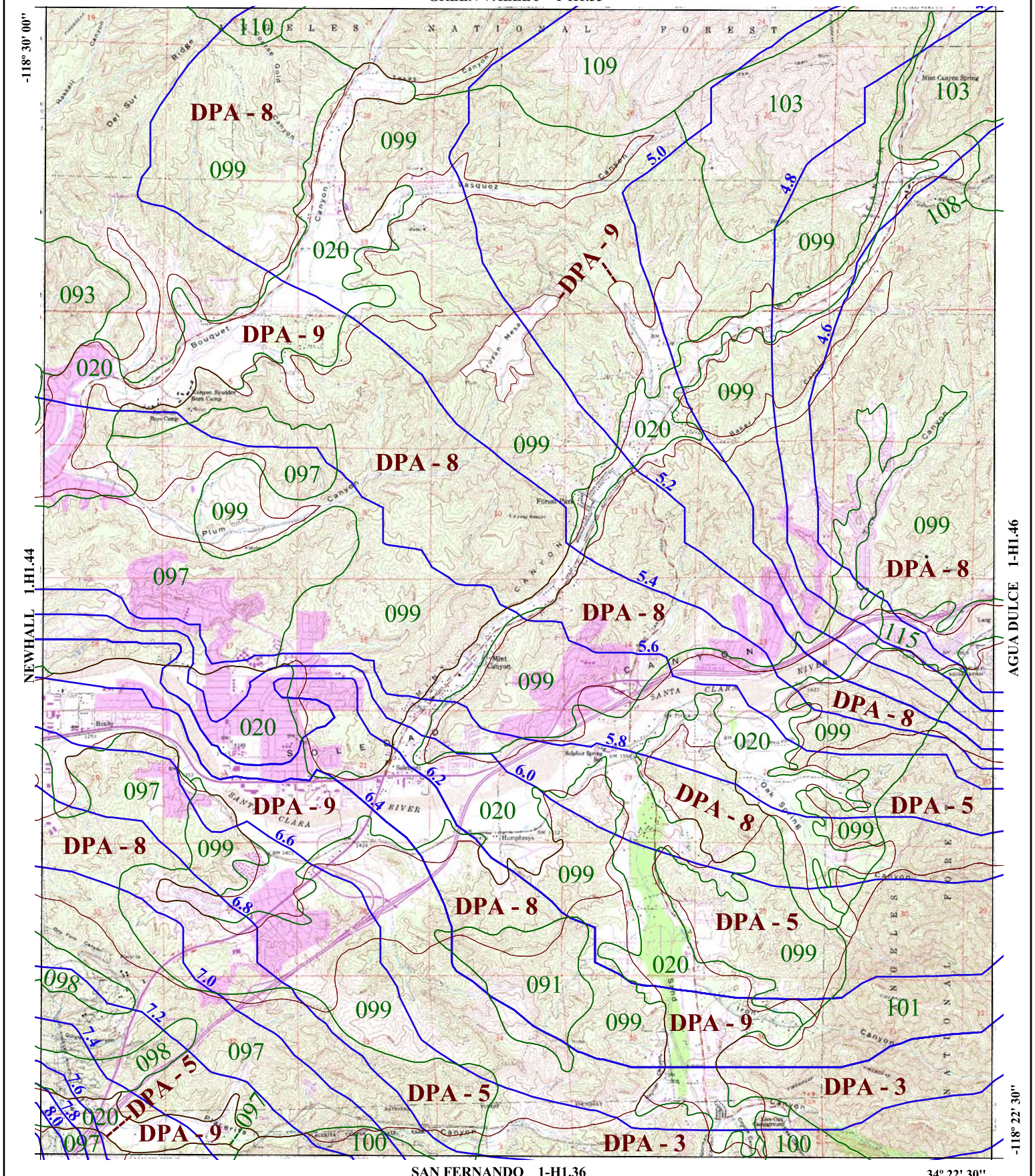
SAND CANYON WATER QUALITY LID EXHIBIT VTTM 78248

IN THE CITY OF SANTA CLARITA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

SCALE: 1" = 100'
DATE: 09/11/2018
JOB No. 0261-001-001
SHEET 1 OF 1 SHEETS

C. Hydrologic Reference Graphs & Table

1. 50-Year, 24-Hour Isohyet (LACDPW)


34° 30' 00"
GREEN VALLEY 1-H1.55
-118° 30' 00"
NEWHALL 1.H1.44
AGUA DULCE 1-H1.46
-118° 22' 30"
SAN FERNANDO 1-H1.36
34° 22' 30"
ANGELES NATIONAL FOREST
DPA - 8
DPA - 9
DPA - 5
DPA - 3
016
020
091
093
097
098
099
100
101
103
108
109
110
115
4.8
5.0
4.6
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0
SOIL CLASSIFICATION AREA
INCHES OF RAINFALL
DEBRIS POTENTIAL AREA
1 0 1 2 Miles
N
W
E
S
25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714
MINT CANYON
50-YEAR 24-HOUR ISOHYET
1-H1.45
LOS ANGELES COUNTY PUBLIC WORKS
Public Service That Works

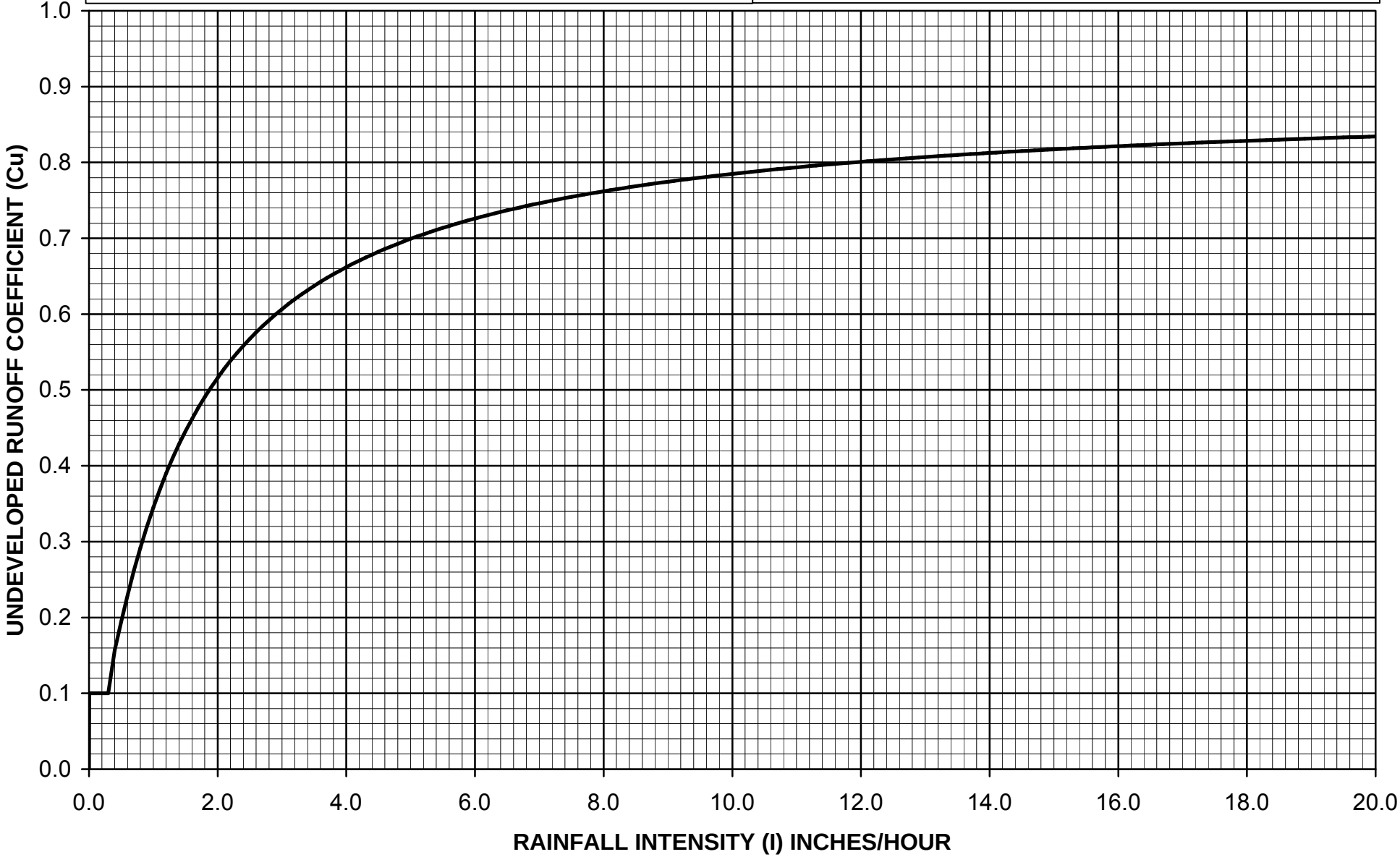
2. Runoff Coefficient Curves for Soil Types 20 and 99

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

Where: C_D = Developed Runoff Coefficient
IMP = Proportion Impervious
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 020

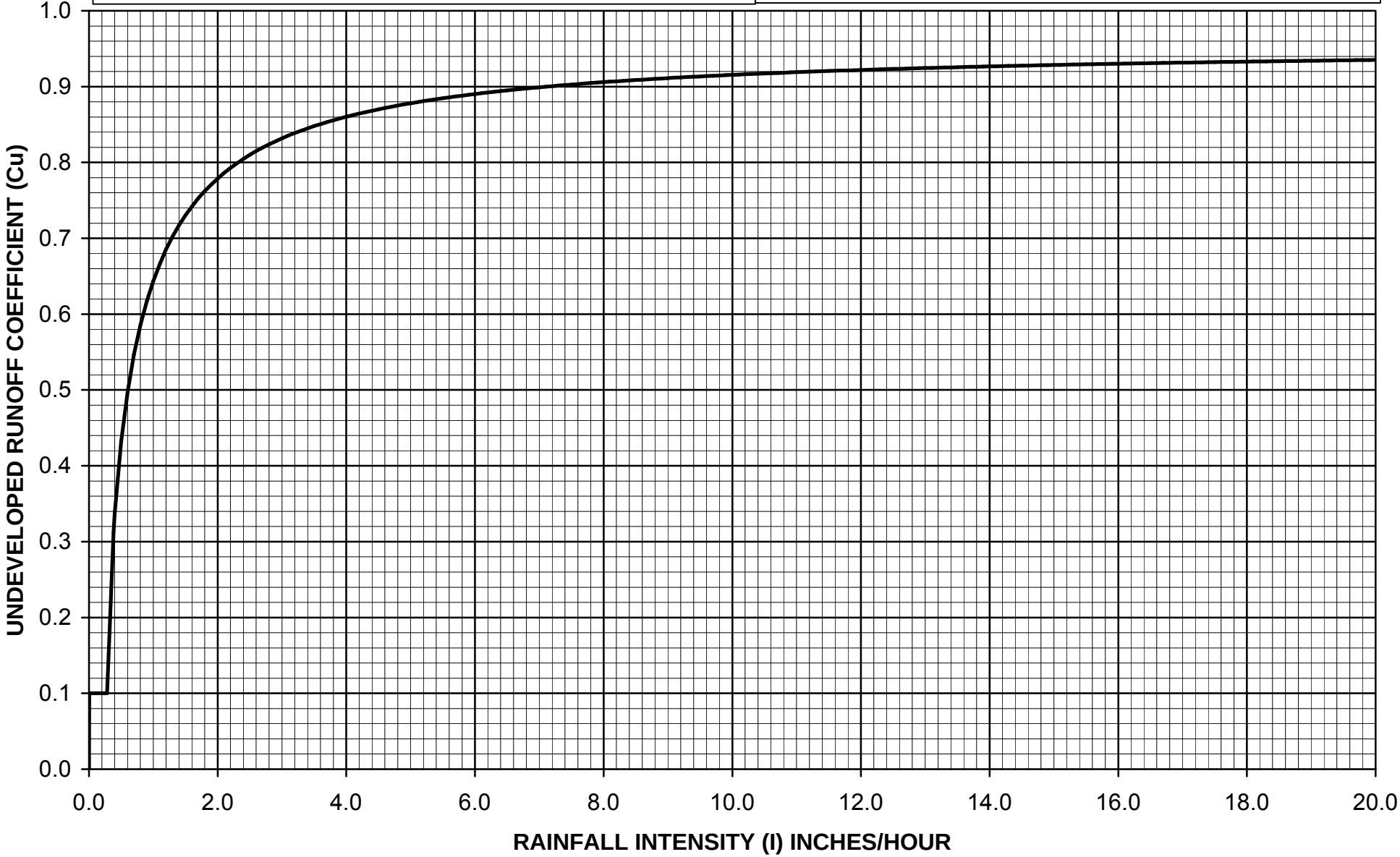


$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

Where: C_D = Developed Runoff Coefficient
IMP = Proportion Impervious
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 099



3. Los Angeles County Proportion Impervious Data Table

Proportion Impervious Data

Code	Land Use Description	% Impervious
1111	High-Density Single Family Residential	42
1112	Low-Density Single Family Residential	21
1121	Mixed Multi-Family Residential	74
1122	Duplexes, Triplexes and 2-or 3-Unit Condominiums and Townhouses	55
1123	Low-Rise Apartments, Condominiums, and Townhouses	86
1124	Medium-Rise Apartments and Condominiums	86
1125	High-Rise Apartments and Condominiums	90
1131	Trailer Parks and Mobile Home Courts, High-Density	91
1132	Mobile Home Courts and Subdivisions, Low-Density	42
1140	Mixed Residential	59
1151	Rural Residential, High-Density	15
1152	Rural Residential, Low-Density	10
1211	Low- and Medium-Rise Major Office Use	91
1212	High-Rise Major Office Use	91
1213	Skyscrapers	91
1221	Regional Shopping Center	95
1222	Retail Centers (Non-Strip With Contiguous Interconnected Off-Street	96
1223	Modern Strip Development	96
1224	Older Strip Development	97
1231	Commercial Storage	90
1232	Commercial Recreation	90
1233	Hotels and Motels	96
1234	Attended Pay Public Parking Facilities	91
1241	Government Offices	91
1242	Police and Sheriff Stations	91
1243	Fire Stations	91
1244	Major Medical Health Care Facilities	74
1245	Religious Facilities	82
1246	Other Public Facilities	91
1247	Non-Attended Public Parking Facilities	91
1251	Correctional Facilities	91
1252	Special Care Facilities	74
1253	Other Special Use Facilities	86
1261	Pre-Schools/Day Care Centers	68
1262	Elementary Schools	82
1263	Junior or Intermediate High Schools	82
1264	Senior High Schools	82
1265	Colleges and Universities	47
1266	Trade Schools and Professional Training Facilities	91
1271	Base (Built-up Area)	65
1271.01	Base High-Density Single Family Residential	42
1271.02	Base Duplexes, Triplexes and 2-or 3-Unit Condominiums and T	55

Code	Land Use Description	% Impervious
1271.03	Base Government Offices	91
1271.04	Base Fire Stations	91
1271.05	Base Non-Attended Public Parking Facilities	91
1271.06	Base Air Field	45
1271.07	Base Petroleum Refining and Processing	91
1271.08	Base Mineral Extraction - Oil and Gas	10
1271.09	Base Harbor Facilities	91
1271.10	Base Navigation Aids	47
1271.11	Base Developed Local Parks and Recreation	10
1271.12	Base Vacant Undifferentiated	1
1272	Vacant Area	2
1273	Air Field	45
1274	Former Base (Built-up Area)	65
1275	Former Base Vacant Area	2
1276	Former Base Air Field	91
1311	Manufacturing, Assembly, and Industrial Services	91
1312	Motion Picture and Television Studio Lots	82
1313	Packing Houses and Grain Elevators	96
1314	Research and Development	91
1321	Manufacturing	91
1322	Petroleum Refining and Processing	91
1323	Open Storage	66
1324	Major Metal Processing	91
1325	Chemical Processing	91
1331	Mineral Extraction - Other Than Oil and Gas	10
1332	Mineral Extraction - Oil and Gas	10
1340	Wholesaling and Warehousing	91
1411	Airports	91
1411.01	Airstrip	10
1412	Railroads	15
1412.01	Railroads-Attended Pay Public Parking Facilities	91
1412.02	Railroads-Non-Attended Public Parking Facilities	91
1412.03	Railroads-Manufacturing, Assembly, and Industrial Services	91
1412.04	Railroads-Petroleum Refining and Processing	91
1412.05	Railroads-Open Storage	66
1412.06	Railroads-Truck Terminals	91
1413	Freeways and Major Roads	91
1414	Park-and-Ride Lots	91
1415	Bus Terminals and Yards	91
1416	Truck Terminals	91
1417	Harbor Facilities	91
1418	Navigation Aids	47
1420	Communication Facilities	82
1420.01	Communication Facilities-Antenna	2

Code	Land Use Description	% Impervious
1431	Electrical Power Facilities	47
1431.01	Electrical Power Facilities-Powerlines (Urban)	2
1431.02	Electrical Power Facilities-Powerlines (Rural)	1
1432	Solid Waste Disposal Facilities	15
1433	Liquid Waste Disposal Facilities	96
1434	Water Storage Facilities	91
1435	Natural Gas and Petroleum Facilities	91
1435.01	Natural Gas and Petroleum Facilities-Manufacturing, Assembly, and In	91
1435.02	Natural Gas and Petroleum Facilities-Petroleum Refining and Processing	91
1435.03	Natural Gas and Petroleum Facilities-Mineral Extraction – Oil and Gas	10
1435.04	Natural Gas and Petroleum Facilities-Vacant Undifferentiated	1
1436	Water Transfer Facilities	96
1437	Improved Flood Waterways and Structures	100
1440	Maintenance Yards	91
1450	Mixed Transportation	90
1460	Mixed Transportation and Utility	91
1460.01	Mixed Utility and Transportation-Improved Flood Waterways and Structures	100
1460.02	Mixed Utility and Transportation-Railroads	15
1460.03	Mixed Utility and Transportation-Freeways and Major Roads	91
1500	Mixed Commercial and Industrial	91
1600	Mixed Urban	89
1700	Under Construction (Use appropriate value)	91
1810	Golf Courses	3
1821	Developed Local Parks and Recreation	10
1822	Undeveloped Local Parks and Recreation	2
1831	Developed Regional Parks and Recreation	2
1832	Undeveloped Regional Parks and Recreation	1
1840	Cemeteries	10
1850	Wildlife Preserves and Sanctuaries	2
1850.01	Wildlife-Commercial Recreation	90
1850.02	Wildlife-Other Special Use Facilities	86
1850.03	Wildlife-Developed Local Parks and Recreation	10
1860	Specimen Gardens and Arboreta	15
1870	Beach Parks	10
1880	Other Open Space and Recreation	10
2110	Irrigated Cropland and Improved Pasture Land	2
2120	Non-Irrigated Cropland and Improved Pasture Land	2
2200	Orchards and Vineyards	2
2300	Nurseries	15
2400	Dairy, Intensive Livestock, and Associated Facilities	42
2500	Poultry Operations	62
2600	Other Agriculture	42
2700	Horse Ranches	42

Code	Land Use Description	% Impervious
3100	Vacant Undifferentiated	1
3200	Abandoned Orchards and Vineyards	2
3300	Vacant With Limited Improvements (Use appropriate value)	42
3400	Beaches (Vacant)	1
4100	Water, Undifferentiated	100
4200	Harbor Water Facilities	100
4300	Marina Water Facilities	100
4400	Water Within a Military Installation	100

4. Los Angeles County Debris Production Rates for Santa Clara Basin

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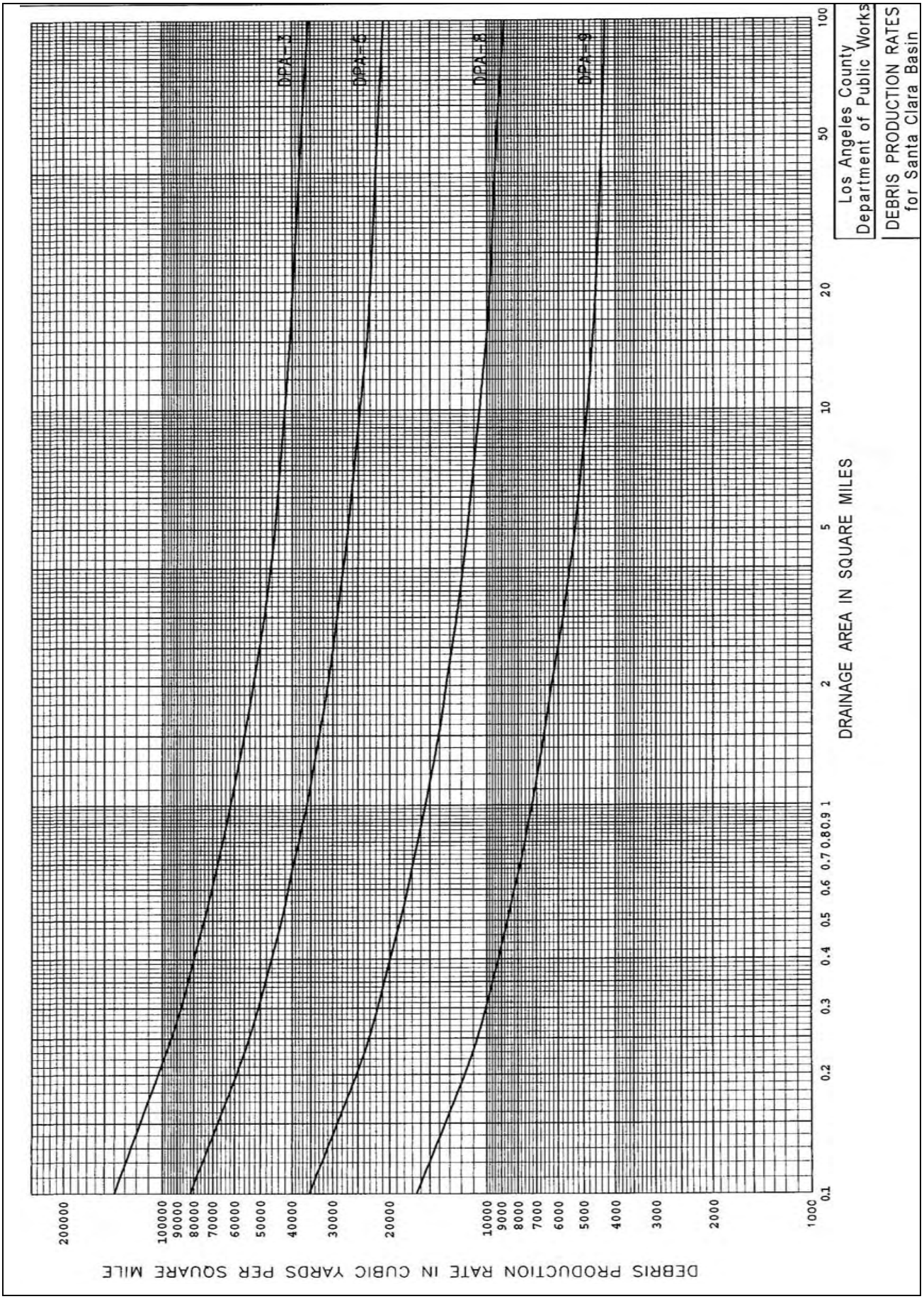
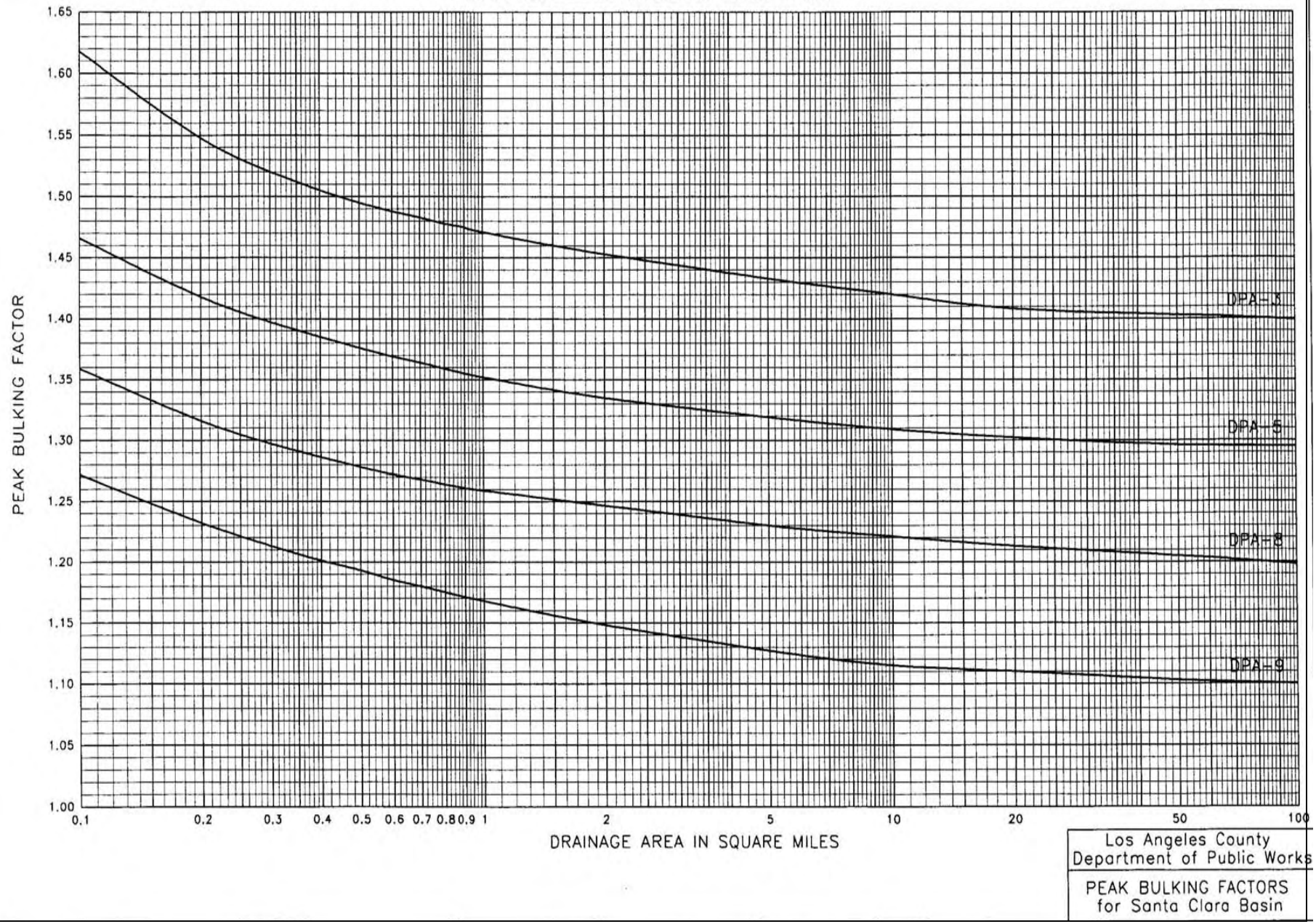

DEBRIS PRODUCTION RATE IN CUBIC YARDS PER SQUARE MILE
200000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
2
5
10
20
50
100
DRAINAGE AREA IN SQUARE MILES
DPA-3
DPA-6
DPA-8
DPA-9
Los Angeles County
Department of Public Works
DEBRIS PRODUCTION RATES
for Santa Clara Basin

5. Los Angeles County Peak Bulking Factors for Santa Clara Basin

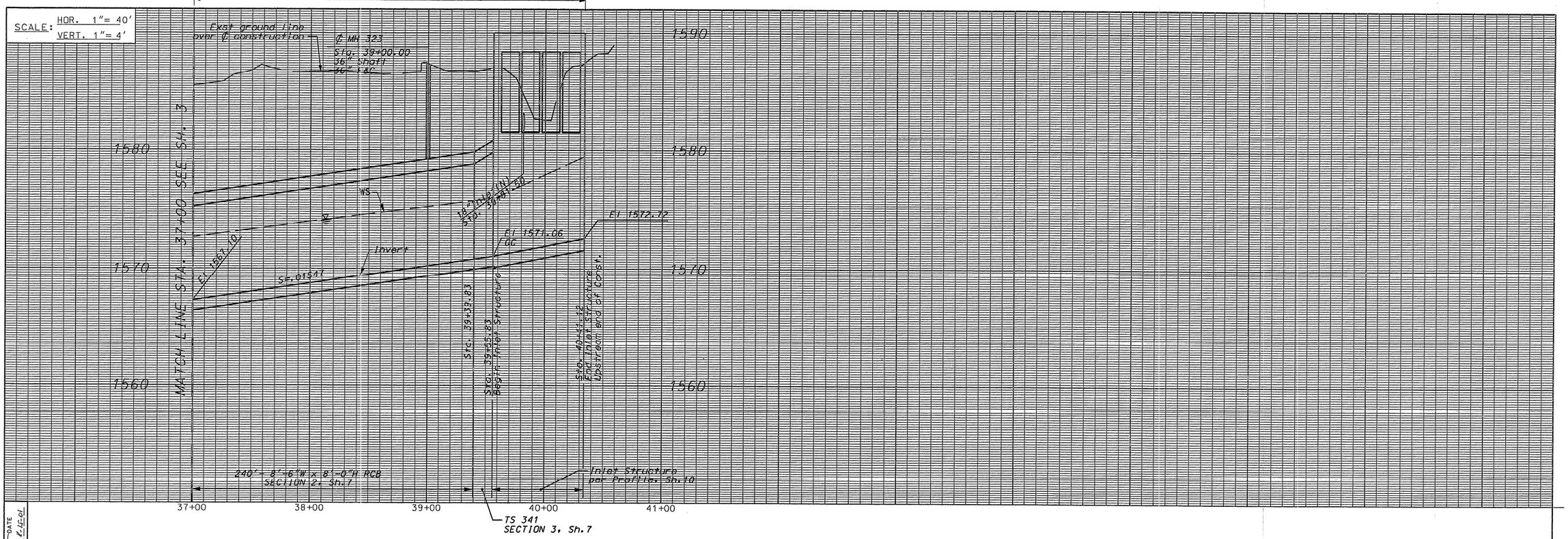

PEAK BULKING FACTOR
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
2
5
10
20
50
100
DRAINAGE AREA IN SQUARE MILES
DPA-3
DPA-5
DPA-8
DPA-9
Los Angeles County
Department of Public Works
PEAK BULKING FACTORS
for Santa Clara Basin

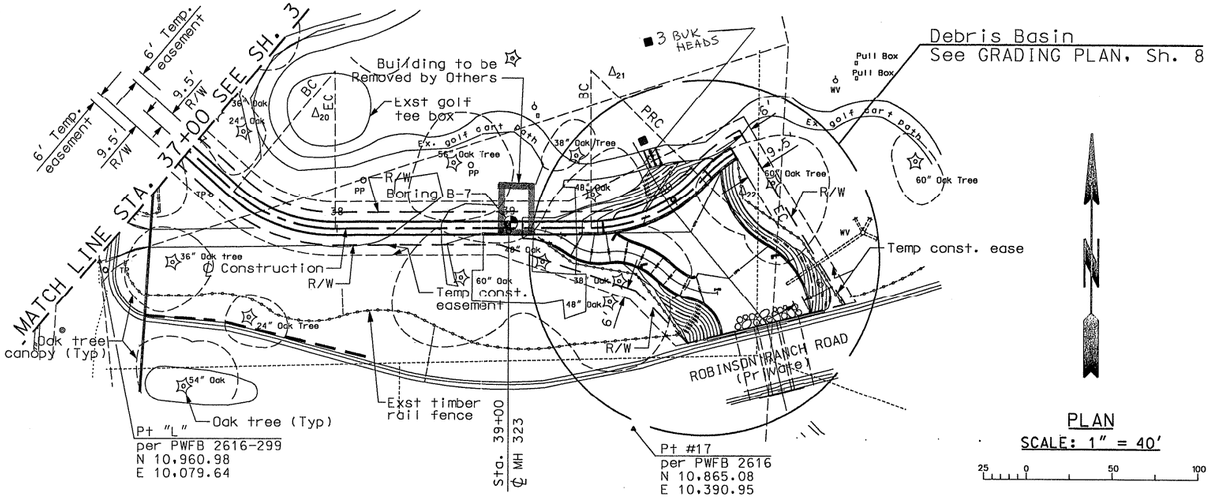
D. Reference Plans

1. L.A.C.D.P.W. PD048475

Q_{50} =1435 cfs

SCALE: HOR. 1"= 40'
VERT. 1"= 4'





PLAN
SCALE: 1" = 40'

25 0 50 100

BENCH MARKS

PT H.
PWLB 2616-334,335
BM NEWHALL "83" Elev.1586.965
Spk & DPW washer FL Near S edge
drwy. Hse #27734 +20' E/O Ctr
Sand Cn. Rd. & 355 N/O Live Oak
Springs Cy. Rd. PWLB 2616-315,316

℄ Construction Curve Data

Δ_{20} = 41°03'20"
R = 90.00
T = 33.70
L = 64.49
BC = 37+34.56
EC = 37+99.05
PI = N 10,980.1109
E 10,183.0820

℄ Construction Curve Data

Δ_{21} = 46°13'40"
R = 90.00
T = 38.41
L = 72.61
BC = 39+48.18
PRC= 40+20.79
PI = N 10,981.4376
E 10,404.3153

℄ Construction Curve Data

Δ_{22} = 14°50'45"
R = 90.00
T = 11.73
L = 23.32
BC = 40+20.79
EC = 40+44.11
PI = N 11,017.8505
E 10,438.7838

DRAFTER	DESIGNER	CHECKER	CADD PROJECT FILE NAME	REVISED BY
T. BUSCH	J. ENRIQUEZ	J. ENRIQUEZ	970134	DATE 2-15-01

DATE	MK	DESCRIPTION
07-03-14	■	"AS BUILT"

REVISIONS

James Enriquez
No. C55520
Exp. 12-31-04
CIVIL
STATE OF CALIFORNIA
REGISTERED PROFESSIONAL ENGINEER

PROJECT ENGINEER — DATE 8/16/01

SUPERSEDES DRAWING NO. 831-D3.4

PD048475

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

LIVE OAK SPRINGS CANYON
UNIT 2
REINFORCED CONCRETE CONDUIT
PLAN AND PROFILE - LINE A
STA. 37+00 TO STA. 40+33.62

JOB X5009141 | DWG 831-D3.4A | SHEET 4 OF 19

PPS-DF 5/99

"AS BUILT DRAWINGS"

GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

May 14, 2019

Sand Canyon Country Club
27734 Sand Canyon Road
Santa Clarita, California 91387

Job No. 2017-006-021

Attention: Mr. Steve Kim

Subject: Report of Infiltration Study
Water Quality Detention Basin
Sand Canyon Country Club
27734 Sand Canyon Road
Santa Clarita, California

Dear Mr. Kim,

This report presents the results of our geotechnical infiltration study that was performed within proposed water quality detention basin area for the Sand Canyon Country Club at the subject site. The proposed basin is located within the general footprint of an existing water feature in the southwestern portion of the site. The work was performed in consideration of the Los Angeles County Department of Public Works (LACDPW), Administrative Manual GS 200.2, Guidelines for Geotechnical Investigation and Reporting, Low Impact Development (LID) Storm Water Infiltration," dated June 30,2017 (LACDPW, 2017).

R.T. Frankian & Associates (RTF&A) previously performed a geotechnical investigation on the existing country club property, which has been summarized in our report Geotechnical Plan Review; dated September 20, 2018 (RTF&A, 2018). Subsurface data presented within our previous investigation report was utilized in developing the conclusions presented within this report.

We have been provided with an exhibit that indicates the location of the water quality detention basin, untitled, prepared by Hunsaker & Associates, undated; copy attached. We are also

in receipt of the project plans for the country club, titled "Major Land Division, Vesting Tentative Tract Map No. 78248," indicating the existing grades of the surrounding areas. A section of the vesting tentative tract map was used as the basis for the attached Geotechnical Map.

Included with and completing this report are a List of References, the exhibit showing the location of the proposed water quality detention basin (Figure 1), a Geotechnical Map (Figure 2), Test Pit Logs (Appendix A) and Groundwater Data (Appendix B).

SITE DESCRIPTION

The proposed water quality detention basin is located within the general footprint of an existing water feature in the southwestern corner of the existing country club property near the intersection of Robinson Ranch and Sand Canyon Roads. In discussions with Mr. Paul Ortega of Hunsaker & Associates, the proposed basin is approximately 60,000 square-feet in area with a proposed depth of approximately 8-feet; the proposed bottom elevation varies from elevation 1590 to 1591. Vegetation within the area of the basin includes native weeds and planted ornamental materials.

SUBSURFACE EXPLORATION

The area of the water quality detention basin was explored on April 16, 2019, with a series of backhoe excavated exploratory test pits (Test Pits TP-1 through TP-3). The test pits were excavated to depths that varied from approximately 7 to 13-feet below the existing ground surface. The test pits were originally intended to facilitate large-scale infiltration testing; however, infiltration testing was not conducted due to the presence of saturated artificial fill soils at depths below the invert elevation of the proposed basin which created heavy caving below a depth of about 2-feet. In addition, a 20-mil geosynthetic membrane was encountered within the bottom of Test Pit TP-3 at a depth of approximately 11-feet below the existing surface which corresponds to an approximate elevation of 1585. The logs of the excavated test pits are presented in Appendix A.

GROUNDWATER

Water well records from the Los Angeles County Department of Public Works (LACDPW) indicate that there are no water wells monitored by LACDPW within the project site; however, one active LACDPW water well is located approximately 500 feet west-southwest of the western property boundary. This well is designated as Well No. 7188A (State Well ID 4N15W23Q02). Water levels in Well No. 7188A were measured from April 1974 through November 2011. During that period, the highest measured water level was 3.8 feet below ground surface, corresponding to a water surface elevation of 1583.2 feet above mean sea level (msl). This water level was recorded on November 27, 1978. The last measurement recorded in this well was 35.9 feet below ground surface (water surface elevation of 1551.1 feet msl) recorded on November 14, 2011. The groundwater measurements from Well No. 7188A have been included within Appendix B – Goundwater Data.

The State of California Seismic Hazard Maps for the Mint Canyon Quadrangle (CDMG, 1998) indicates that the historic high groundwater ranges from 0 to 10 feet below ground surface near the southeastern corner of Sand Canyon Road and Robinson Ranch Road in the vicinity of the proposed water quality detention basin. The Historically Highest Groundwater Contour Map from the Seismic Hazard Maps for the Mint Canyon Quadrangle has been included within Appendix B – Goundwater Data.

INFILTRATION EVALUATION

As previously mentioned, the exploratory test pits (Test Pits TP-1 through TP-3) were originally intended to facilitate large-scale infiltration testing; however, infiltration testing was not conducted due to the presence of saturated artificial fill soils at depths below the invert elevation of the proposed basin and heavy caving within the saturated soils below a depth of 2-feet. In addition, a 20-mil geosynthetic membrane was encountered within the bottom of Test Pit TP-3 at a depth of approximately 11-feet below the existing surface which corresponds to an approximate elevation of 1585. We did not encounter the geomembrane liner in the other test pits, but we

suspect that the liner, if present, was deeper than we were able to excavate. The liner, where encountered, was approximately 5 to 6-feet below proposed basin invert elevation. The geosynthetic membrane mantels the native soils that would be considered the elevation of infiltration which is within 10-feet of historic high groundwater.

CONCLUSIONS AND RECOMMENDATIONS

It is our understanding that consideration is being given to infiltrating collected storm water as part of the proposed industrial building development at the subject site. It is our opinion that the site is not a candidate for the infiltration of water for the reasons specified below.

Due to the depth of the artificial fill soils that do not have favorable infiltration characteristics, the elevation of the geosynthetic membrane that mantels the native infiltration soils (approximate elevation 1585 msl), and the historic high groundwater elevation (approximate elevation 1583 msl), there is not sufficient vertical distance between the proposed infiltration invert elevation and historic high groundwater as required by Los Angeles County Department of Public Works (LACDPW), Administrative Manual GS 200.2, Guidelines for Geotechnical Investigation and Reporting, Low Impact Development (LID) Storm Water Infiltration," dated June 30,2017 (LACDPW, 2017).

Due to the potential for shallow historically high groundwater, infiltration of stormwater into the subsurface soils is not recommended at the subject site. It is our opinion that methods other than infiltration into subsurface soils at the subject site be considered for the disposal of collected storm water.

LIMITATIONS

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been prepared for Sand Canyon Country

Club and their design consultants, to be used solely for planning and design of the water quality detention basin and associated grading. The report has not been prepared for use by other parties and may not contain sufficient information for purposes of other parties or other uses.

-oOo-

We appreciate the opportunity to be of service. Please call if you have questions or would like to discuss this report in more detail.

The following are attached and complete this report.

- List of References
- Exhibit – Figure 1
- Geotechnical Map – Figure 2
- Appendix A – Test Pit Logs
- Appendix B – Groundwater Data

Respectfully submitted,

R. T. FRANKIAN & ASSOCIATES

Alan W. Rasplicka
Principal Geotechnical Engineer

SDR/AWR//jh

PDF Distribution via Email:
- Sand Canyon Country Club – Mr. Steve Kim
- Hunsaker & Associates – Mr. Paul Ortega, Ms. Wai Lan Lee

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

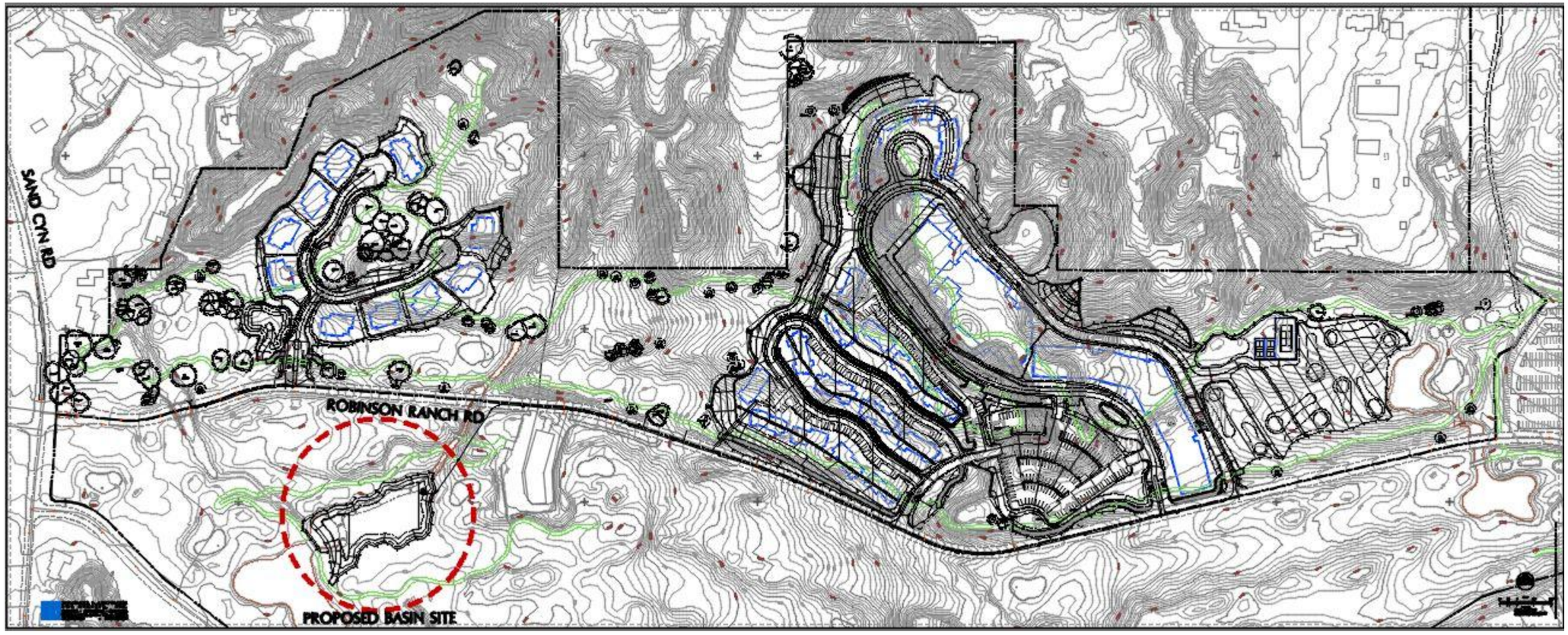
REFERENCES

California Division of Mines and Geology, 1998, "Seismic Hazard Zone Report for the Mint Canyon 7.5-minute Quadrangle, Los Angeles County, California," Seismic Hazard Zone Report 018.

Frankian, R. T., & Associates, 2018, "Geotechnical Plan Review, Vesting Tentative Tract Map No. 78248, Planning Area OF 1-8, Santa Clarita, California," for Sand Canyon Country Club, dated September 20, 2018, Job No. 2017-006-021

Los Angeles County Department of Public Works, Geotechnical and Materials Engineering Division, 2011, "Low Impact Development Best Management Practice Guideline for Design, Investigation, and Reporting," dated June 1, 2011, GS200.1.

Los Angeles County Department of Public Works, Geotechnical and Materials Engineering Division, 2014, "Guidelines for Design, Investigation, and Reporting Low Impact Development Stormwater Infiltration," dated December 31, 2014, GS200.1.



Provided by Hunsaker & Associates, Inc.

Exhibit
Water Quality Detention Basin

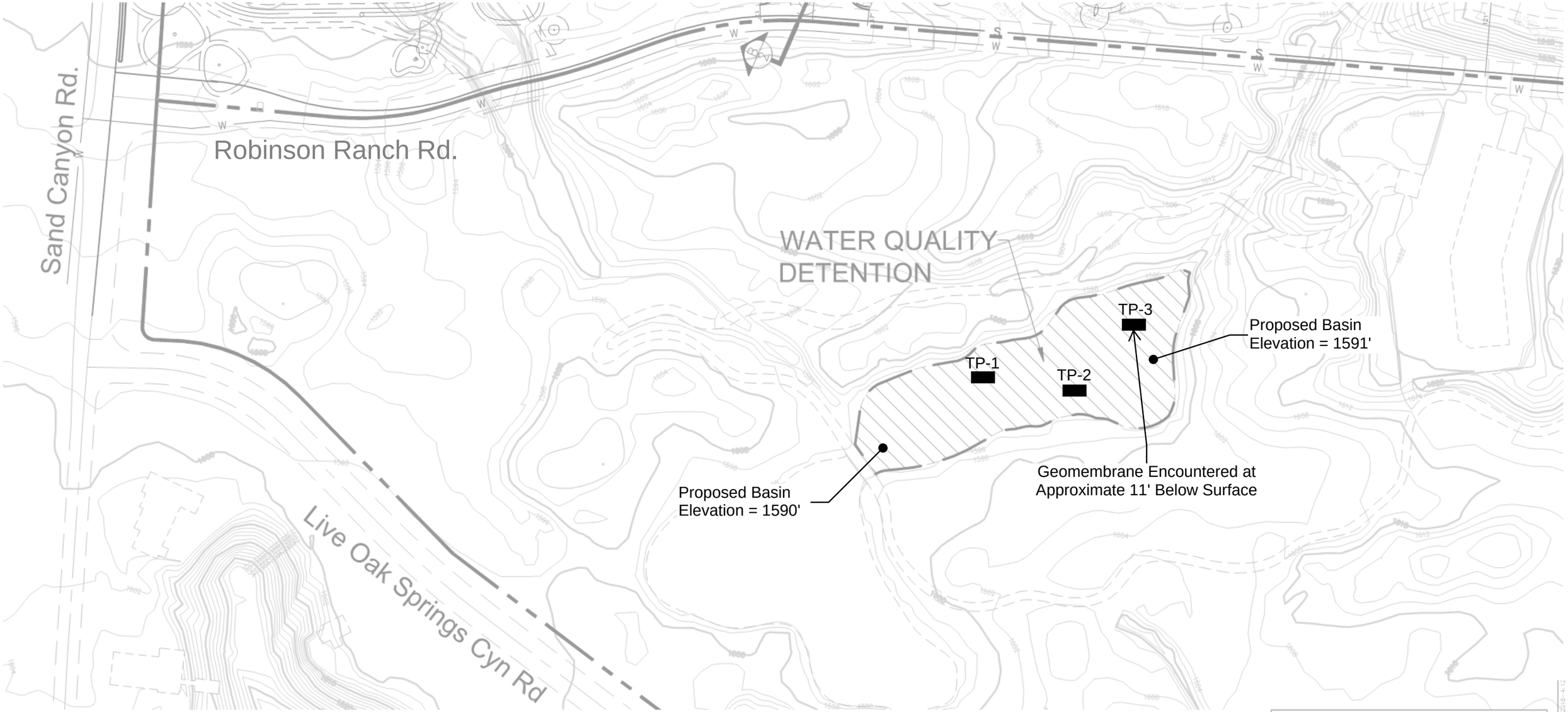
Prepared For:
Sand Canyon Country Club

Sand Canyon Country Club
27734 Sand Canyon Road
Santa Clarita, California

Scale:	Drawn By:	Checked By:
NTS	JH	SDR
Date: 5/14/2019	Figure 1	2017-006-052

R. T. FRANKIAN & ASSOCIATES
26027 Huntington Lane, Unit A
Santa Clarita, California 91355
(818) 531-1501
www.RTFrankian.com

RT&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY



GEOTECHNICAL MAP

Prepared For:

Sand Canyon Country Club

Sand Canyon Country Club
27734 Sand Canyon Road
Santa Clarita, California

Scale:	Drawn By:	Checked By:
NTS	JH	SDR
Date: 5/14/2019	Figure 2	2017-006-052

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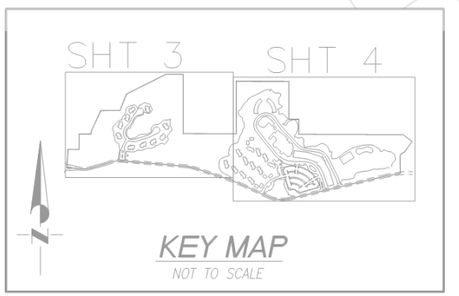
Santa Clarita, California 91355
(818) 531-1501
www.RTFrankian.com

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

SHEET INDEX

SHEET No.	DESCRIPTION
1	TITLE SHEET
2	DETAILS AND STREET / ROAD SECTIONS SECTIONS AND EASEMENT DESCRIPTIONS
3 AND 4	SAND CANYON RESORT



KEY MAP
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
JASON H. FUKUMITSU
No. 40695
CIVIL
STATE OF CALIFORNIA

PLANS PREPARED BY:

HUNSAKER & ASSOCIATES
LOS ANGELES, INC.
PLANNING ▪ ENGINEERING ▪ SURVEYING
26074 Avenue Hall, Ste 23 ▪ Valencia, CA 91355
PH: (661) 294-2211 ▪ FX: (661) 294-9890

JASON H. FUKUMITSU DATE

MAJOR LAND DIVISION
VESTING TENTATIVE TRACT MAP NO. 78248
TITLE SHEET

IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

SCALE: PER PLAN
DATE: 09/05/2018
JOB No. 0261-001-001

SHEET 1 OF 4 SHEETS

G:\Sand Canyon Resort\Tentative\HSC010-01_TTM Sand Cyn Resort.dwg Plotted on Sep 05, 2018-4:12

APPENDIX A

TEST PIT LOGS

LOG OF TEST PIT TP-1

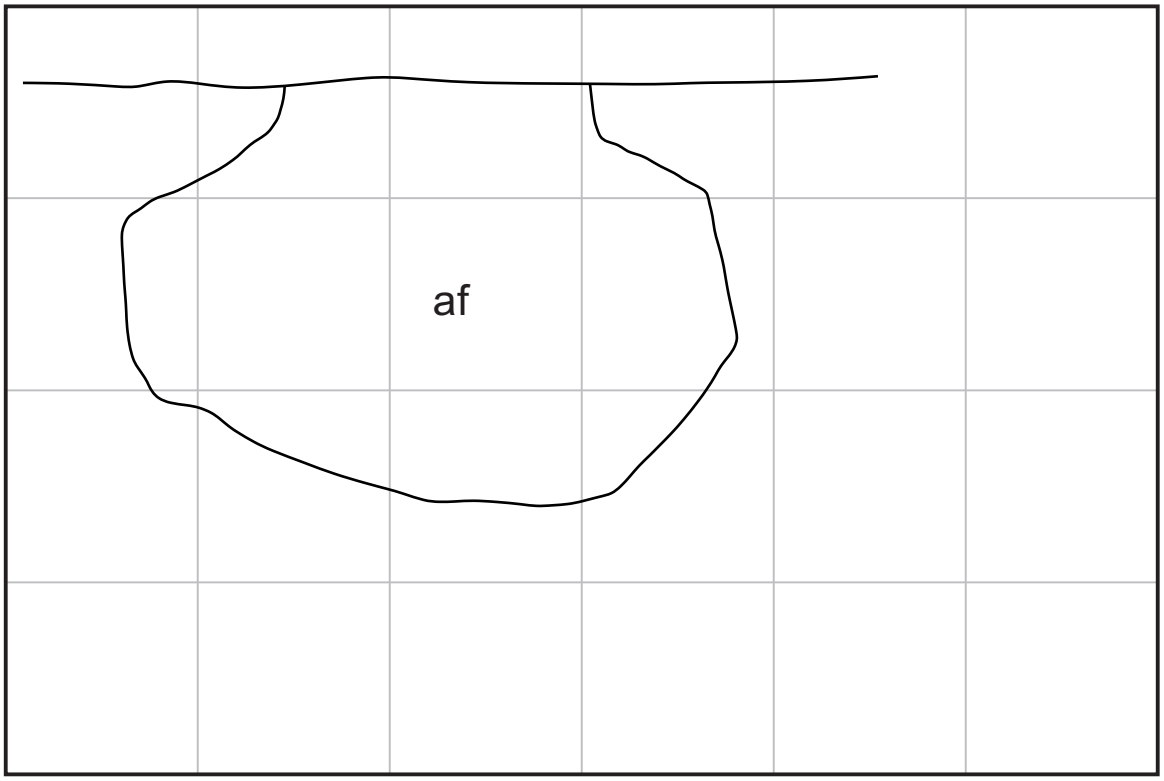
JOB NUMBER 2017-006-052 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION Water Quality Detention Basin **ELEVATION** 1596 **DATE LOGGED** 4/16/2019

0 - 11’ **ARTIFICIAL FILL (af)**
SILTY SAND TO CLAYEY SILTS(SM/ML)
Dark Brown to Light Gray, Very Fine to Medium, Very Soft,
Very Moist to Saturated, Heavy Caving Below 2’
(Sidewalls “Squeezing” into Excavation).

Test Pit Abandoned at 11’

BEARING:



SCALE: 1’’ = 5’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-2

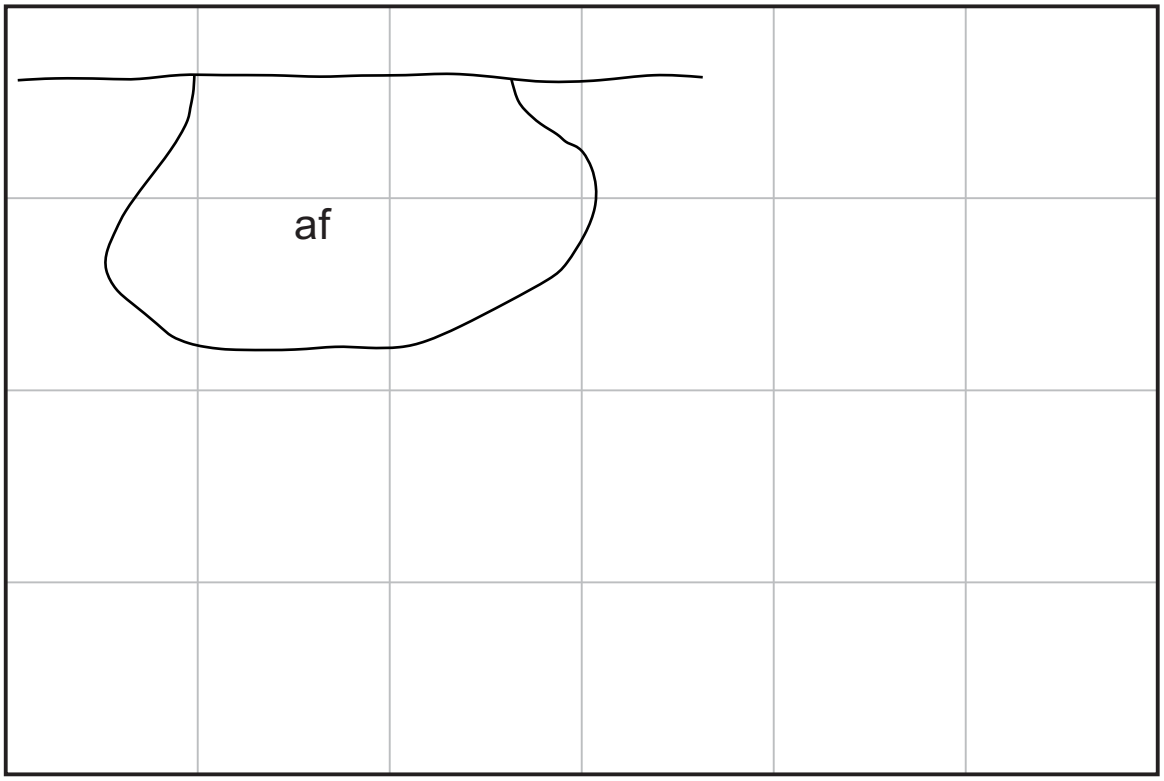
JOB NUMBER 2017-006-052 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION Water Quality Detention Basin **ELEVATION** 1595 **DATE LOGGED** 4/16/2019

0 - 7’ **ARTIFICIAL FILL (af)**
SILTY SAND TO CLAYEY SILTS(SM/ML)
Dark Brown to Light Gray, Very Fine to Medium, Very Soft,
Very Moist to Saturated, Heavy Caving Below 2’
(Sidewalls “Squeezing” into Excavation).

Test Pit Abandoned at 7’

BEARING:



SCALE: 1’’ = 5’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOG OF TEST PIT TP-3

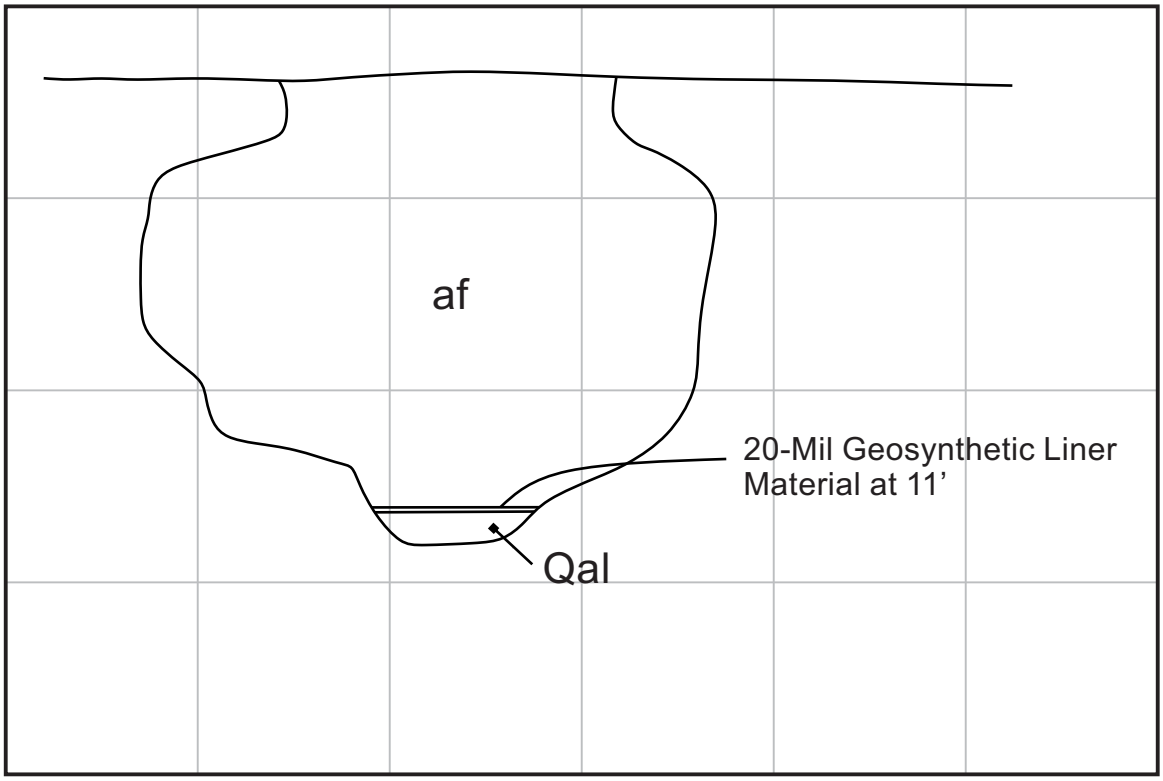
JOB NUMBER 2017-006-052 **CLIENT** Sand Canyon Country Club **LOGGED BY** SDR

LOCATION Water Quality Detention Basin **ELEVATION** 1596 **DATE LOGGED** 4/16/2019

0 - 11’ **ARTIFICIAL FILL (af)**
SILTY SAND TO CLAYEY SILTS(SM/ML)
Dark Brown to Light Gray, Very Fine to Medium, Very Soft,
Very Moist to Saturated, Heavy Caving Below 2’
(Sidewalls “Squeezing” into Excavation).

11’ - 13’ **ALLUVIUM (Qal)**
SILTY SAND (SM)
Light Brown, Very Fine to Fine, Moderately Dense, Moist

BEARING:



SCALE: 1’’ = 5’

NOTE:
THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC TEST PIT LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX B

GROUNDWATER DATA

Sand Canyon Country Club
May 14, 2019
2017-006-021

LOS ANGELES COUNTY WATER WELL DATA

Well Identification 7188A

(https://dpw.lacounty.gov/general/wells/#)

WELL ID	MEASURE DATE	RP TO WS	GS ELEV	RP ELEV	GS TO WS	WATER SURFACE ELEVATION
7188A	11/14/11	36.9	1587	1588		1551.1
7188A	05/26/11	44.8	1587	1588		1543.2
7188A	05/18/09		1587	1588		
7188A	05/21/08		1587	1588		
7188A	11/08/06		1587	1588		
7188A	05/16/06	18.3	1587	1588	17.3	1569.7
7188A	11/30/05	11.7	1587	1588	10.7	1576.3
7188A	05/18/04	62.9	1587	1588	61.9	1525.1
7188A	07/02/03		1587	1588		
7188A	12/02/02	76.9	1587	1588	75.9	1511.1
7188A	05/08/02	62.2	1587	1588	61.2	1525.8
7188A	11/13/01	60.2	1587	1588	59.2	1527.8
7188A	04/17/01	56.4	1587	1588	55.4	1531.6
7188A	11/27/00	58.9	1587	1588	57.9	1529.1
7188A	06/01/00	48.2	1587	1588	47.2	1539.8
7188A	11/29/99	37.8	1587	1588	36.8	1550.2
7188A	05/26/99	19.7	1587	1588	18.7	1568.3
7188A	11/17/98	8	1587	1588	7.0	1580
7188A	10/30/97	54	1587	1588	53.0	1534
7188A	05/19/97	47.2	1587	1588	46.2	1540.8
7188A	11/25/96	38.9	1587	1588	37.9	1549.1
7188A	05/22/96	24.8	1587	1588	23.8	1563.2
7188A	10/30/95	16.3	1587	1588	15.3	1571.7
7188A	05/23/95	21	1587	1588	20.0	1567
7188A	10/26/94	33.7	1587	1588	32.7	1554.3
7188A	04/11/94	15.9	1587	1588	14.9	1572.1
7188A	12/08/93	7.5	1587	1588	6.5	1580.5
7188A	05/04/93	8.2	1587	1588	7.2	1579.8
7188A	04/20/92	55.4	1587	1588	54.4	1532.6
7188A	11/13/91		1587	1588		
7188A	10/17/90		1587	1588		

Sand Canyon Country Club
May 14, 2019
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LOS ANGELES COUNTY WATER WELL DATA

Well Identification 7188A

(https://dpw.lacounty.gov/general/wells/#)

WELL ID	MEASURE DATE	RP TO WS	GS ELEV	RP ELEV	GS TO WS	WATER SURFACE ELEVATION
7188A	10/25/89	84.3	1587	1588	83.3	1503.7
7188A	05/10/89	73.1	1587	1588	72.1	1514.9
7188A	11/07/88		1587	1588		
7188A	04/27/88	89	1587	1588	88.0	1499
7188A	05/13/87	56	1587	1588	55.0	1532
7188A	04/15/86	63.5	1587	1588	62.5	1524.5
7188A	11/21/85	61	1587	1588	60.0	1527
7188A	05/07/85	45.9	1587	1588	44.9	1542.1
7188A	11/07/84	33.5	1587	1588	32.5	1554.5
7188A	04/18/84	16	1587	1588	15.0	1572
7188A	12/07/83	6.8	1587	1588	5.8	1581.2
7188A	04/15/83	34	1587	1588	33.0	1554
7188A	11/05/82	57.1	1587	1588	56.1	1530.9
7188A	05/05/82	48.2	1587	1588	47.2	1539.8
7188A	11/16/81	40.1	1587	1588	39.1	1547.9
7188A	04/13/81	20.8	1587	1588	19.8	1567.2
7188A	11/13/80	11.6	1587	1588	10.6	1576.4
7188A	05/27/80	11.2	1587	1588	10.2	1576.8
7188A	11/13/79	14.3	1587	1588	13.3	1573.7
7188A	04/23/79	8.8	1587	1588	7.8	1579.2
7188A	11/27/78	4.8	1587	1588	3.8	1583.2
7188A	04/21/78	44.5	1587	1588	43.5	1543.5
7188A	11/08/77	91.1	1587	1588	90.1	1496.9
7188A	04/15/77	85.9	1587	1588	84.9	1502.1
7188A	11/02/76	83.4	1587	1588	82.4	1504.6
7188A	04/09/76	70.5	1587	1588	69.5	1517.5
7188A	11/19/75	70.7	1587	1588	69.7	1517.3
7188A	04/21/75	54	1587	1588	53.0	1534
7188A	11/19/74	48	1587	1588	47.0	1540
7188A	04/04/74	45.1	1587	1588	44.1	1542.9

Sand Canyon Country Club
May 14, 2019
2017-006-021

HISTORICALLY HIGHEST GROUNDWATER CONTOURS
(CDMG, 1998)

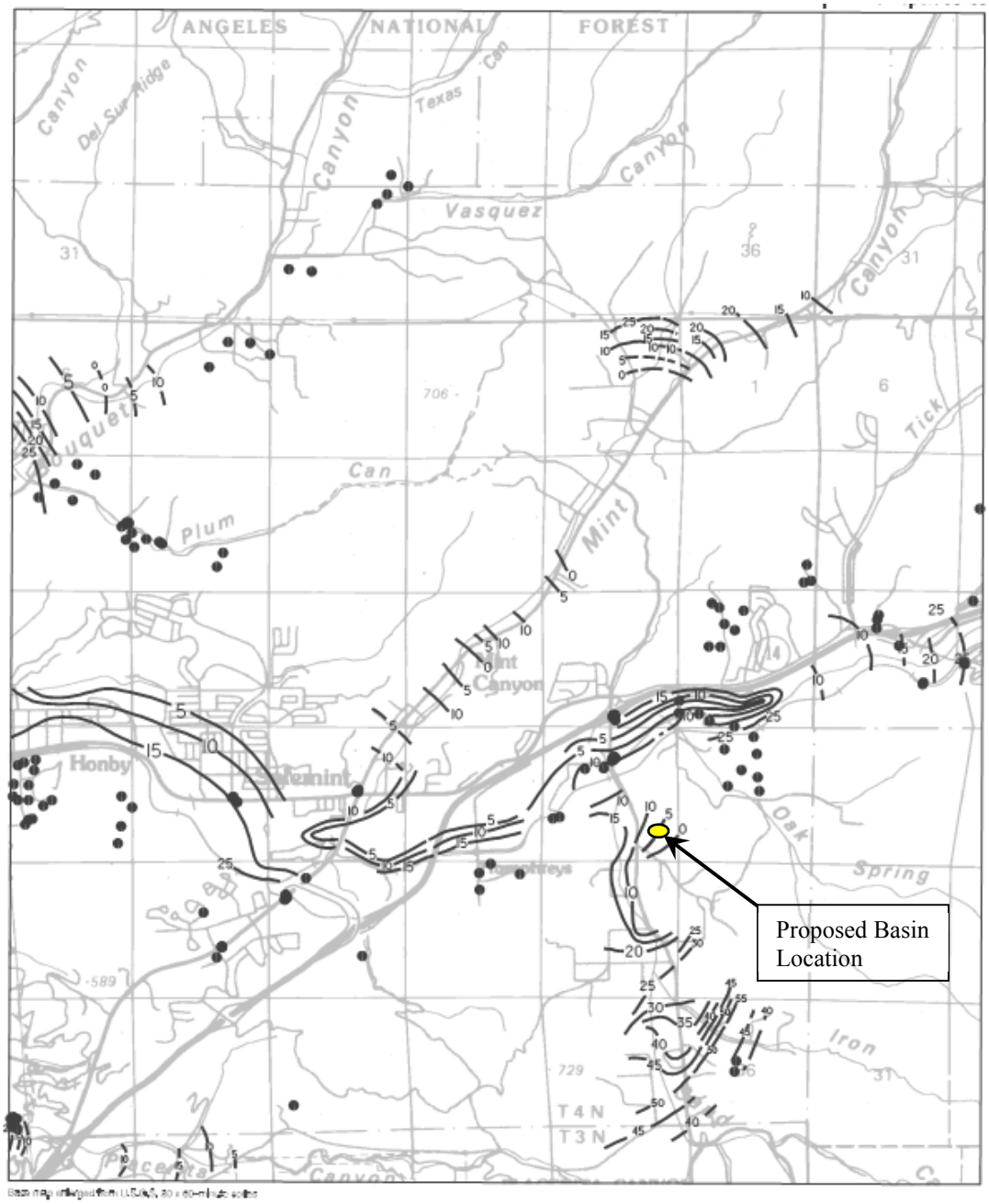

Plate T.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Mint Canyon Quadrangle.

● Borehole Site — 30 — Depth to ground water in feet

RTE&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY