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Drainage Concept/ Hydrology Study

Building Address: 347 Highland Place,
Monrovia, CA 91016

EGL JOB NO. 21-241-002
Date: 09/15/2023



Project Description

The project site is located north of Hillcrest Blvd at 347 Highland Avenue. Project site is composed of existing hillside and existing private road. Project site is approximately 6.64 acres of proposed development area and 1.16 AC of undeveloped area.

Existing Pre-Developed Drainage Conditions

Existing Condition: Project site currently receives Off site drainage from West (Off-Site Area 1), South (Off-Site Area 2) and North (Off-Site Area 3) of property. Project site Drainage pattern drains from northwest to southeast of project site towards existing private road. Private road drains to Highland Place via gravity (See attached Off-Site Hydrology Map).

HydroCalc has been used to analyze the hydrology.

Off-Site Area 1

AREA (ACRES)	IMP. (%)	FREQUENCY	SOIL TYPE	LENGTH	SLOPE	Isohyet
13.38	0.01	50	15	960'	0.365	8.5

Q (Peak Flow Rate) = 34.87 cfs

Off-Site Area 2

AREA (ACRES)	IMP. (%)	FREQUENCY	SOIL TYPE	LENGTH	SLOPE	Isohyet
1.50	0.17	50	15	755'	0.228	8.5

Q (Peak Flow Rate) = 4.87 cfs

Off-Site Area 3

AREA (ACRES)	IMP. (%)	FREQUENCY	SOIL TYPE	LENGTH	SLOPE	Isohyet
0.22	0.01	50	15	226'	0.372	8.5

Q (Peak Flow Rate) = 0.66 cfs

Total Off-Site Peak Q = Area 1+ Area 2+ Area3= 34.87 + 4.87 + 0.66 = 40.40 cfs

continues the existing drainage pattern into the Project Site.

Project Site

Pre-Development

AREA (ACRES)	IMP. (%)	FREQUENCY	SOIL TYPE	LENGTH	SLOPE	Isohyet
6.64	0.03	50	15	1334'	0.264	8.5

Q (Peak Flow Rate) = 14.12 cfs (See attached Project Site Hydrology Map Pre-Development)

Total Off-Site Peak Q + Project site Q= 40.40 cfs + 14.12 cfs = 54.52 cfs

continues the existing drainage pattern towards Highland Place.

Proposed Developed Drainage Conditions

Project will create 4 Lots, Lot 1 will contain proposed detention basin, Lots 2-4 will consists of 3 new Single Family Houses and private driveway Total 6.64 AC. Drainage pattern at post development will be similar to the existing. Project will accept drainage from Off-Site Areas 1-3 and maintain existing drainage pattern from northwest to southeast of project site towards proposed private driveway. Drainage will then be collected via curb drains/ catch basins and directed into underground storm drain. Storm Drain will tie into existing storm drain located on Highland Place.

Post Development

AREA (ACRES)	IMP. (%)	FREQUENCY	SOIL TYPE	LENGTH	SLOPE	Isohyet
6.64	0.15	50	15	1334'	0.264	8.5

Q (Peak Flow Rate) = 15.38 cfs

$\Delta Q = 14.12 - 15.38 = 1.26$ cfs, of runoff will be increased at post development.

Total Off-Site and Post Development Peak Q = 40.40 cfs + 15.38 cfs = **55.78 cfs**

Conceptual Mitigation Measures

Sub-Area 1

Off-Site Area 1 will enter site at west end of project site into Sub-Area 1. Sub-Area 1 will remain undisturbed and will continue the existing drainage course down to proposed Basin. Interception of offsite area 1 and Sub-Area 1 will be mitigated via basin and CMP Riser (Basin to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 1 = 2.69 acres

$Q = 15.38 \times (2.69/6.64) = 6.23$ cfs

Off-Site Area 1 Q (Peak Flow Rate) = 34.87 cfs

Sub-Area 1 + Off-Site Area 1 = 6.23 + 34.87 = 41.10 cfs

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 2

Off-Site Area 2 will enter site at south end of project site into Sub-Area 2. Sub-Area 2 will remain undisturbed and will continue the existing drainage course down to proposed concrete swale. Interception of offsite area 2 and Sub-Area 2 will be mitigated via concrete swale and catch basin (Concrete Swale and Catch basin to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 2 = 0.62 acres

$Q = 15.38 \times (0.62/6.64) = 1.44$ cfs

Off-Site Area 2 Q (Peak Flow Rate) = 4.87 cfs

Sub-Area 2 + Off-Site Area 2 = 1.44 + 4.87 = 6.31 cfs

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 3

Off-Site Area 3 will enter site at south end of project site into Sub-Area 3. Sub-Area 3 will remain undisturbed and will continue the existing drainage course down to proposed concrete swale. Interception of offsite area 3 and Sub-Area 3 will be mitigated via concrete swale and catch basin (Concrete Swale and Catch basin to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 3= 0.12 acres

$Q = 15.38 \times (0.12/6.64) = 0.28 \text{ cfs}$

Off-Site Area 3 Q (Peak Flow Rate) = 0.66 cfs

Sub-Area 3+ Off-Site Area 3 = $0.28 + 0.66 = 0.94 \text{ cfs}$

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 4

Sub-Area 4 will remain undisturbed and will continue the existing drainage course down to proposed concrete swale. Interception of Sub-Area 4 will be mitigated via concrete swale and catch basin (Concrete Swale and Catch basin to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 4= 2.08 acres

$Q = 15.38 \times (2.08/6.64) = 4.82 \text{ cfs}$

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 5

Sub-Area 5 will remain undisturbed and will continue the existing drainage course down to proposed concrete swale. Interception of Sub-Area 5 will be mitigated via concrete swale and catch basin (Concrete Swale and Catch basin to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 5= 0.11 acres

$Q = 15.38 \times (0.11/6.64) = 0.25 \text{ cfs}$

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 6

Sub-Area 6 will be developed and create impervious surface which will drain to proposed private driveway. Interception of Sub-Area 6 will be mitigated via curb opening catch basin and Filterra System (Filterra System to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 6= 0.51 acres

$Q = 15.38 \times (0.51/6.64) = 1.18 \text{ cfs}$

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 7

Sub-Area 7 will be developed and will drain to proposed private driveway. Interception of Sub-Area 7 will be mitigated via curb opening catch basin and Filterra System (Filterra System to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 7= 0.26 acres

$Q = 15.38 \times (0.26/6.64) = 0.60 \text{ cfs}$

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 8

Sub-Area 8 will be developed and will drain to proposed private driveway. Interception of Sub-Area 8 will be mitigated via curb opening catch basin and Filterra System (Filterra System to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 8= 0.12 acres

$Q = 15.38 \times (0.12/6.64) = 0.28 \text{ cfs}$

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

Sub-Area 9

Sub-Area 9 will be developed and will drain to proposed private driveway. Interception of Sub-Area 9 will be mitigated via curb opening catch basin and Filterra System (Filterra System to be designed in future Grading Plan). See attached Developed Sub Areas Map.

Sub-Area 9= 0.09 acres

$Q = 15.38 \times (0.09/6.64) = 0.21 \text{ cfs}$

Drainage will then enter Storm Drain system per Separate Storm Drain Plan

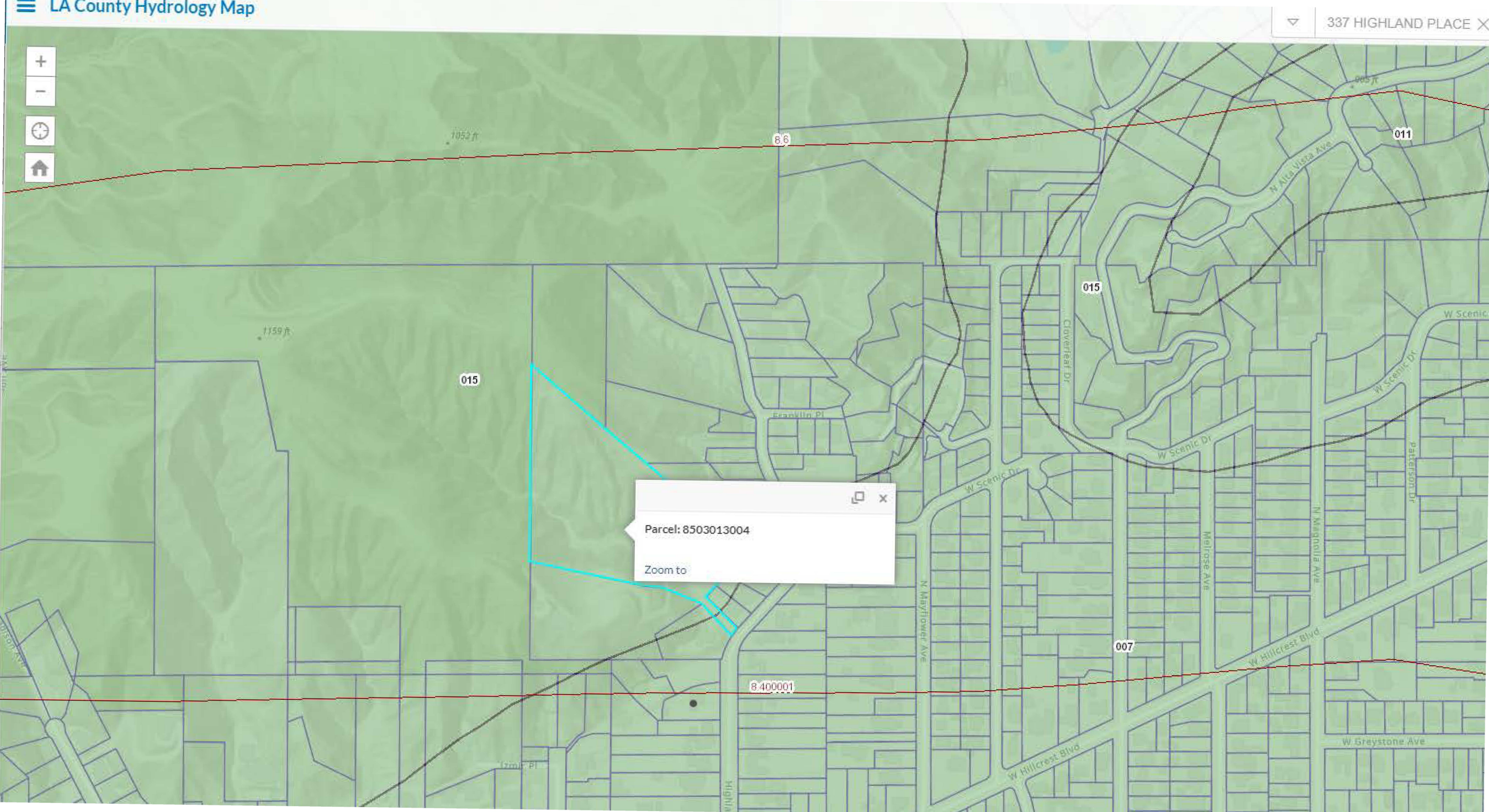
Sub-Area 10

Sub-Area 10 will be developed and will drain to proposed private driveway. Interception of Sub-Area 10 will maintain the existing drainage pattern towards Highland Place. See attached Developed Sub Areas Map.

Sub-Area 10= 0.04 acres

$Q = 15.38 \times (0.04/6.64) = 0.09 \text{ cfs}$

Drainage will then enter Highland Place via Gravity flow.

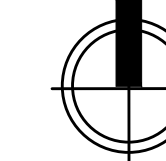


Parcel: 8503013004

Zoom to

OFF-SITE HYDROLOGY MAP

NORTH



SCALE: 1"=70'-0"

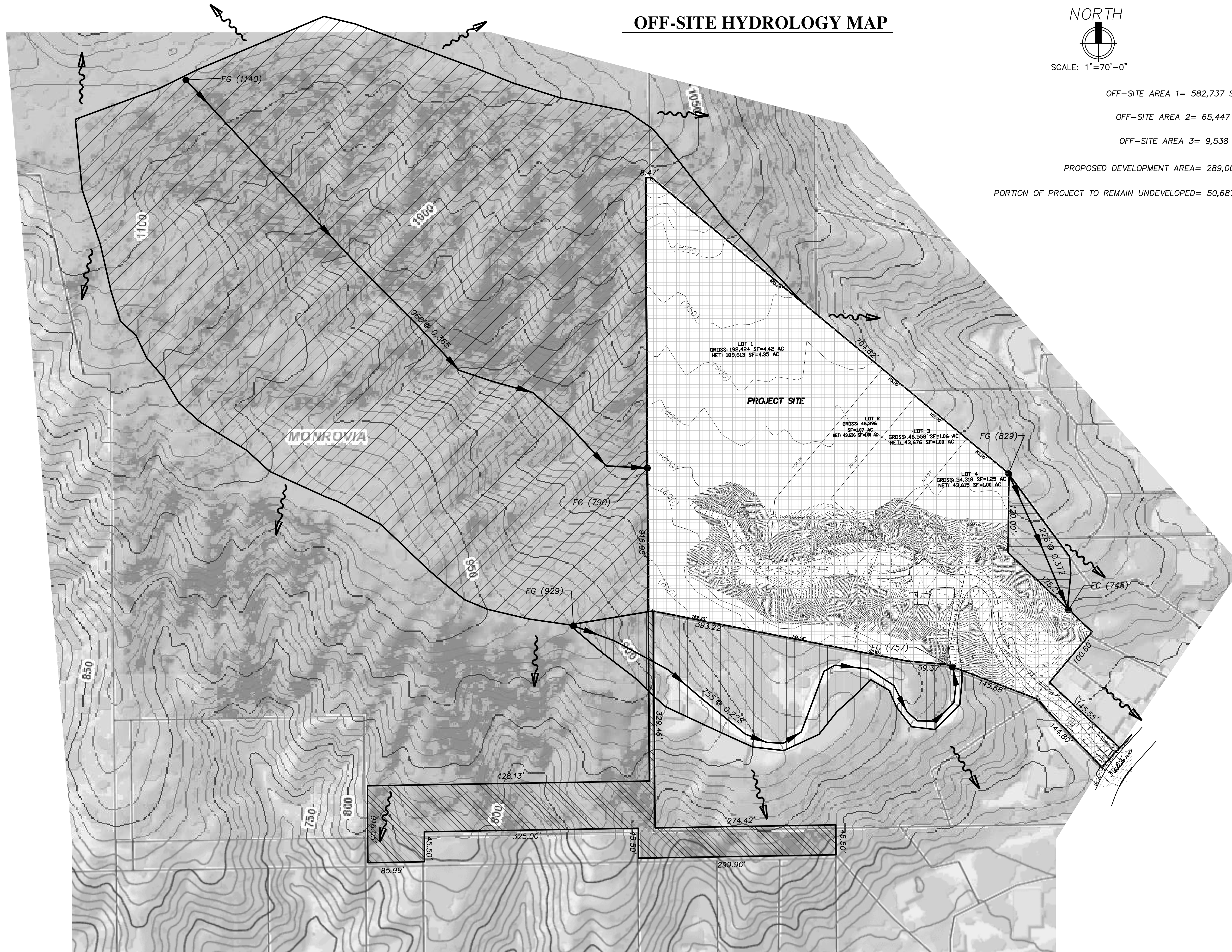
OFF-SITE AREA 1= 582,737 SF= 13.38 AC

OFF-SITE AREA 2= 65,447 SF= 1.50 AC

OFF-SITE AREA 3= 9,538 SF= 0.22 AC

PROPOSED DEVELOPMENT AREA= 289,009 SF= 6.64 AC 

PORTION OF PROJECT TO REMAIN UNDEVELOPED= 50,687 SF= 1.16 AC 



Peak Flow Hydrologic Analysis

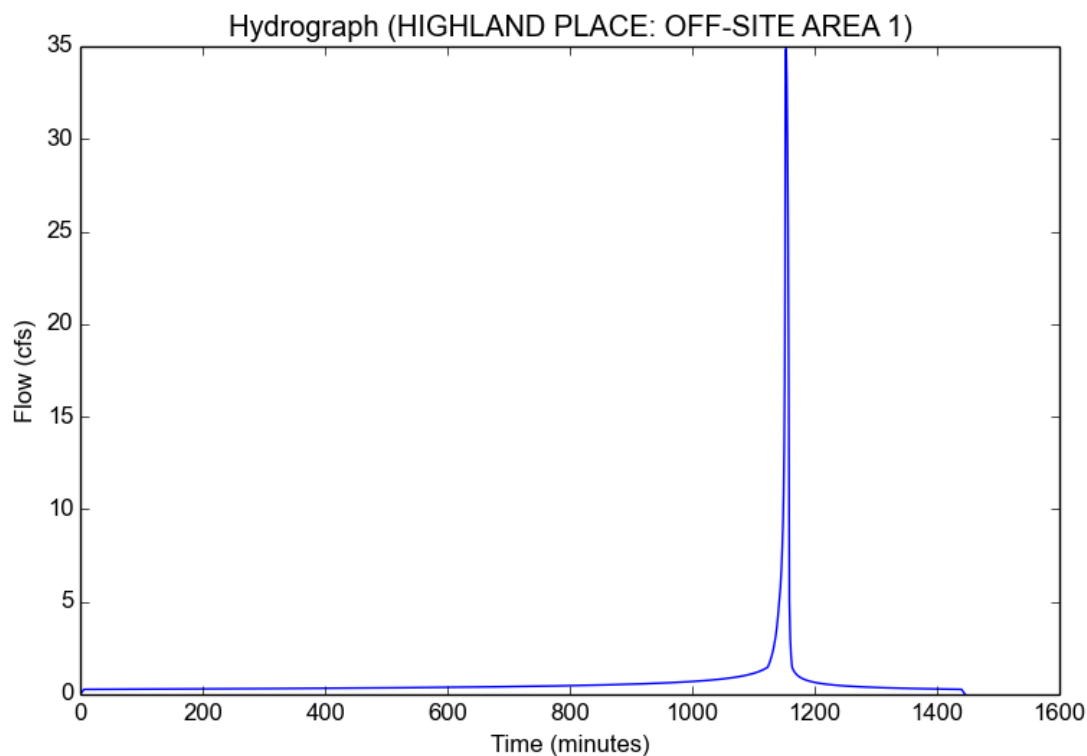
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	HIGHLAND PLACE
Subarea ID	OFF-SITE AREA 1
Area (ac)	13.38
Flow Path Length (ft)	960.0
Flow Path Slope (vft/hft)	0.365
50-yr Rainfall Depth (in)	8.5
Percent Impervious	0.01
Soil Type	15
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	8.5
Peak Intensity (in/hr)	4.6549
Undeveloped Runoff Coefficient (Cu)	0.5564
Developed Runoff Coefficient (Cd)	0.5599
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	34.8703
Burned Peak Flow Rate (cfs)	34.8703
24-Hr Clear Runoff Volume (ac-ft)	1.3261
24-Hr Clear Runoff Volume (cu-ft)	57765.5453



Peak Flow Hydrologic Analysis

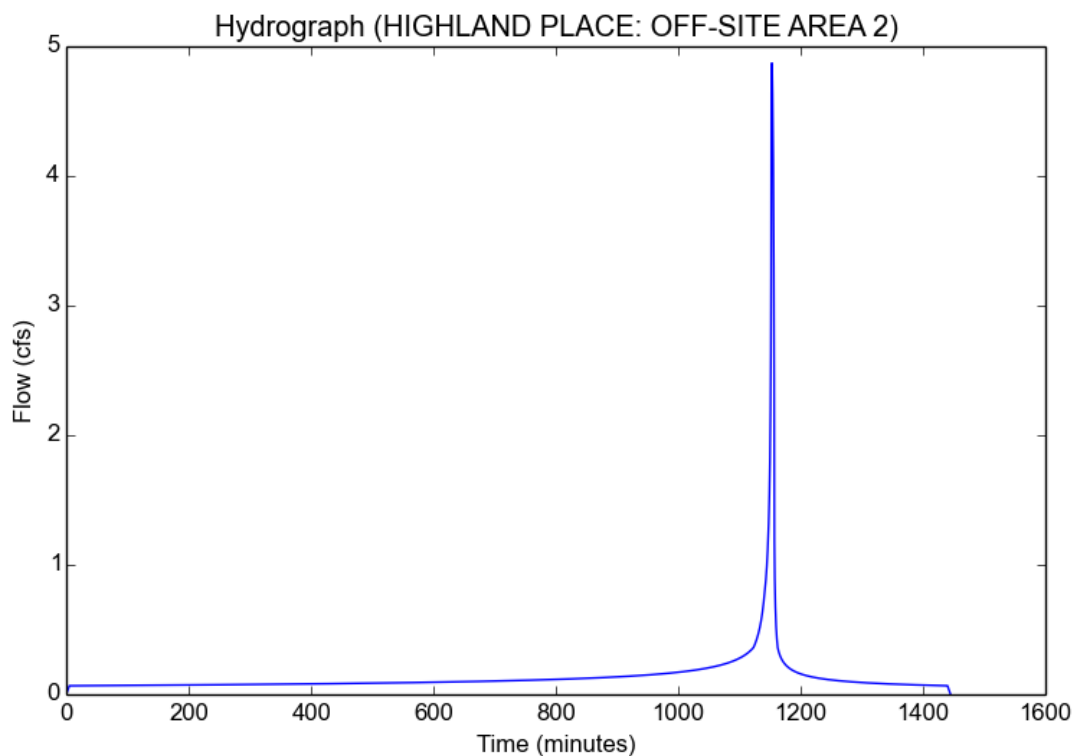
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	HIGHLAND PLACE
Subarea ID	OFF-SITE AREA 2
Area (ac)	1.5
Flow Path Length (ft)	755.0
Flow Path Slope (vft/hft)	0.228
50-yr Rainfall Depth (in)	8.5
Percent Impervious	0.17
Soil Type	15
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	8.5
Peak Intensity (in/hr)	5.0713
Undeveloped Runoff Coefficient (Cu)	0.5871
Developed Runoff Coefficient (Cd)	0.6403
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	4.8709
Burned Peak Flow Rate (cfs)	4.8709
24-Hr Clear Runoff Volume (ac-ft)	0.2785
24-Hr Clear Runoff Volume (cu-ft)	12130.9643



Peak Flow Hydrologic Analysis

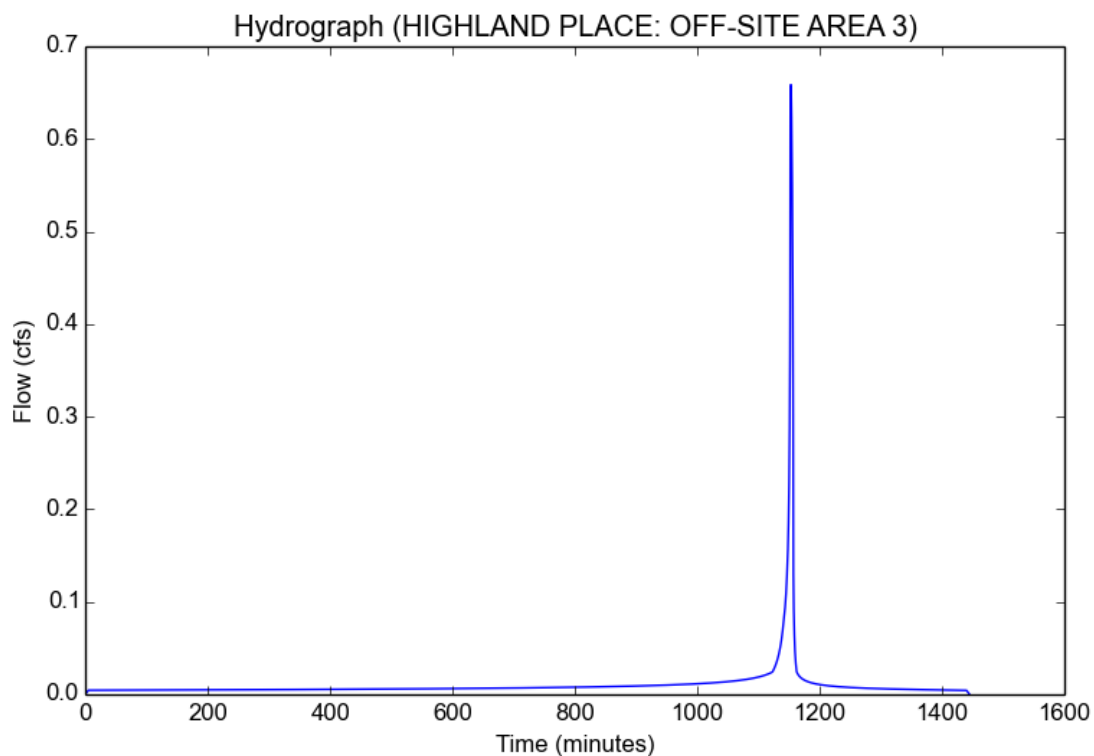
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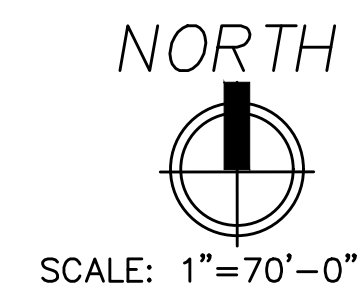
Project Name	HIGHLAND PLACE
Subarea ID	OFF-SITE AREA 3
Area (ac)	0.22
Flow Path Length (ft)	226.0
Flow Path Slope (vft/hft)	0.372
50-yr Rainfall Depth (in)	8.5
Percent Impervious	0.01
Soil Type	15
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	8.5
Peak Intensity (in/hr)	5.0713
Undeveloped Runoff Coefficient (Cu)	0.5871
Developed Runoff Coefficient (Cd)	0.5903
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.6585
Burned Peak Flow Rate (cfs)	0.6585
24-Hr Clear Runoff Volume (ac-ft)	0.0219
24-Hr Clear Runoff Volume (cu-ft)	954.2262



PROJECT SITE HYDROLOGY MAP
PRE-DEVELOPMENT

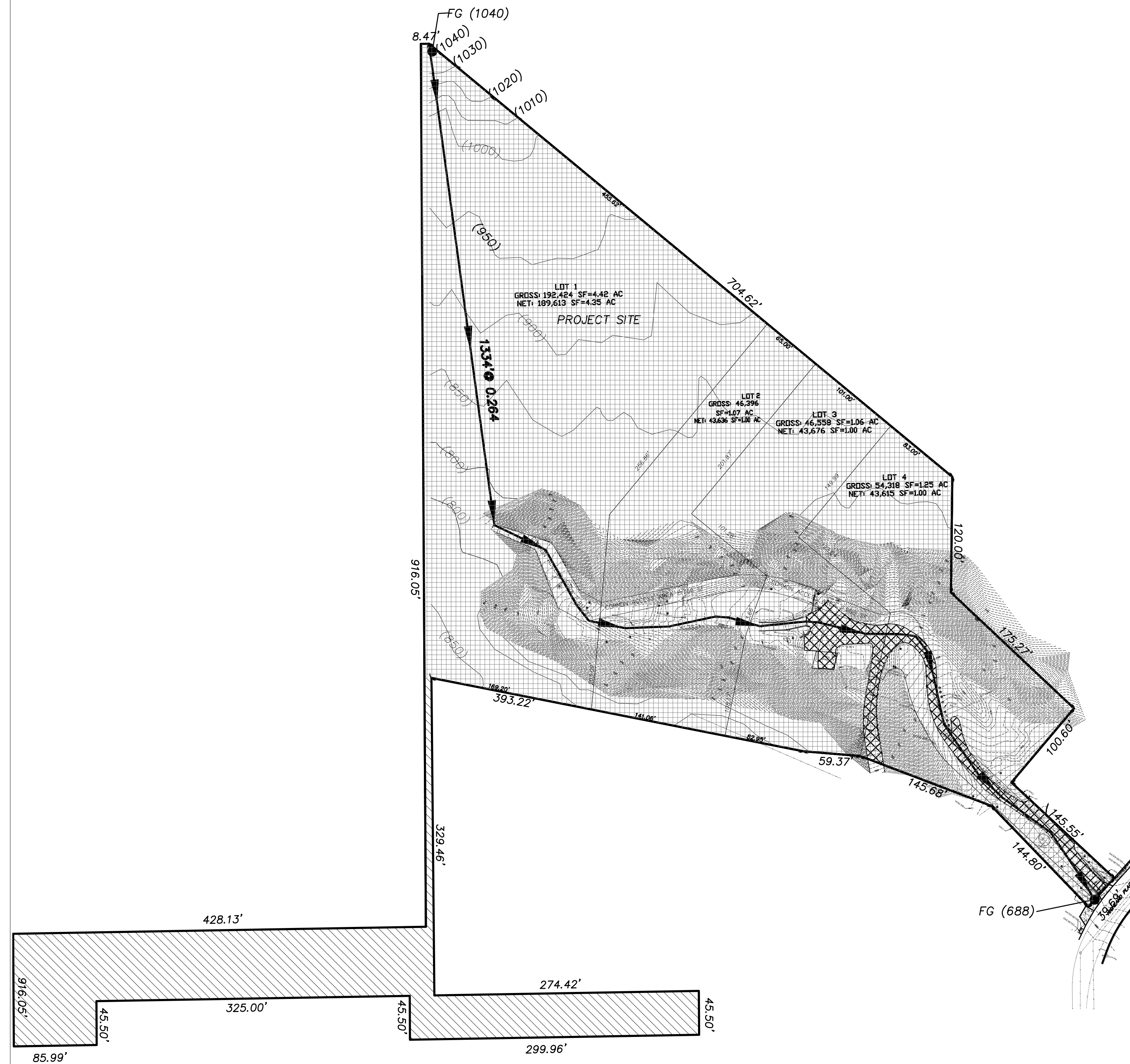


PROPOSED DEVELOPMENT AREA= 289,009 SF= 6.64 AC

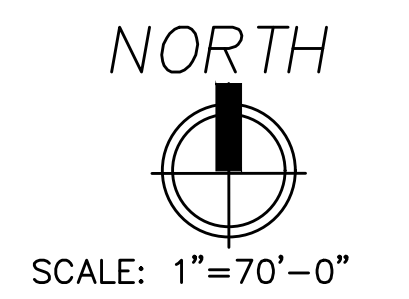
PORTION OF PROJECT TO REMAIN UNDEVELOPED= 50,687 SF= 1.16 AC

TOTAL IMPERVIOUS AREA=0.22 AC

IMPERVIOUS RATIO= $0.22/6.64 = 0.03$



PROJECT SITE HYDROLOGY MAP
POST-DEVELOPMENT

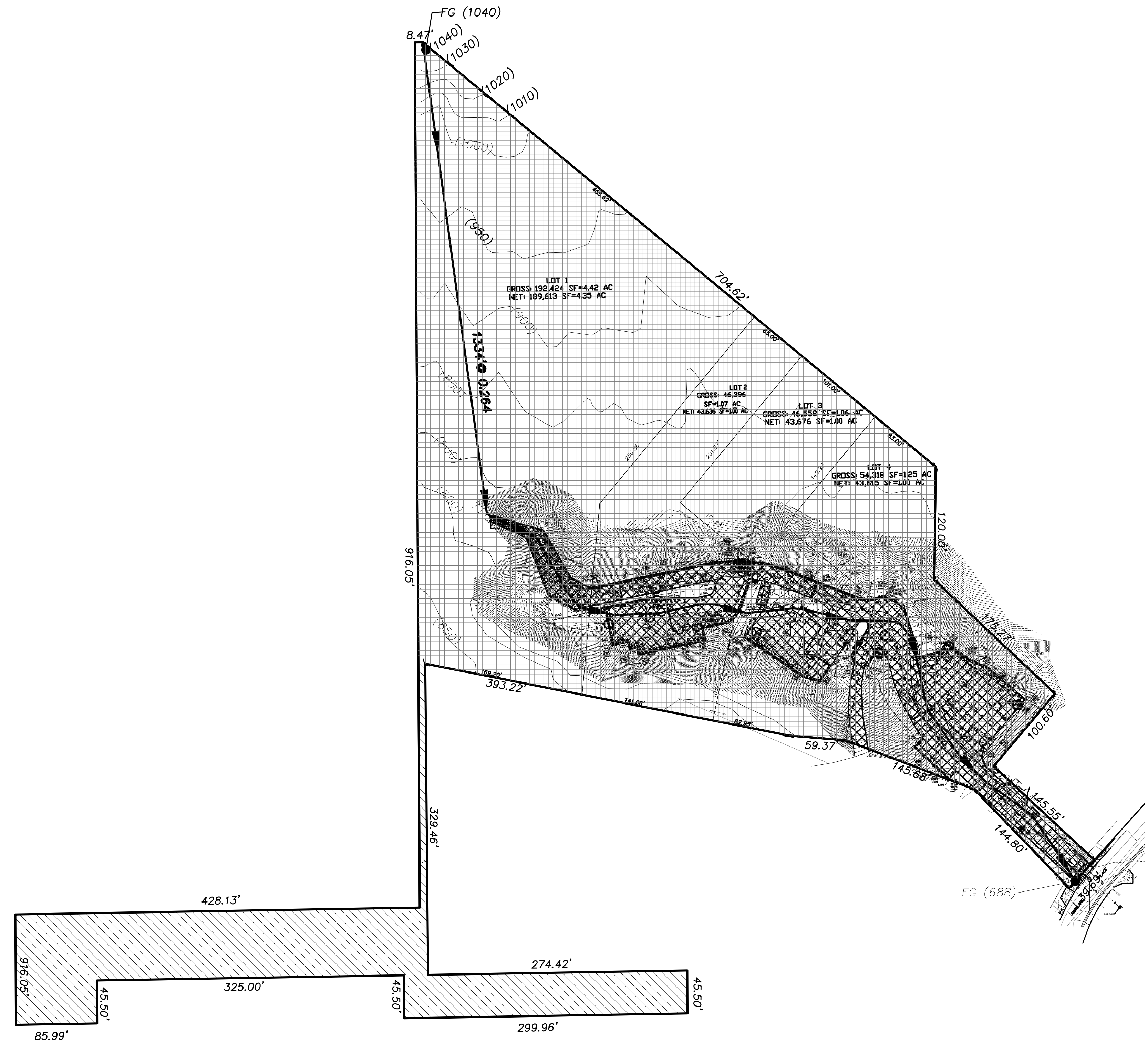


PROPOSED DEVELOPMENT AREA= 289,009 SF= 6.64 AC

PORTION OF PROJECT TO REMAIN UNDEVELOPED= 50,687 SF= 1.16 AC

TOTAL IMPERVIOUS AREA=0.97 AC

IMPERVIOUS RATIO= $0.97/6.64 = 0.15$



Peak Flow Hydrologic Analysis

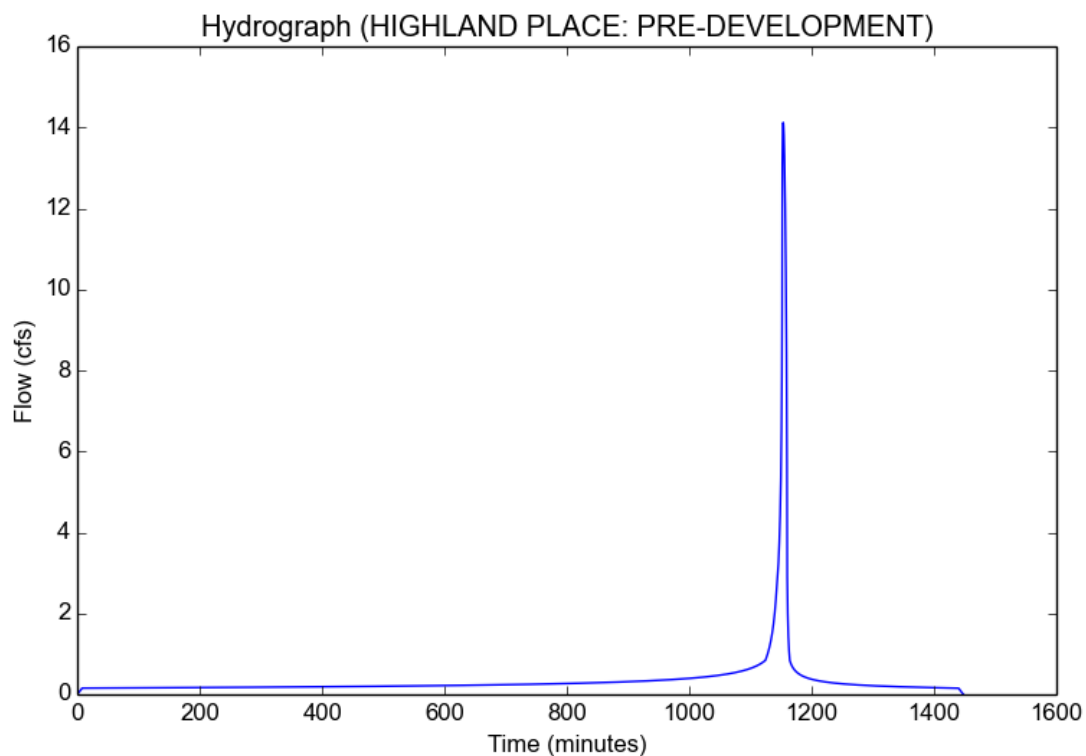
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	HIGHLAND PLACE
Subarea ID	PRE-DEVELOPMENT
Area (ac)	6.64
Flow Path Length (ft)	1334.0
Flow Path Slope (vft/hft)	0.264
50-yr Rainfall Depth (in)	8.5
Percent Impervious	0.03
Soil Type	15
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	8.5
Peak Intensity (in/hr)	4.0662
Undeveloped Runoff Coefficient (Cu)	0.5113
Developed Runoff Coefficient (Cd)	0.523
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	14.1205
Burned Peak Flow Rate (cfs)	14.1205
24-Hr Clear Runoff Volume (ac-ft)	0.7246
24-Hr Clear Runoff Volume (cu-ft)	31562.6387



Peak Flow Hydrologic Analysis

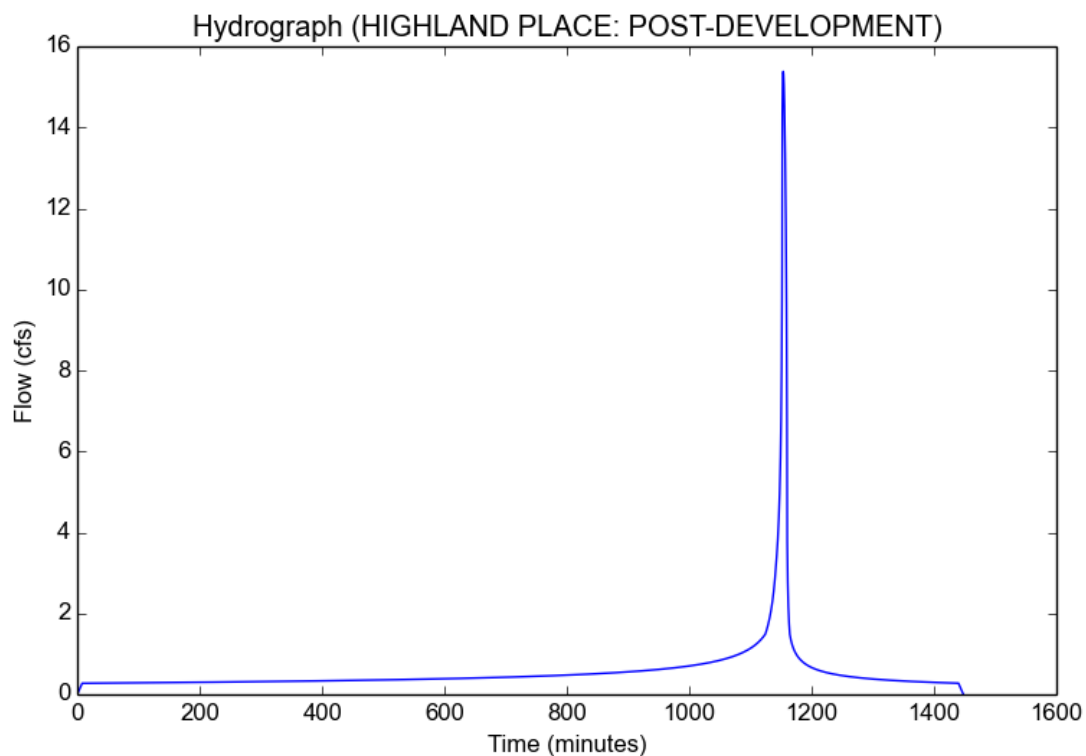
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	HIGHLAND PLACE
Subarea ID	POST-DEVELOPMENT
Area (ac)	6.64
Flow Path Length (ft)	1334.0
Flow Path Slope (vft/hft)	0.264
50-yr Rainfall Depth (in)	8.5
Percent Impervious	0.15
Soil Type	15
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

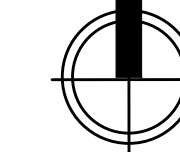
Output Results

Modeled (50-yr) Rainfall Depth (in)	8.5
Peak Intensity (in/hr)	4.0662
Undeveloped Runoff Coefficient (Cu)	0.5113
Developed Runoff Coefficient (Cd)	0.5696
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	15.3797
Burned Peak Flow Rate (cfs)	15.3797
24-Hr Clear Runoff Volume (ac-ft)	1.1543
24-Hr Clear Runoff Volume (cu-ft)	50280.549



DEVELOPED SUB AREAS

NORTH



SCALE: 1"=70'-0"

OFF-SITE AREA 1= 582,737 SF= 13.38 AC

OFF-SITE AREA 2= 65,447 SF= 1.50 AC

OFF-SITE AREA 3= 9,538 SF= 0.22 AC

PROPOSED DEVELOPMENT AREA= 289,009 SF= 6.64 AC

PORTION OF PROJECT TO REMAIN UNDEVELOPED= 50,687 SF= 1.16 AC

