Appendix K

Hydrology Report

Drainage Report

Hydrologic & Hydraulic Analysis

Rockaway Quarry Reclamation

06/14/2019

Prepared For:

Baylands Soils

Prepared By:

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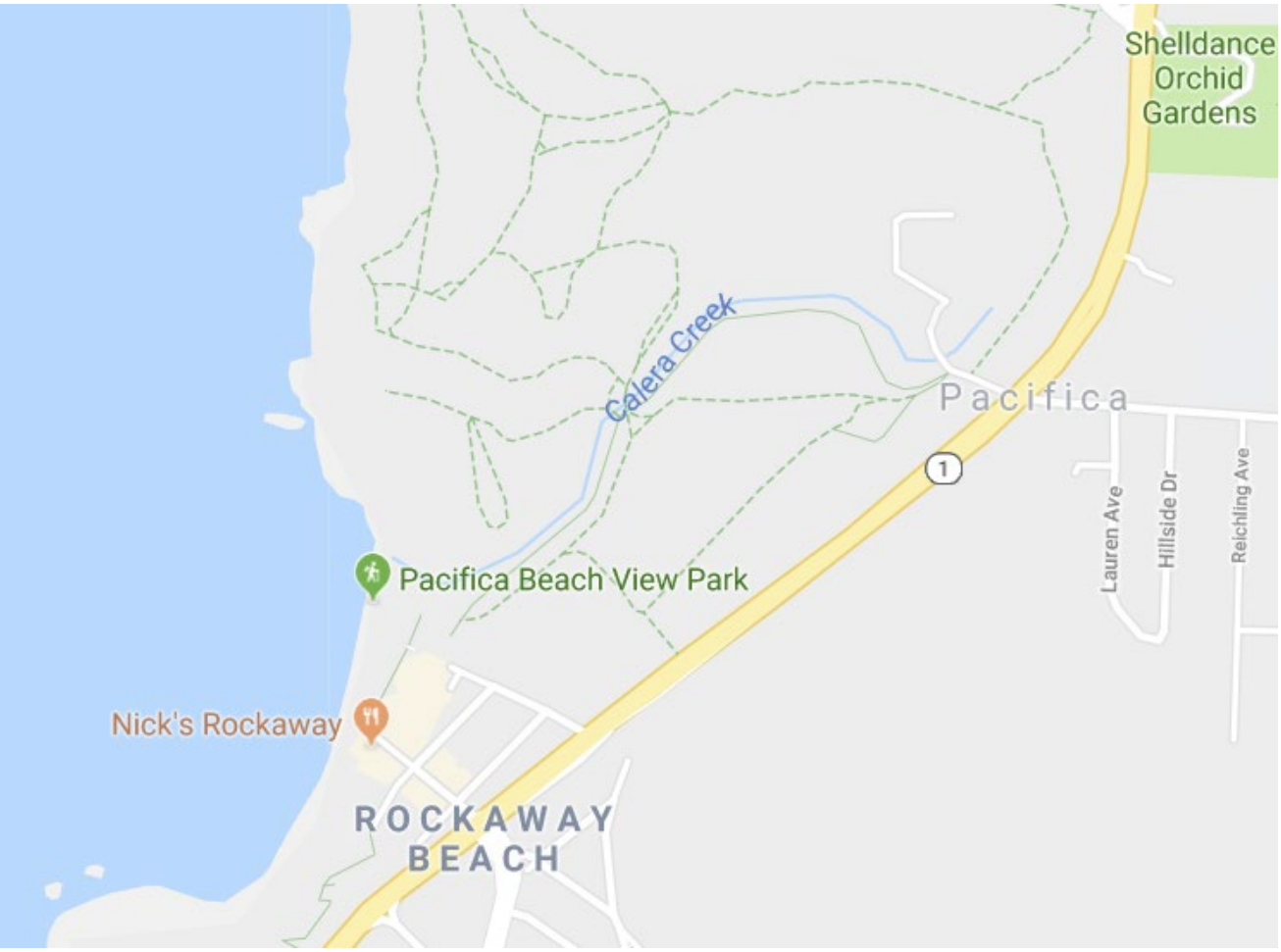
1. Introduction and Background

The project site is located at along Highway 1 on Assessor's Parcel Number 018-150-110, 018-150-120 and 018-150-150 in the County of San Mateo, CA. The project will consist of reclaiming the existing quarry land and returning the land to its natural state.

This report will investigate the project compliance with requirements set forth in the City of Pacifica. This will be done by implementing stormwater control measures set forth, while also best utilizing the project site and existing conditions.

2. Location Map and Description

The project site is comprised of 3 parcels with a total area of approximately 86.1 acres. The project is located directly adjacent to California Highway 1, with the Calera Creek bisecting the two halves of the project.



3. Watershed Description and Delineation

The pre- and post-development hydrologic conditions can be found in Appendix A-Drainage Management Area (DMA) Exhibit. The DMA Exhibit shows, graphically and numerically, the area considered for the drainage calculations. The directions of flow and watersheds can be seen in the exhibit.

The site conditions include a relatively hilly topography on the West Quarry Parcel (DMA 1) with gentle slopes on the East Quarry Parcel (DMA 2). Soils onsite are categorized as Hydraulic Soil Group C per the USDA Web Soil Survey (see Appendix B). The existing surface cover of DMA 1 is a mix of vegetated cover and exposed rock surfaces due to the previous mining operations. DMA 2 almost completely covered in native vegetation. Historically, half of DMA 1's drainage travels via overland flow where it eventually discharges into a depression located at the southwest end of the parcel. From here, the drainage is then transported to Calera Creek via a 24" CMP culvert located onsite. The other half directly discharges directly into Calera Creek and the Pacific Ocean, traveling via overland flow. Most of DMA 2's drainage travels via overland flow where it ultimately discharges at the easternmost portion of the site containing four existing PVC culverts.

4. Hydrologic & Hydraulic Analysis

Per the City of Pacifica requirements, the proposed and existing drainage facilities have been designed to safely convey the 100-Year, 24-Hour storm event. The effect on existing Hydrologic and Hydraulic calculations were performed utilizing AutoDesk's Civil 3D Storm and Sanitary Analysis 2014 Program (SSA). This program performs calculations based on the Hydrograph Analysis Method of the National Resources Conservation Service (NRCS TR-55 Method) with Pond Routing Method for Storage-indication based on site conditions. Results of the analysis and calculations can be seen Appendix B.

The Rainfall Distribution modeled in the calculations is an SCS Type I storm event contained in SSA. The storm event modeled is the 100-year 24-hour event with a total rainfall amounting to 6.7 inches. Only the 100-year event was modeled, as this would drive the basis for the flood control analysis.

The Time of Concentration was calculated utilizing SSA's built-in Time of Concentration calculator. Results and equations can be found in Attachment A. The Time Increment for the analysis was taken at a minimum of 0.10 hour increments.

The model was designed to compare the pre- and post-development flow rates at critical drainage points (see Appendix A). Once the model was run, the impact on the existing system was assessed. Mitigation measures and proposed storm drains were adjusted to meet the requirements set forth.

5. Conclusions

Overall, the peak flow rates were not significantly increased as a result of the proposed development (see summary of peak flow rates at critical points in Appendix A). This means that the existing drainages facilities will not be adversely impacted. Overall peak from the DMA 1 was reduced from 70.8 cfs to 60.0 cfs. This is due to the fact that the slopes were significantly softened, the existing exposed rock face will

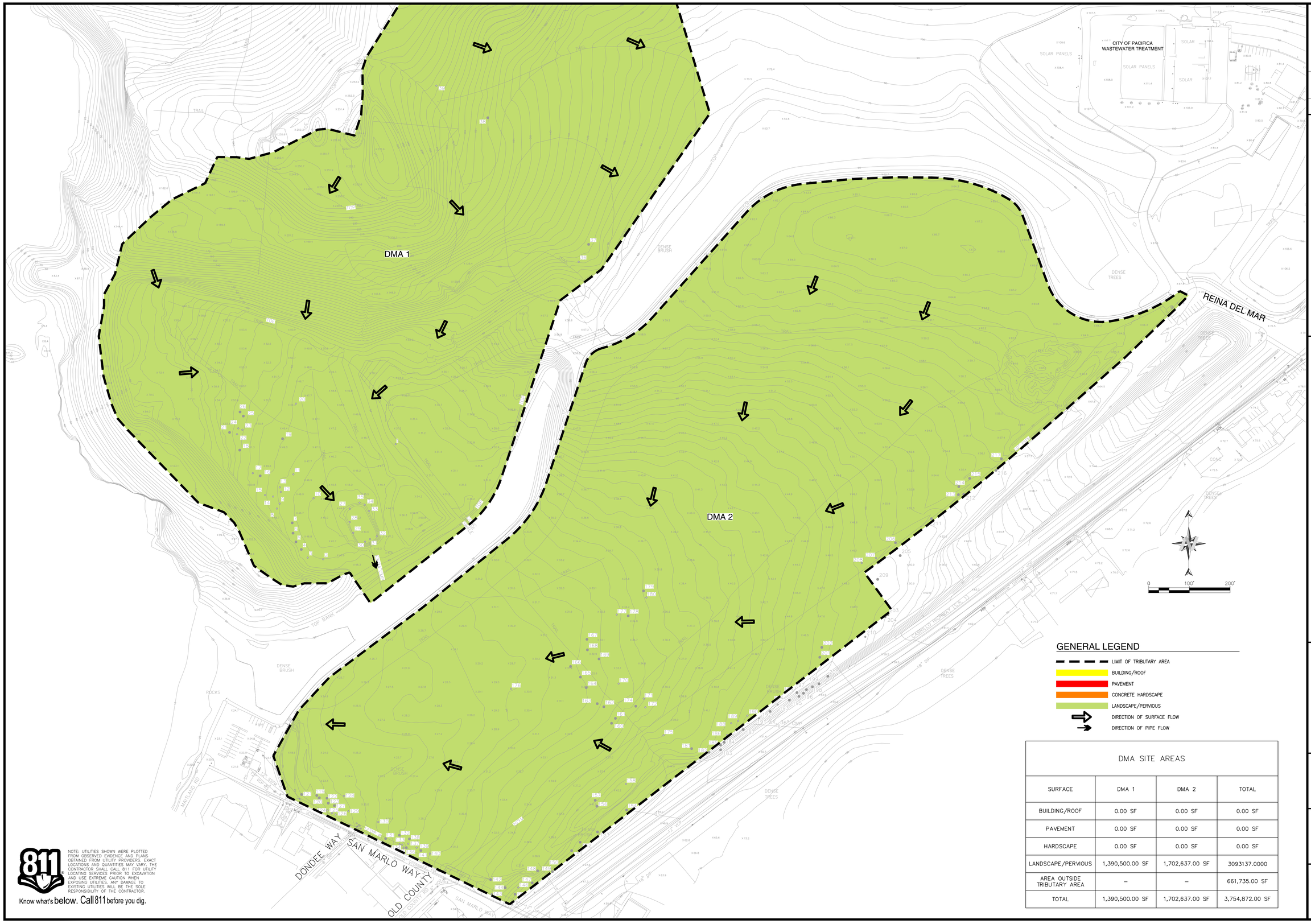
be revegetated, and the historically direct flow path has been redirected through a series of concrete swales and storm drains. As a result, the existing three 72” HDPE culverts passing under the access road, and the existing 24” CMP culvert will be adequate to transport the desired storm events. Sizing of proposed storm drain pipes can be found in the “Conveyance Links” tab located within Appendix B. As for DMA 2, peak flows were slightly increased from 39.5 cfs to 39.9 cfs. Although slopes were dramatically softened here as well, the channelization created by the protected in place wetlands slightly increased the peak runoff. Despite this increase, the existing four 24” PVC culverts should be more than adequate to convey the storm event in question. Lastly, the point of confluence between the DMAs was modeled. At this point the overall peak flow was decreased from 91.8 cfs to 84.4 cfs due to decrease in peak flow rate from DMA 1.

6. Appendices

A: Drainage Management Area (DMA) Exhibits

B: Support Calculations

Appendix A: Drainage Management Area Exhibits



GENERAL LEGEND

- LIMIT OF TRIBUTARY AREA
- BUILDING/ROOF
- PAVEMENT
- CONCRETE HARDSCAPE
- LANDSCAPE/PERVIOUS
- DIRECTION OF SURFACE FLOW
- DIRECTION OF PIPE FLOW

DMA SITE AREAS			
SURFACE	DMA 1	DMA 2	TOTAL
BUILDING/ROOF	0.00 SF	0.00 SF	0.00 SF
PAVEMENT	0.00 SF	0.00 SF	0.00 SF
HARDSCAPE	0.00 SF	0.00 SF	0.00 SF
LANDSCAPE/PERVIOUS	1,390,500.00 SF	1,702,637.00 SF	3093137.0000
AREA OUTSIDE TRIBUTARY AREA	–	–	661,735.00 SF
TOTAL	1,390,500.00 SF	1,702,637.00 SF	3,754,872.00 SF

811

NOTE: UTILITIES SHOWN WERE PLOTTED FROM OBSERVED EVIDENCE AND PLANS OBTAINED FROM UTILITY PROVIDERS. EXACT LOCATIONS AND QUANTITIES MAY VARY. THE CONTRACTOR SHALL CALL 811 FOR UTILITY LOCATING SERVICES PRIOR TO EXCAVATION AND USE EXTREME CAUTION WHEN EXPOSING UTILITIES. ANY DAMAGE TO EXISTING UTILITIES WILL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

Know what's below. Call 811 before you dig.

NO.	DATE	REVISIONS

WALSH ENGINEERING
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ROCKAWAY QUARRY RECLAMATION PLAN

PACIFICA, CA

REGISTERED PROFESSIONAL ENGINEER
MATTHEW R. WALSH
C 79026
CIVIL
STATE OF CALIFORNIA

DESIGNED BY: KKE
DRAFTED BY: KKE
CHECKED BY: MRW
DATE: 06/14/2018

PRE-DEVELOPEMENT HYDROLOGY EXHIBIT

SHEET

1 OF 2

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GENERAL LEGEND

- LIMIT OF TRIBUTARY AREA
- BUILDING/ROOF
- PAVEMENT
- CONCRETE HARDSCAPE
- LANDSCAPE/PERVIOUS
- DIRECTION OF SURFACE FLOW
- DIRECTION OF PIPE FLOW

DMA SITE AREAS			
SURFACE	DMA 1	DMA 2	TOTAL
BUILDING/ROOF	0.00 SF	0.00 SF	0.00 SF
PAVEMENT	0.00 SF	0.00 SF	0.00 SF
HARDSCAPE	10,196.00 SF	0.00 SF	10,196.00 SF
LANDSCAPE/PERVIOUS	1,383,028.00 SF	1,702,637.00 SF	3,085,665.00 SF
AREA OUTSIDE TRIBUTARY AREA	–	–	661,735.00 SF
TOTAL	1,393,224.00 SF	1,702,637.00 SF	3,757,596.00 SF

811 Know what's below. Call 811 before you dig.

NOTE: UTILITIES SHOWN WERE PLOTTED FROM OBSERVED EVIDENCE AND PLANS OBTAINED FROM UTILITY PROVIDERS. EXACT LOCATIONS AND QUANTITIES MAY VARY. THE CONTRACTOR SHALL CALL 811 FOR UTILITY LOCATING SERVICES PRIOR TO EXCAVATION AND USE EXTREME CAUTION WHEN EXPOSING UTILITIES. ANY DAMAGE TO EXISTING UTILITIES WILL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

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STATE OF CALIFORNIA

DESIGNED BY: KKE
DRAFTED BY: KKE
CHECKED BY: MRW
DATE: 06/14/2018

POST-DEVELOPEMENT HYDROLOGY EXHIBIT

SHEET
2 OF 2

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Appendix B: Support Calculations

Project Description

File Name ..... 100-Year Storm Analysis_Pre.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On ..... Oct 29, 2018 00:00:00
End Analysis On ..... Oct 30, 2018 12:00:00
Start Reporting On ..... Oct 29, 2018 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	2
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	2
Channels	1
Pipes	1
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100-year	Cumulative	inches	California	San Mateo (Millbrae)	100	6.70	SCS Type I 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ft²)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DMA1_Pre	1390500.02	79.00	6.70	4.31	137.61	72.70	0 00:23:58
2	DMA2_Pre	1702635.99	74.00	6.70	3.78	147.83	39.64	0 01:17:19

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out1_Pre	Junction	22.00	40.00	0.00	0.00	0.00	70.81	23.36	0.00	16.64	0 00:00	0.00	0.00
2	Out2_Pre	Junction	0.00	6.00	0.00	6.00	0.00	39.53	0.00	0.00	6.00	0 00:00	0.00	0.00
3	Out_Combined_Pre	Outfall	19.00					91.80	20.36					

Subbasin Hydrology

Subbasin : DMA1_Pre

Input Data

Area (ft²) 1390500.02
Weighted Curve Number 79.00
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
50 - 75% grass cover, Fair	1390500.02	C	79.00
Composite Area & Weighted CN	1390500.02		79.00

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.35	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.90	0.00	0.00
Velocity (ft/sec) :	0.28	0.00	0.00
Computed Flow Time (min) :	17.78	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1060	0.00	0.00
Slope (%) :	17	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	2.89	0.00	0.00
Computed Flow Time (min) :	6.11	0.00	0.00

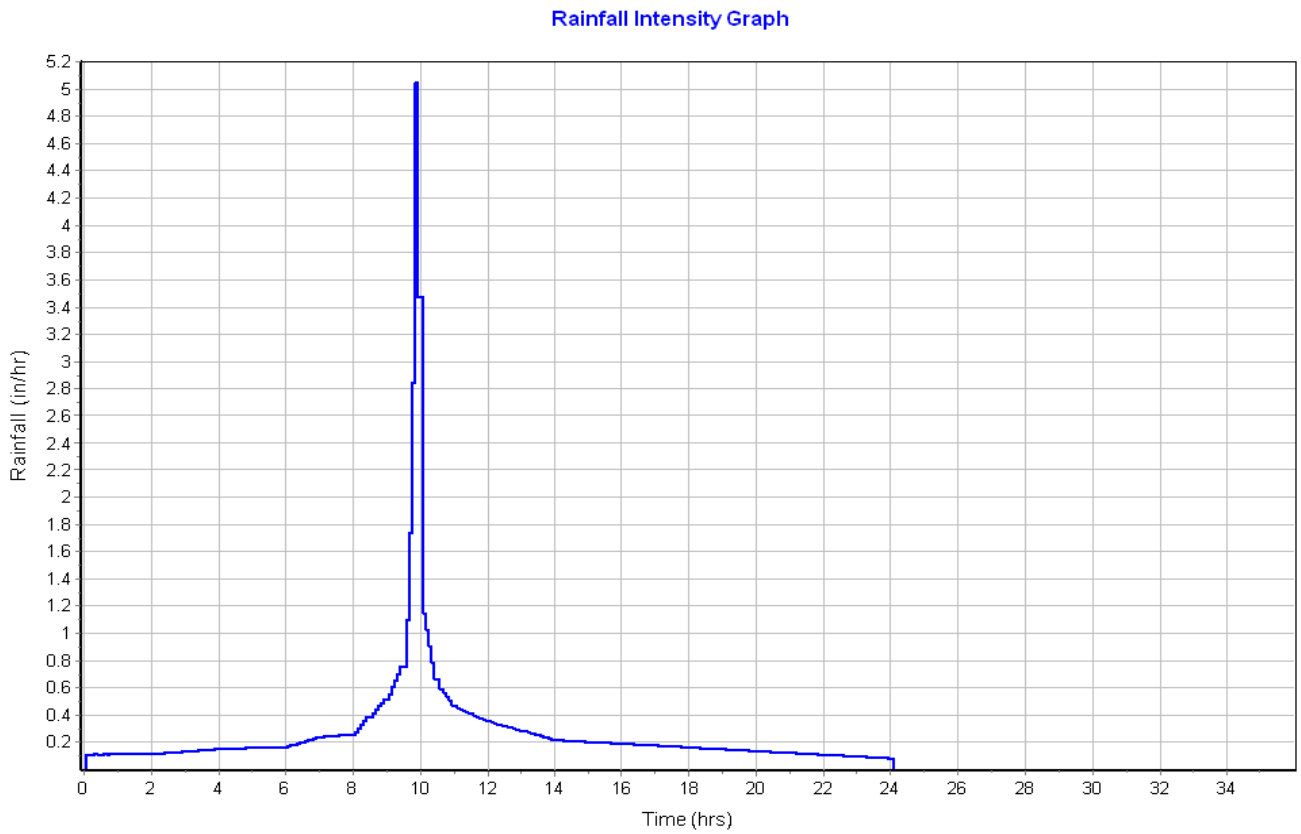
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	125	0.00	0.00
Channel Slope (%) :	14	0.00	0.00
Cross Section Area (ft²) :	3.14	0.00	0.00
Wetted Perimeter (ft) :	6.28	0.00	0.00
Velocity (ft/sec) :	27.02	0.00	0.00
Computed Flow Time (min) :	0.08	0.00	0.00

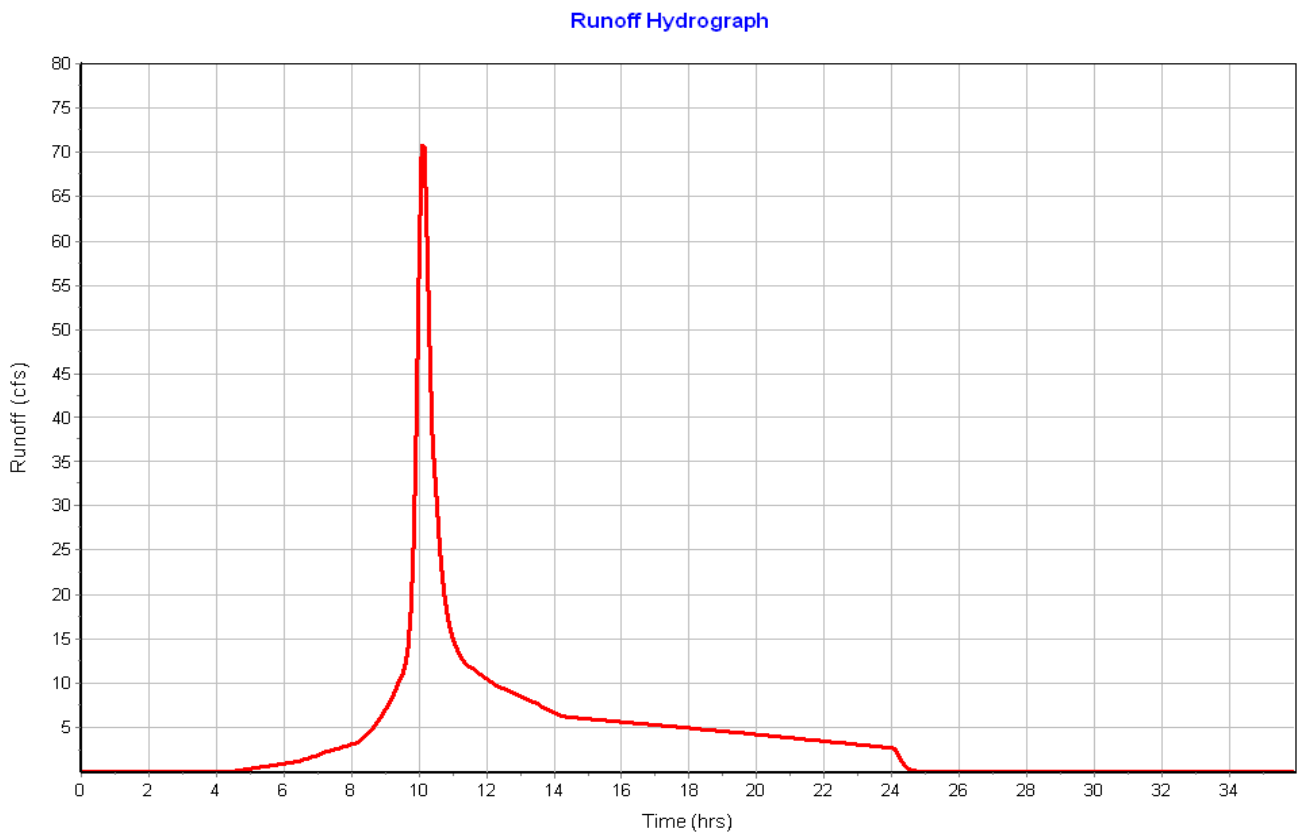
Total TOC (min) 23.97

Subbasin Runoff Results

Total Rainfall (in) 6.70
Total Runoff (in) 4.31
Peak Runoff (cfs) 72.70
Weighted Curve Number 79.00
Time of Concentration (days hh:mm:ss) 0 00:23:58

Subbasin : DMA1_Pre





Subbasin : DMA2_Pre

Input Data

Area (ft²) 1702635.99
Weighted Curve Number 74.00
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
> 75% grass cover, Good	1702635.99	C	74.00
Composite Area & Weighted CN	1702635.99		74.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	3	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.90	0.00	0.00
Velocity (ft/sec) :	0.11	0.00	0.00
Computed Flow Time (min) :	46.19	0.00	0.00

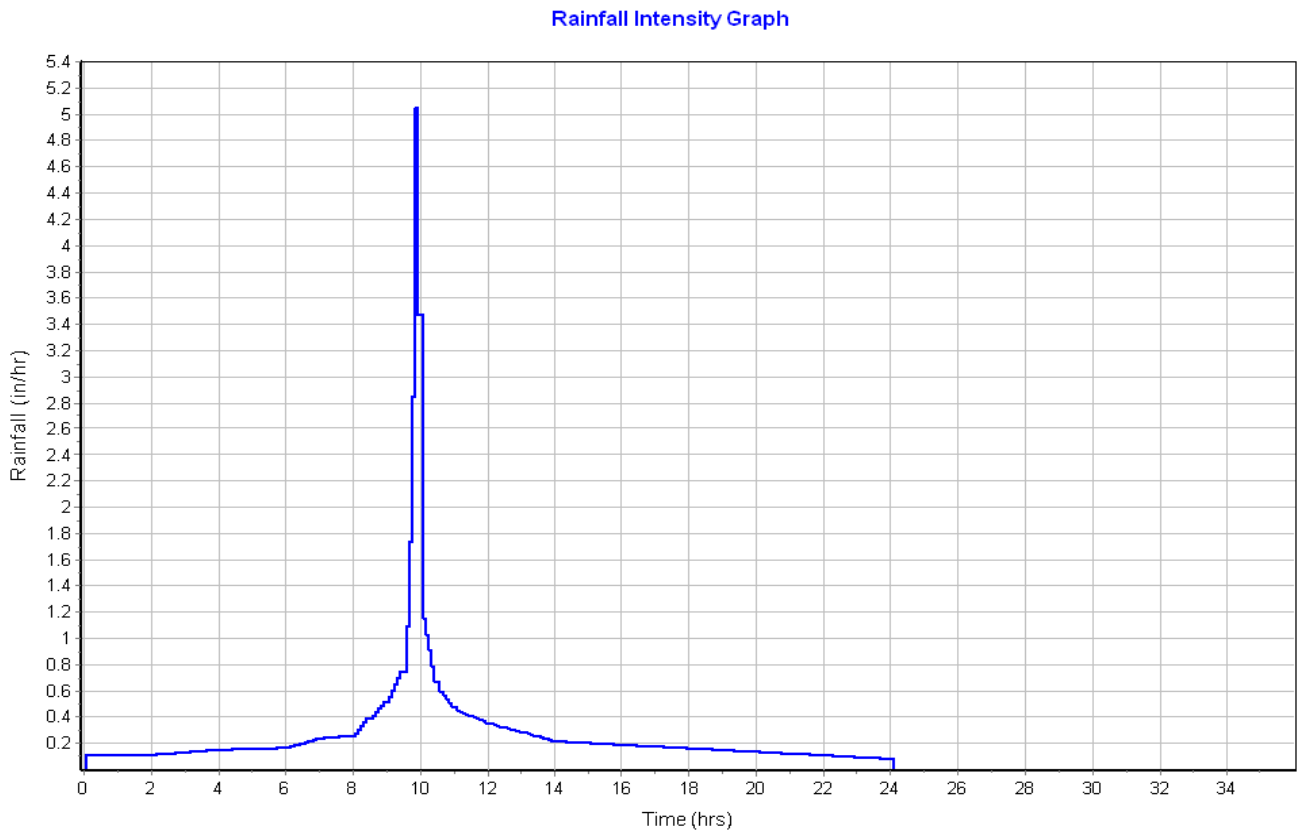
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1850	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.99	0.00	0.00
Computed Flow Time (min) :	31.14	0.00	0.00

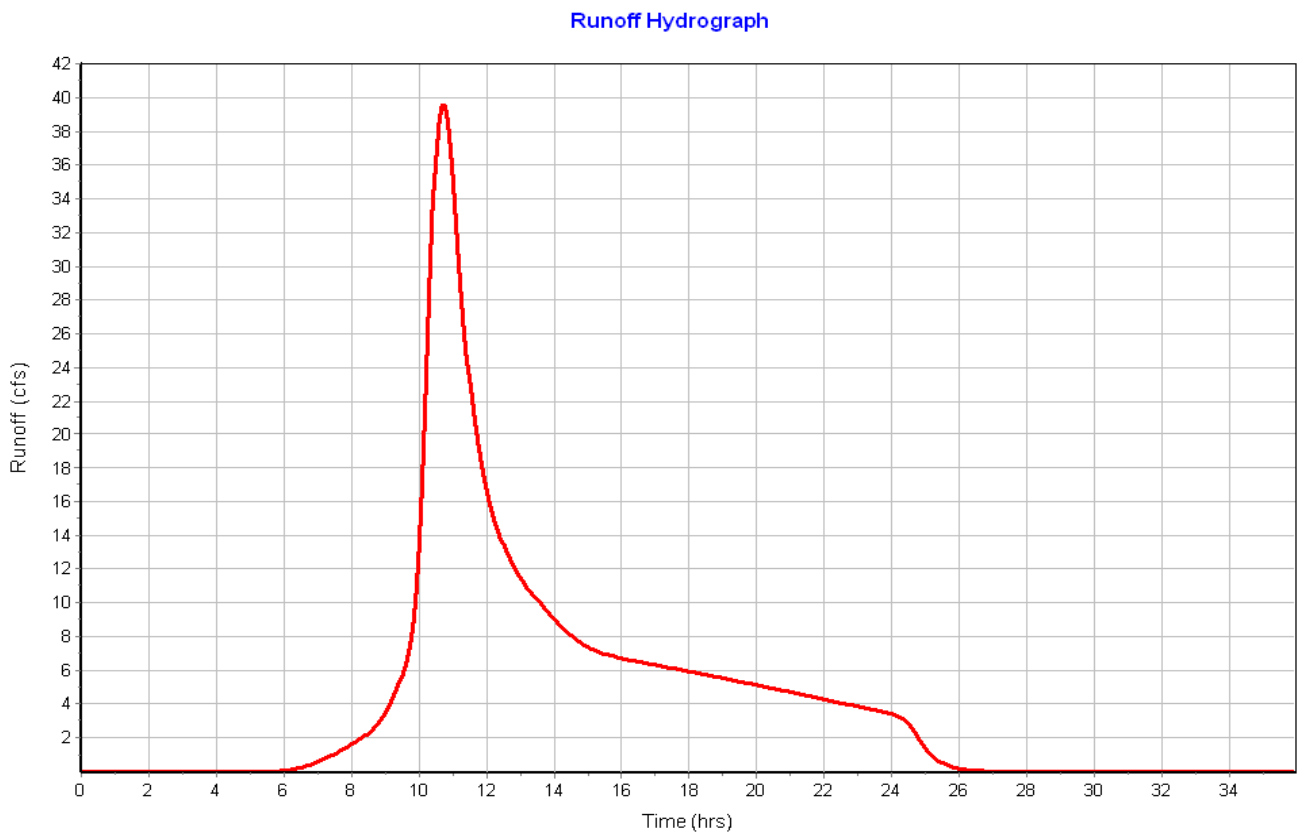
Total TOC (min) 77.33

Subbasin Runoff Results

Total Rainfall (in) 6.70
Total Runoff (in) 3.78
Peak Runoff (cfs) 39.64
Weighted Curve Number 74.00
Time of Concentration (days hh:mm:ss) 0 01:17:20

Subbasin : DMA2_Pre





Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out1_Pre	70.81	70.81	23.36	1.36	0.00	16.64	22.17	0.17	0 10:10	0 00:00	0.00	0.00
2	Out2_Pre	39.53	39.53	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00

Project Description

File Name ..... 100-Year Storm Analysis_Post.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On ..... Oct 29, 2018 00:00:00
End Analysis On ..... Oct 30, 2018 12:00:00
Start Reporting On ..... Oct 29, 2018 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	5
Nodes	6
Junctions	5
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	5
Channels	2
Pipes	3
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100-year	Cumulative	inches	California	San Mateo (Millbrae)	100	6.70	SCS Type I 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ft²)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DMA1A_Post	363789.99	74.00	6.70	3.78	31.59	16.12	0 00:24:36
2	DMA1B_Post	2239.99	74.00	6.70	3.77	0.19	0.13	0 00:10:00
3	DMA1C_Post	745441.02	74.33	6.70	3.82	65.30	33.98	0 00:23:52
4	DMA1D_Post	271557.00	74.00	6.70	3.78	23.58	13.17	0 00:20:13
5	DMA2_Post	1702636.99	74.00	6.70	3.78	147.83	39.92	0 01:16:27

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out1A_Post	Junction	97.00	102.00	0.00	0.00	0.00	44.54	38.34	0.00	6.66	0 00:00	0.00	0.00
2	72inHDPEculverts_Post	Junction	32.70	45.00	0.00	0.00	0.00	59.63	49.63	0.00	0.78	0 00:00	0.00	0.00
3	Out1_Post	Junction	20.50	50.00	0.00	0.00	0.00	33.10	80.57	0.00	1.43	0 00:00	0.00	0.00
4	Out1C_Post	Junction	79.00	82.00	0.00	0.00	0.00	39.87	17.77	0.00	7.23	0 00:00	0.00	0.00
6	Out_Combined_Post	Outfall	0.00	25.00	0.00	0.00	0.00	84.42	20.48					

Subbasin Hydrology

Subbasin : DMA1A_Post

Input Data

Area (ft²) 363789.99
Weighted Curve Number 74.00
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
> 75% grass cover, Good	363789.99	C	74.00
Composite Area & Weighted CN	363789.99		74.00

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.90	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	20.82	0.00	0.00

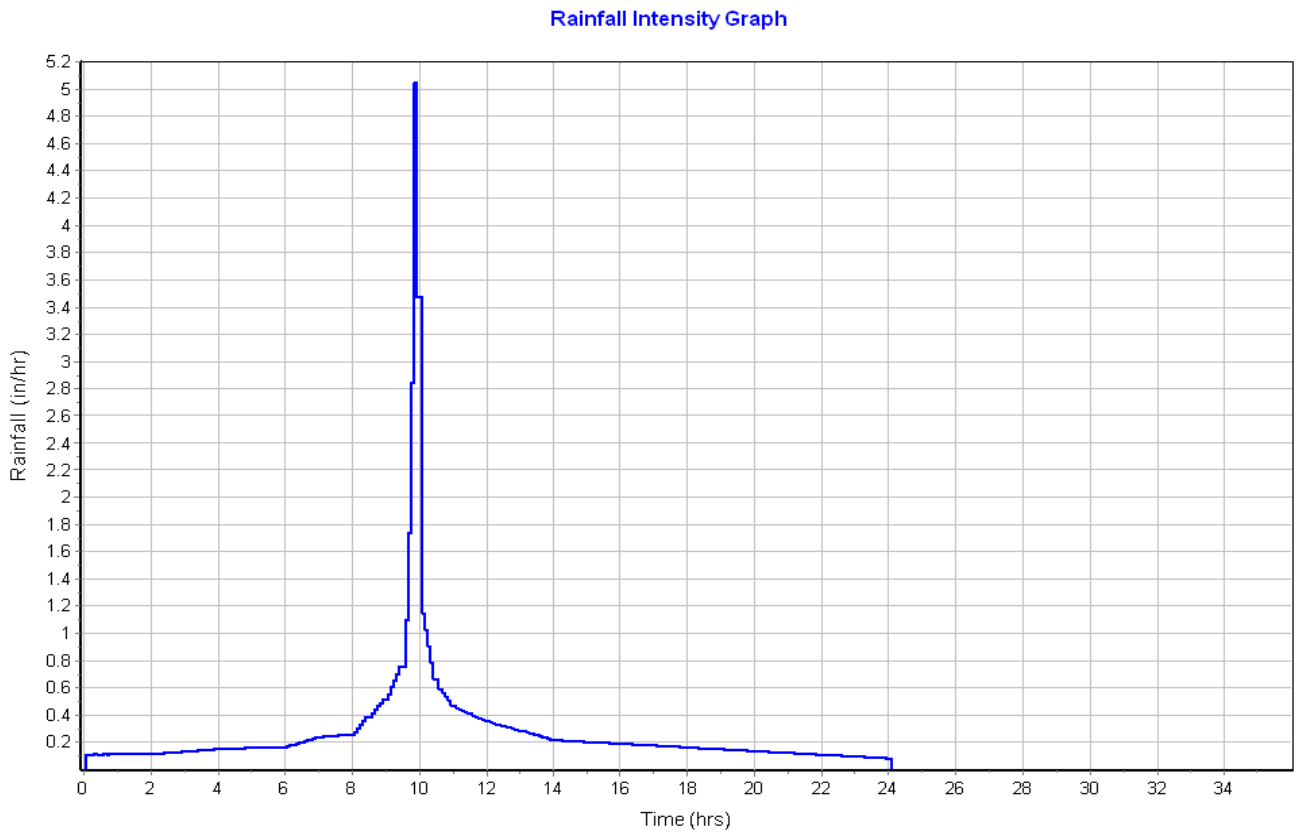
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1078	0.00	0.00
Slope (%) :	10	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	4.74	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00

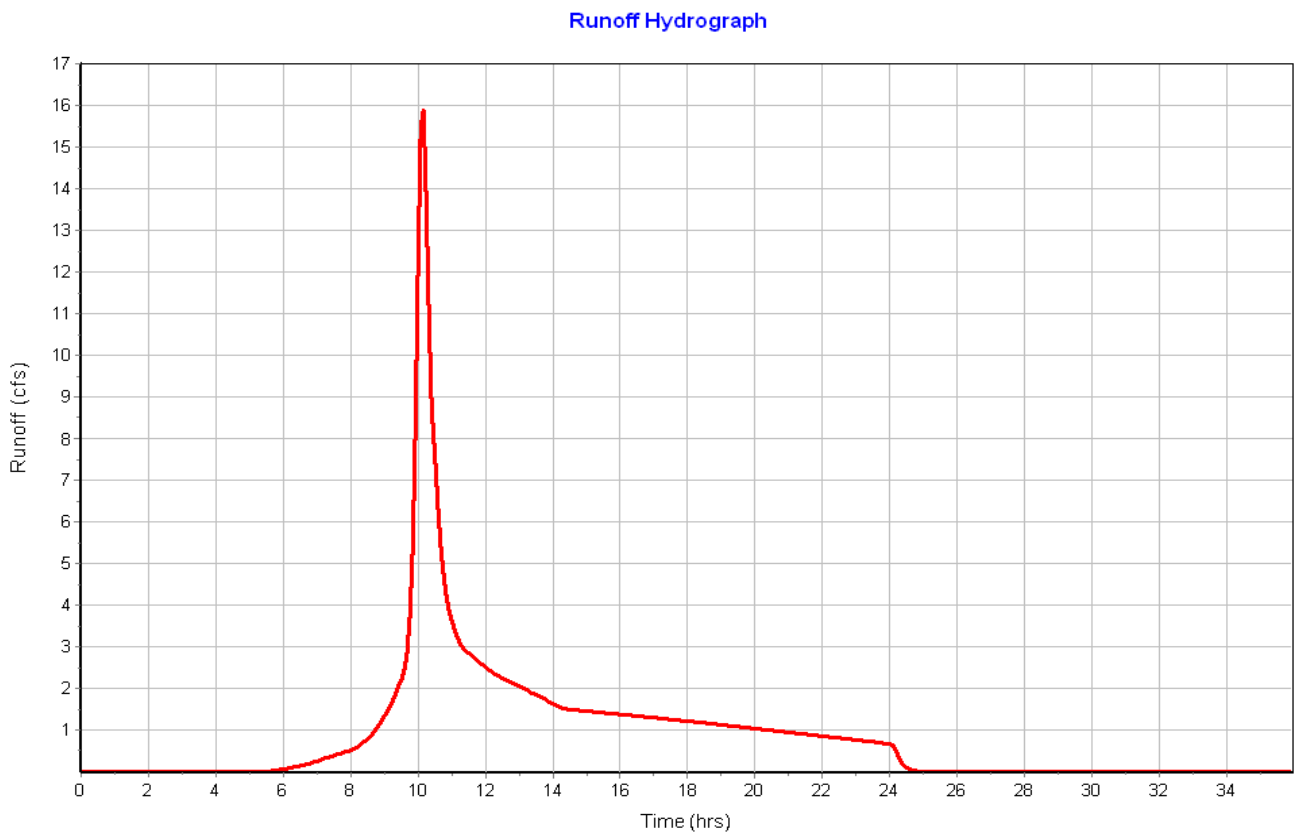
Total TOC (min) 24.61

Subbasin Runoff Results

Total Rainfall (in) 6.70
Total Runoff (in) 3.78
Peak Runoff (cfs) 16.12
Weighted Curve Number 74.00
Time of Concentration (days hh:mm:ss) 0 00:24:37

Subbasin : DMA1A_Post





Subbasin : DMA1B_Post

Input Data

Area (ft²) 2239.99
Weighted Curve Number 74.00
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
> 75% grass cover, Good	2239.99	C	74.00
Composite Area & Weighted CN	2239.99		74.00

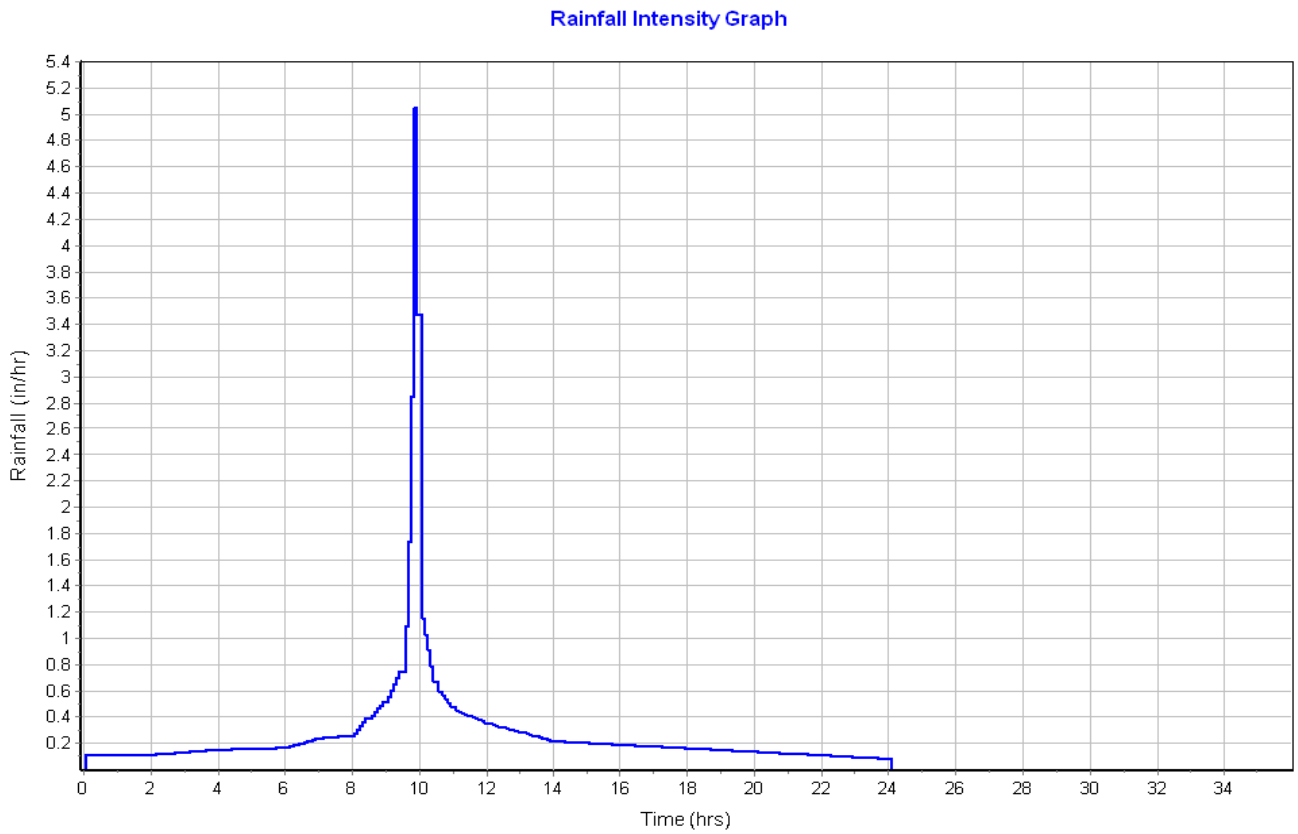
Time of Concentration

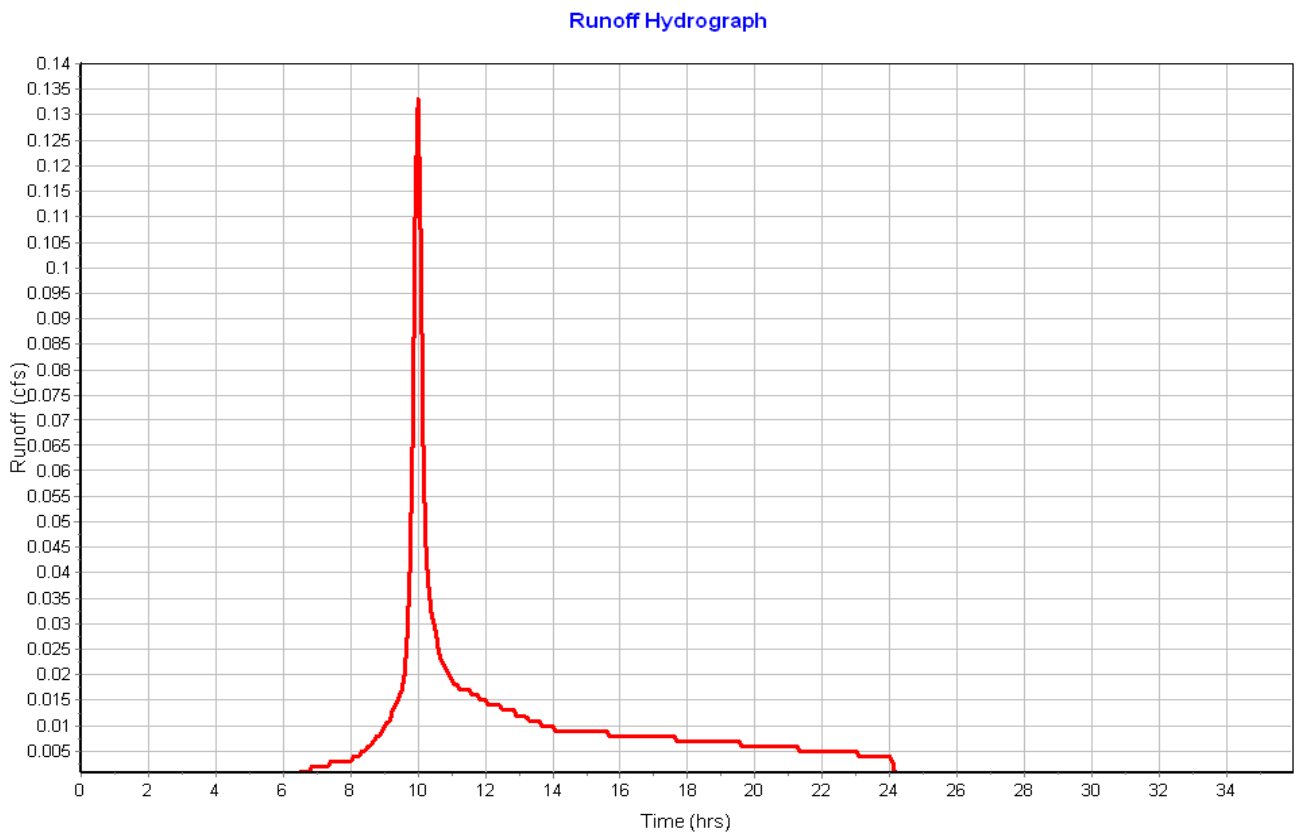
User-Defined TOC override (minutes): 10

Subbasin Runoff Results

Total Rainfall (in) 6.70
Total Runoff (in) 3.77
Peak Runoff (cfs) 0.13
Weighted Curve Number 74.00
Time of Concentration (days hh:mm:ss) 0 00:10:00

Subbasin : DMA1B_Post





Subbasin : DMA1C_Post

Input Data

Area (ft²) 745441.02
Weighted Curve Number 74.33
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
> 75% grass cover, Good	735215.00	C	74.00
Paved parking & roofs	10196.00	C	98.00
Composite Area & Weighted CN	745411.00		74.33

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	21	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.90	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.21	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	360	0.00	0.00
Slope (%) :	9	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	4.50	0.00	0.00
Computed Flow Time (min) :	1.33	0.00	0.00

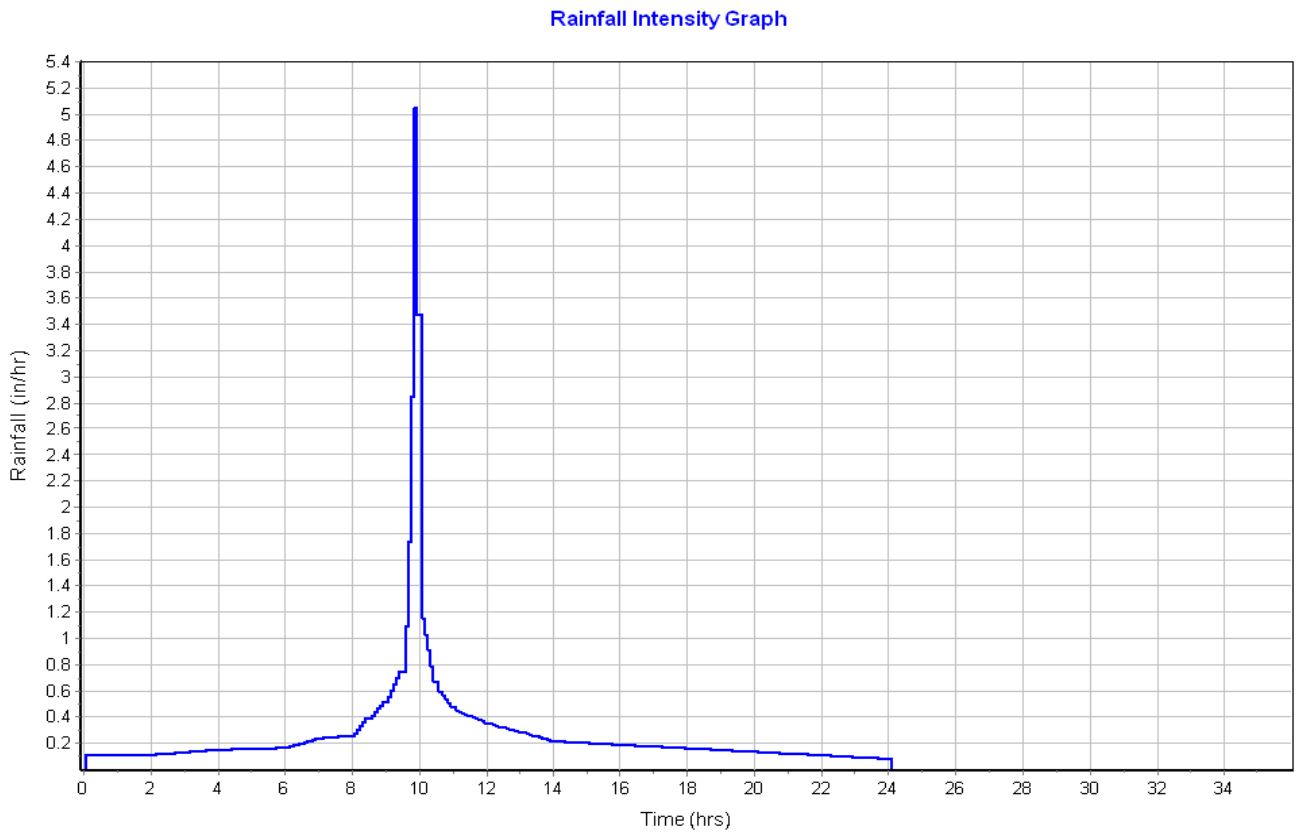
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.00	0.00
Flow Length (ft) :	885	0.00	0.00
Channel Slope (%) :	5	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	2.83	0.00	0.00
Velocity (ft/sec) :	11.10	0.00	0.00
Computed Flow Time (min) :	1.33	0.00	0.00

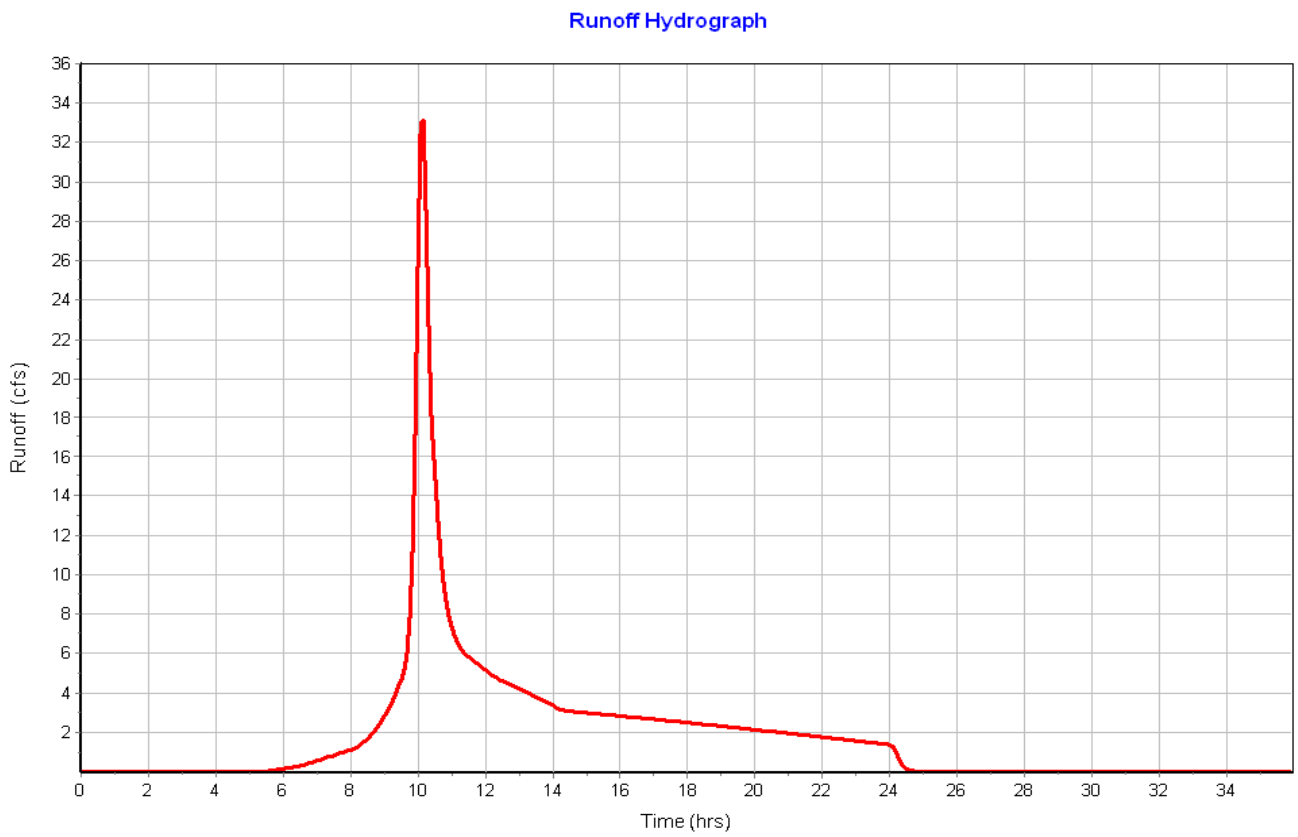
Total TOC (min) 23.87

Subbasin Runoff Results

Total Rainfall (in) 6.70
Total Runoff (in) 3.82
Peak Runoff (cfs) 33.98
Weighted Curve Number 74.33
Time of Concentration (days hh:mm:ss) 0 00:23:52

Subbasin : DMA1C_Post





Subbasin : DMA1D_Post

Input Data

Area (ft²) 271557.00
Weighted Curve Number 74.00
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
> 75% grass cover, Good	271557.00	C	74.00
Composite Area & Weighted CN	271557.00		74.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	41	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.90	0.00	0.00
Velocity (ft/sec) :	0.31	0.00	0.00
Computed Flow Time (min) :	16.23	0.00	0.00

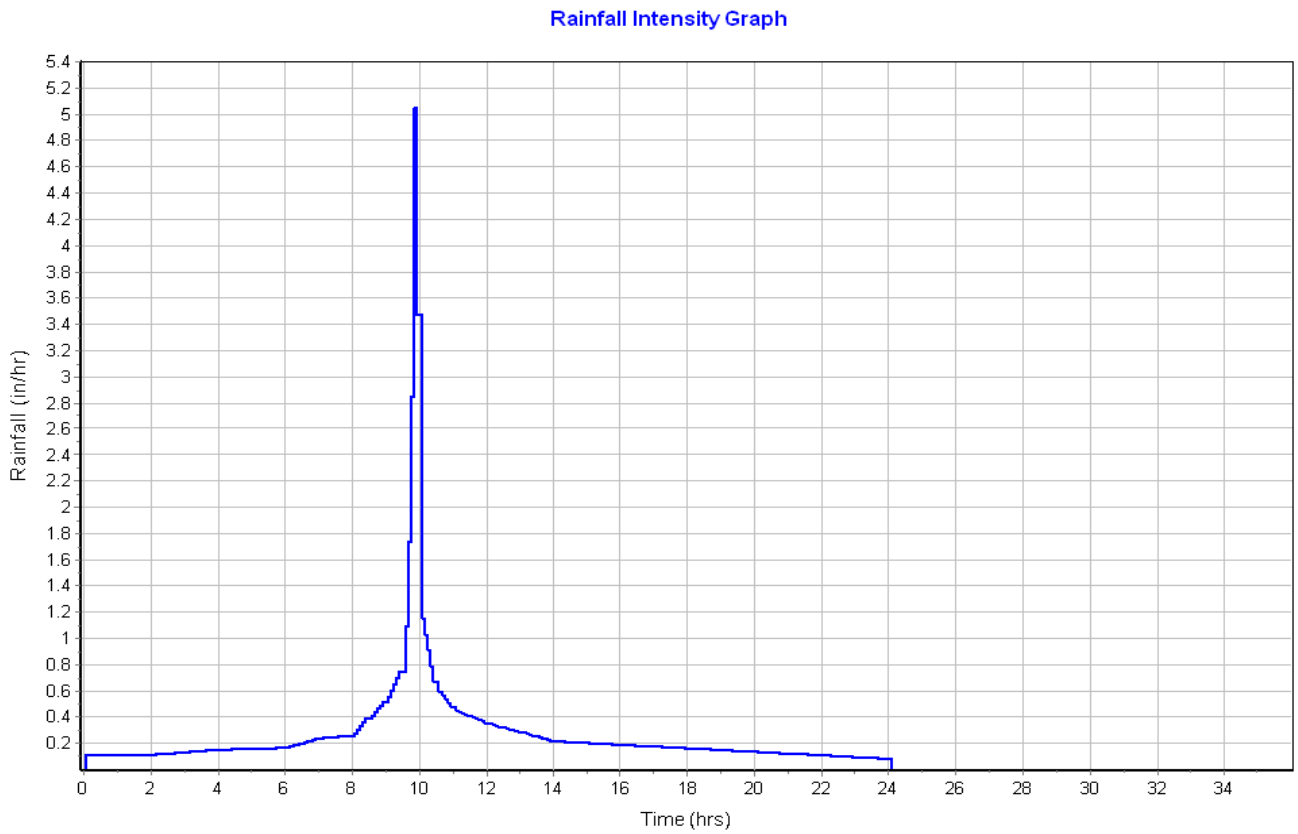
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	628	0.00	0.00
Slope (%) :	14	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	2.62	0.00	0.00
Computed Flow Time (min) :	3.99	0.00	0.00

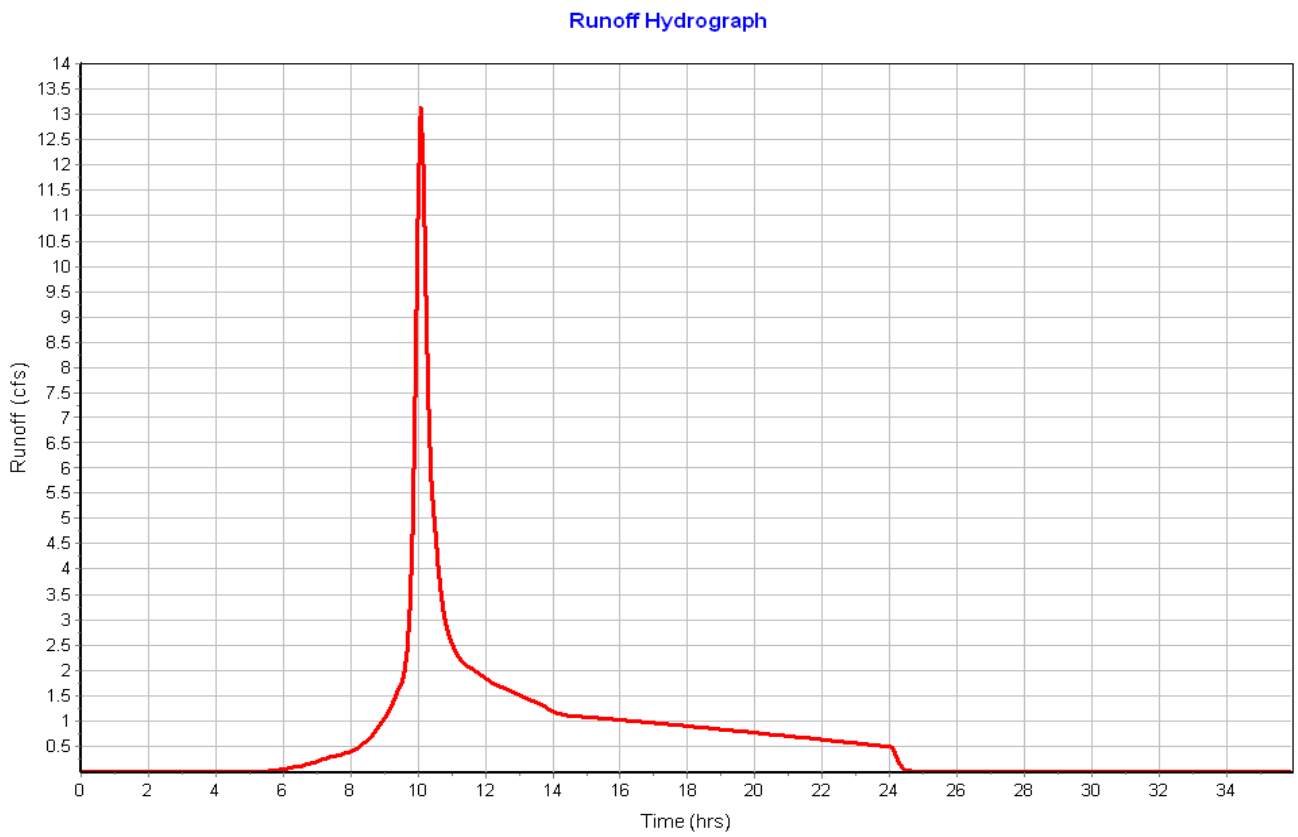
Total TOC (min) 20.22

Subbasin Runoff Results

Total Rainfall (in) 6.70
Total Runoff (in) 3.78
Peak Runoff (cfs) 13.17
Weighted Curve Number 74.00
Time of Concentration (days hh:mm:ss) 0 00:20:13

Subbasin : DMA1D_Post





Subbasin : DMA2_Post

Input Data

Area (ft²) 1702636.99
Weighted Curve Number 74.00
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
> 75% grass cover, Good	1702636.99	C	74.00
Composite Area & Weighted CN	1702636.99		74.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	3	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.90	0.00	0.00
Velocity (ft/sec) :	0.11	0.00	0.00
Computed Flow Time (min) :	46.19	0.00	0.00

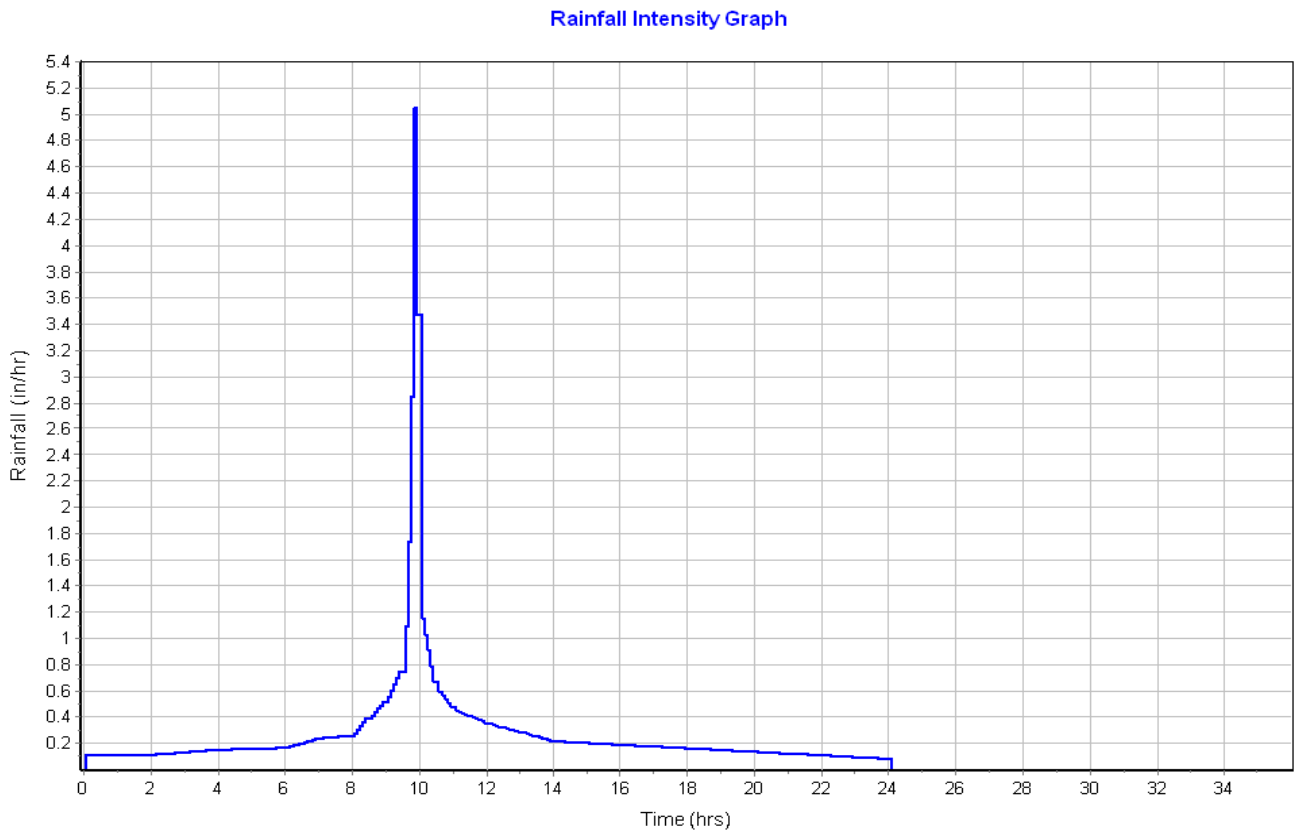
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1160	1185	0.00
Slope (%) :	2	1.5	0.00
Surface Type :	Grass pasture	ssed wate	Unpaved
Velocity (ft/sec) :	0.99	1.84	0.00
Computed Flow Time (min) :	19.53	10.73	0.00

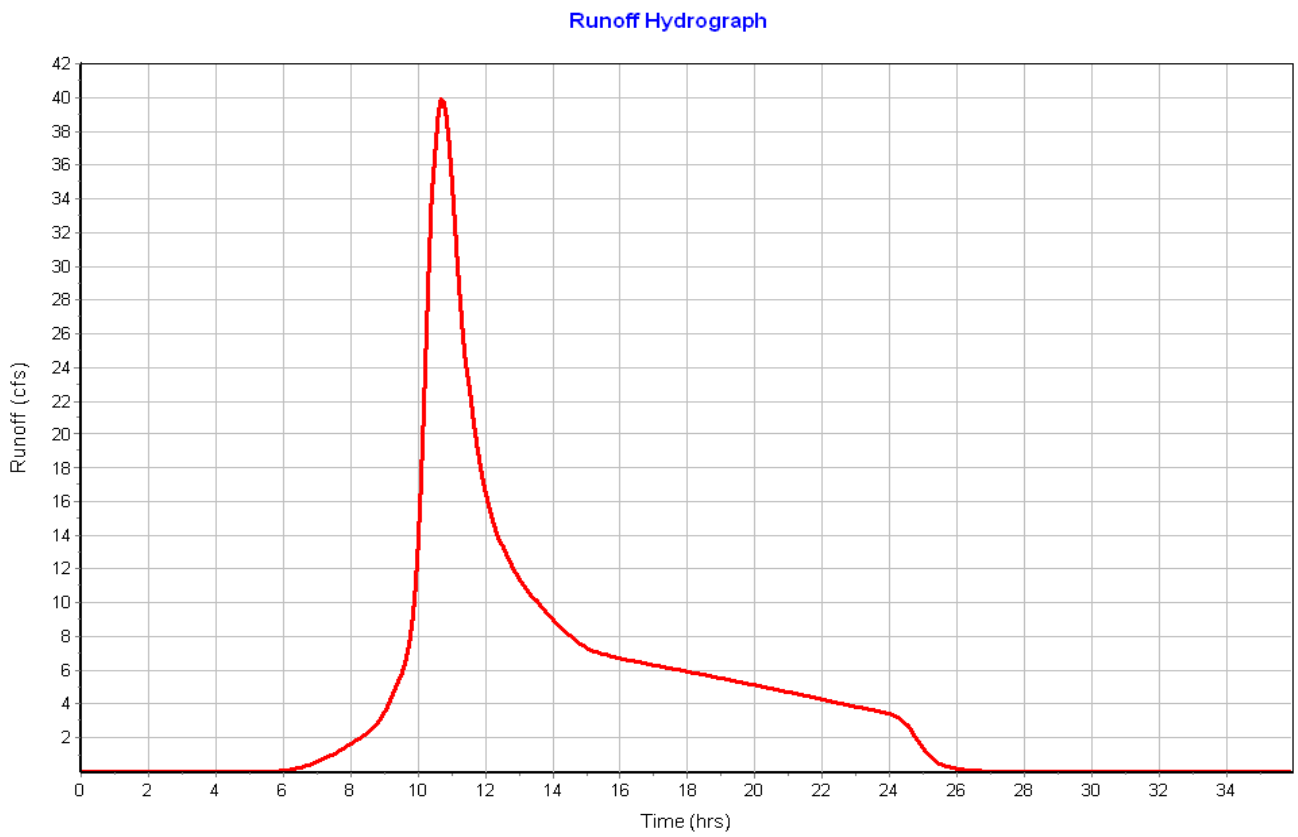
Total TOC (min) 76.45

Subbasin Runoff Results

Total Rainfall (in) 6.70
Total Runoff (in) 3.78
Peak Runoff (cfs) 39.92
Weighted Curve Number 74.00
Time of Concentration (days hh:mm:ss) 0 01:16:27

Subbasin : DMA2_Post





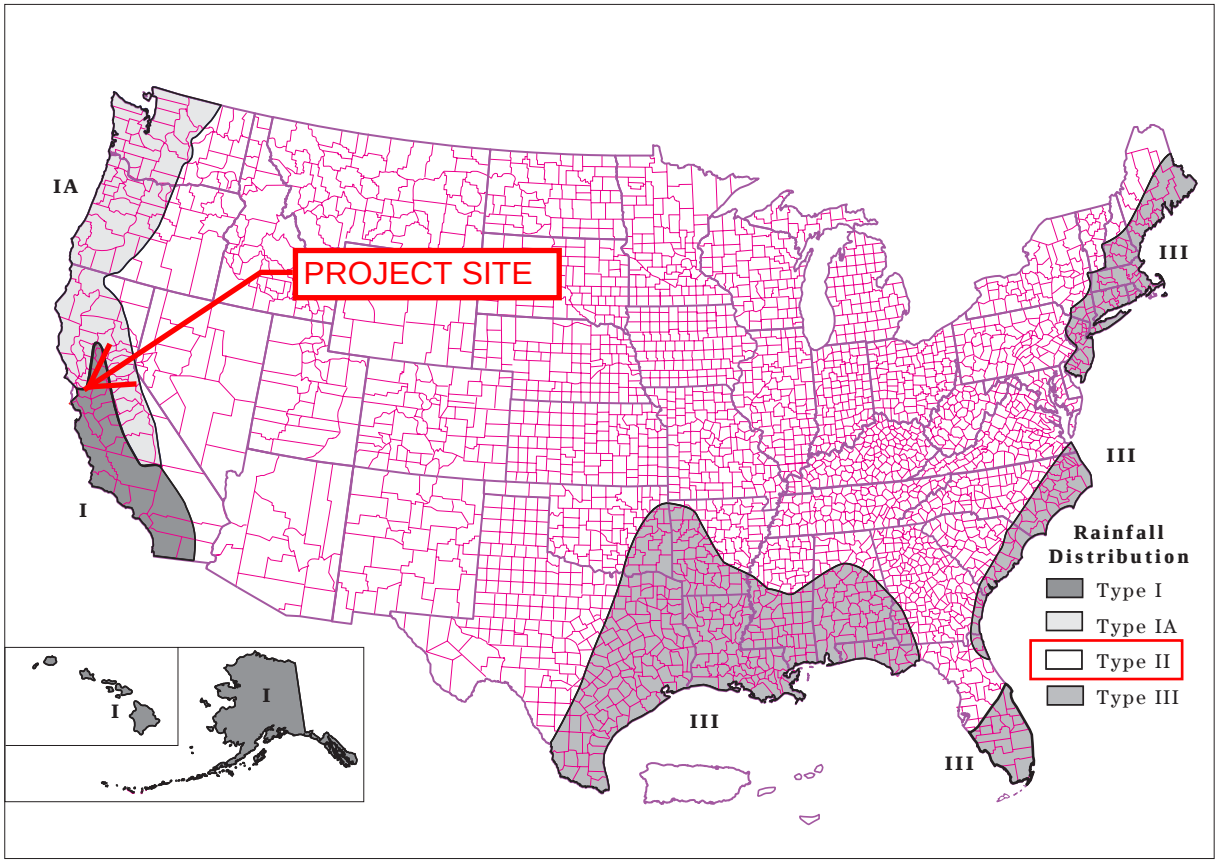
Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out1A_Post	44.54	13.13	38.34	5.64	0.00	6.66	36.99	4.29	0 10:16	0 00:00	0.00	0.00
2	72inHDPEculverts_Post	59.63	0.13	49.63	29.13	0.00	0.78	48.59	28.09	0 10:19	0 00:00	0.00	0.00
3	Out1_Post	33.10	33.10	80.57	1.57	0.00	1.43	79.22	0.22	0 10:15	0 00:00	0.00	0.00
4	Out1C_Post	39.87	39.87	17.77	0.00	0.00	7.23	17.77	0.00	0 00:00	0 00:00	0.00	0.00
5	Out2_Post												

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-05	39.87	0 10:45	0.00	0.69	0.00		1.71	0.86	0.00		Calculated
2	24inCMPCulvert_Post	33.07	0 10:16	45.99	0.72	10.46	4.02	1.56	0.63	0.00		Calculated
3	PIPE1C											

Figure B-2 Approximate geographic boundaries for NRCS (SCS) rainfall distributions



Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Ocean and Atmospheric Administration.

East of 105th meridian

Hershfield, D.M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 155 p.

West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I Montana; Vol. II, Wyoming; Vol III, Colorado; Vol. IV, New Mexico; Vol V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dept. of Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. of Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

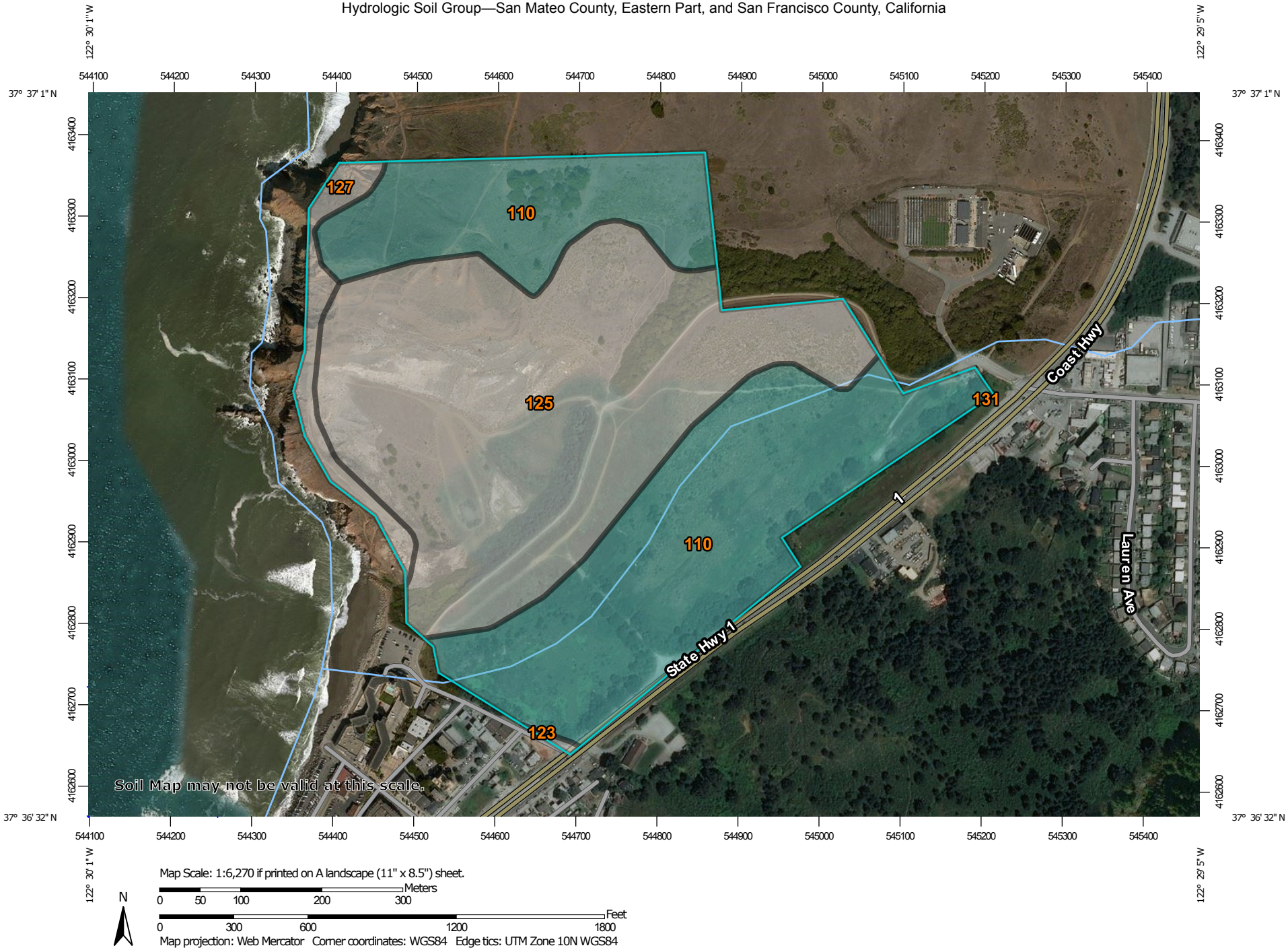
Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 P.

Hydrologic Soil Group—San Mateo County, Eastern Part, and San Francisco County, California



Map Scale: 1:6,270 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: San Mateo County, Eastern Part, and San Francisco County, California
Survey Area Data: Version 14, Sep 12, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 26, 2010—May 19, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
110	Candlestick-Kron-Buriburi complex, 30 to 75 percent slo pes	C	43.2	46.7%
123	Orthents, cut and fill-Urban land complex, 0 to 5 percent slopes		0.1	0.2%
125	Pits and Dumps		45.7	49.4%
127	Rock outcrop-Orthents complex, 30 to 75 percent slopes		3.5	3.8%
131	Urban land		0.0	0.0%
Totals for Area of Interest			**92.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher