HYDROLOGY STUDY
FOR THE
INGLEWOOD VILLAGE BUSINESS PARK
BUILDING "D"
1275 INGLEWOOD AVENUE
ST. HELENA, CALIFORNIA
APN 027-590-001

Prepared For:

Phillip L. Smith
The Phillip L. Smith Company
P.O. Box 98
Acampo, CA 95220
(209) 368-9732

Prepared By:

Bartelt Engineering
1303 Jefferson Street, Suite 200B
Napa, CA 94559
(707) 258-1301

Paul N. Bartelt, P.E.
Principal Engineer

Job # 96-48
March 2012

March 16, 2012
#96-48

Drew Lander
Napa County Department of Public Works
1195 Third Street, Room 201
Napa, CA 94559

Re: Hydrology Study for Inglewood Village Business Park, Building "D", 1275 Inglewood Avenue, Saint Helena, CA APN 027-590-001

Dear Mr. Lander:

At the request of Napa County Department of Public Works, Bartelt Engineering has completed a hydrology study for the proposed construction of Building "D" within the Inglewood Village Business Park located at the above referenced address.

The current condition of the proposed Building "D" site can be characterized as a vineyard with grass ground cover. The vineyard was planted as temporary landscaping at the conclusion of previous construction activities by the developer. Please review the attached "Existing Conditions" exhibit for the location and current conditions of the Building "D" site.

The developer is proposing to complete the Inglewood Village Business Park by constructing a commercial building along with a parking lot and detached sidewalk. Approximately 11,400 S.F. of additional impervious surface will be created by this development. Please review the attached "Proposed Conditions" exhibit which identifies the impervious area to be constructed as shaded regions under this development.

Analysis and Results

The Soil Conservation Service's (SCS)[1] methodology was used to evaluate the pre-construction and post-construction peak storm water flow rate (Q_{PEAK}) and runoff volume (V) for the 100-yr, 6-hr storm event. Additionally, an analysis of the 2-yr, 24-hr storm event was conducted as outlined by the Napa County Post-Construction Runoff Management Requirements, Adopted Date: June 3, 2008. Along with site location, size, and local rainfall data, the SCS method requires the civil engineer to determine a site's curve number (CN) and Time of Concentration (T_C) to complete the analysis.

The National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 provided rainfall data for different storm events and different durations[2]. The data provided by NOAA has been recently updated and is site specific. The NOAA data also provides a range of rainfall intensity and depth values for each storm. Bartelt Engineering has elected to use the upper bound values in our analysis to produce conservative results. Please review the attached "Point Precipitation Frequency Estimates" output pages for information on rainfall.

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[1] United States Department of Agriculture, Natural Resource Conservation Service, Conservation Engineering Division, Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds, 1986.

[2] NOAA's National Weather Service (NWS), Hydrometeorological Design Studies Center (HDSC), Precipitation Frequency Data Server (PFDS), Atlas 14, Volume 6, Version 2, Point Precipitation Frequency Estimates.

Curve Numbers (CN) related to the site's Hydrologic Soil Group (HSG) and different land use conditions were selected. Please review the attached Web Soil Survey's Hydrologic Soil Group maps for locations and descriptions of the different hydrologic soil groups found under and around the site.

Below is Table 1 which summarizes the hydrology calculation results between the existing and proposed condition. Please see the attached output pages for details and the pre- and post-construction hydrographs[3] for the different storm events and durations.

TABLE 1 – CALCULATION SUMMARY

	SCS CN	2-yr, 24-hr			100-yr, 6-hr		
		Time to Peak (min)	Peak Runoff Rate (Q) (cfs)	Runoff Volume (V) (ft^3)	Time to Peak (min)	Peak Runoff Rate (Q) (cfs)	Runoff Volume (V) (ft^3)
Pre-Construction	39	1,365	0.003	88	483	0.06	597
Post-Construction	98	474	0.27	3,939	474	0.62	6,039
Difference	--	--	0.27	3,851	--	0.58	5,442

The results show that approximately 5,442 cubic-feet of water will need to be detained to mitigate the introduction of impervious surface created by constructing Building "D", the parking lot, and sidewalk for the 100-yr, 6-hr storm event. A subsurface detention vault approximately 50 feet wide, 75 feet long, and 1.5 feet high is adequate to provide this volume. The detention vault can be installed underneath the proposed parking lot as shown on our "Proposed Storm Drain Improvements" exhibit and "Conceptual Site Plan" and not interfere with other utilities or the structural integrity of the pavement. The outlet of this vault will be metered so that the post-construction peak runoff rate will not exceed the pre-construction peak runoff rate for the development during the 100-yr, 6-hr event.

It is interesting to note that the runoff volume for the 2-yr, 24-hr storm event is 3,851 cubic-feet. The 2-yr, 24-hr storm event runoff volume is associated with storm water policies and is the typical quantity volume required to comply with current State and County regulations. The 100-yr, 6-hr volume this project is being required to mitigate is more than 140% of the 2-yr, 24-hr volume.

A detention vault similar to the Atlantis D-Raintank product that was installed onsite in January 2007, or any number of other proprietary products available on the market today, could be utilized for this project. The vault will be encapsulated with an impervious barrier because of the high water table in the area. Both of the proposed drop inlets in the corner of the proposed parking lot will contain pre-treatment devices, convey surface runoff into the underground vault, and act as emergency overflow structures when either a storm event

[3] Bentley Systems, Inc., PondPack, v8.11.01.54

producing runoff in excess of the underground vault's storage capacity occurs or when the system is under a backwater condition because of downstream capacity issues.

Conclusions

Bartelt Engineering proposes an underground storm water detention vault beneath the proposed parking lot to mitigate the increase in storm water runoff as a result of the construction of Building "D". Although there is adequate room to construct the underground vault to detain the 5,442 cubic-feet of increased runoff volume, less expensive, above ground detention systems should also be looked at due the high cost impacts associated with underground system to the proposed construction. Due to the current economic climate, Bartelt Engineering will work closely with the project owner, architect, and County to investigate alternative solutions to keep development costs down while meeting the storm water requirements.

The above calculations should be adequate for the Use Permit Modification application to Napa County for the development of Building D. Full design calculations and construction plans for the addition of Building D will be provided after the approval of the Use Permit Modification. If you have any questions regarding my recommendations please feel free to call me at (707) 258-1301.

Sincerely,

Michael G. Grimes, RCE
Project Engineer

MGG:sd

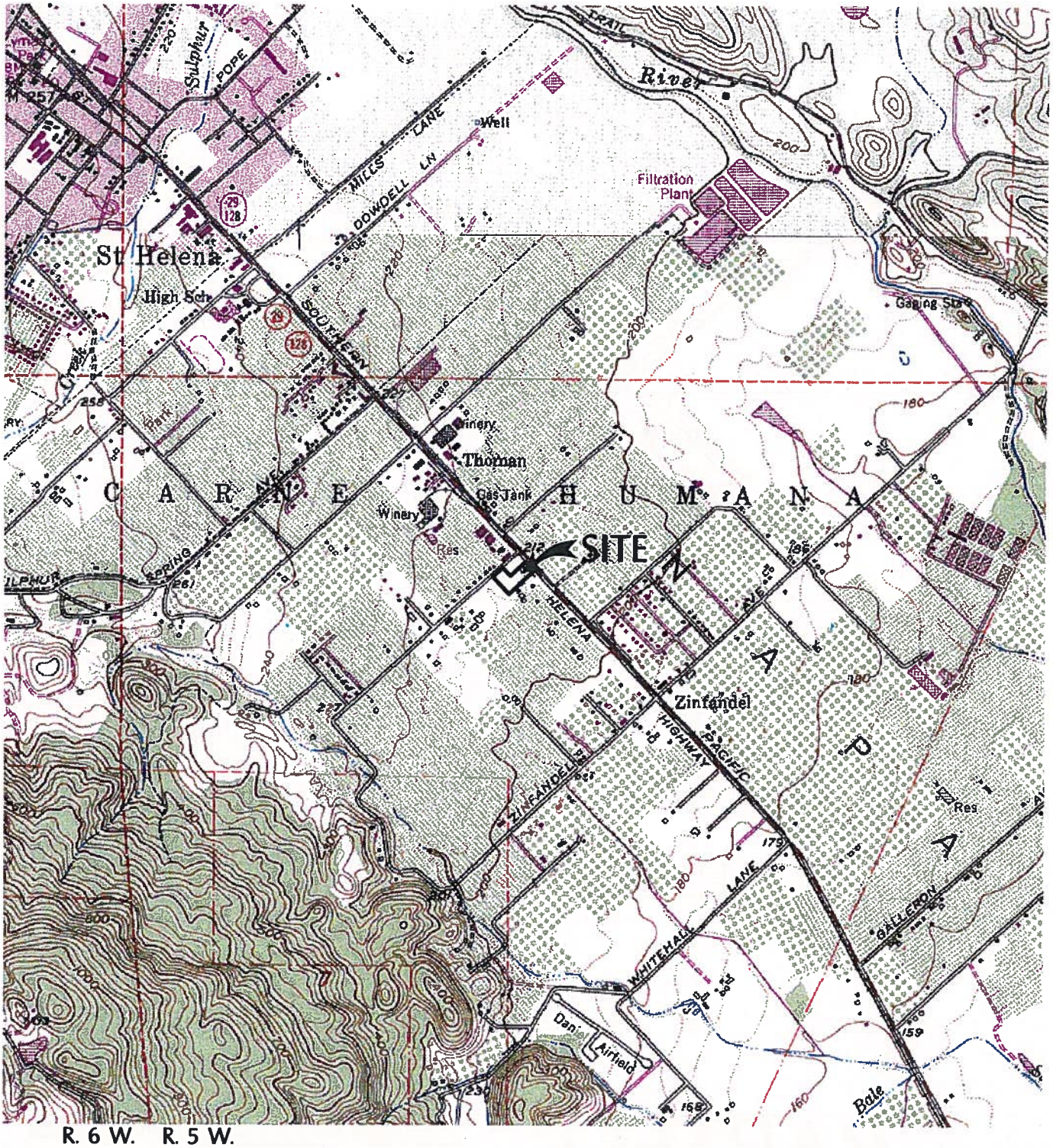
Enclosures

cc: Phillip Smith, Inglewood Business Partners, LLC
Donna Oldford, Plans4wine

TOPOGRAPHIC SITE LOCATION INFORMATION

USGS 7.5 MINUTE QUADRANGLE "RUTHERFORD"

Scale: 1" = 2000'



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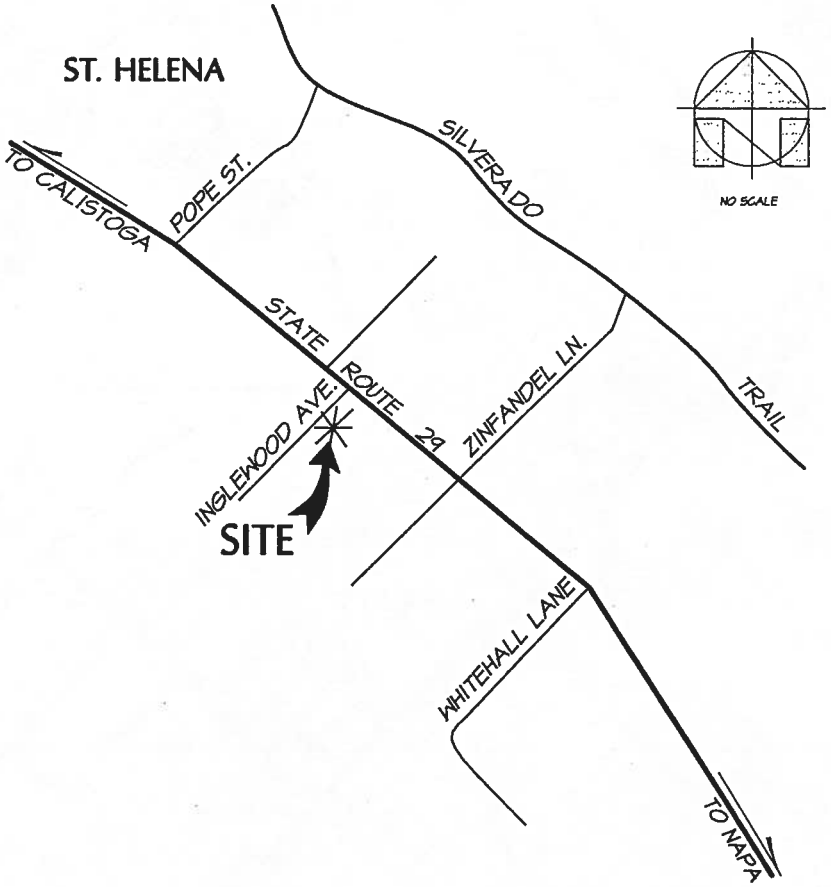
Inglewood Village Business Park
1275 Inglewood Avenue
St. Helena, CA 94574
APN 027-120-063

Job no. 96-48

March 2012



LOCATION MAP

NO SCALE

BARTELT
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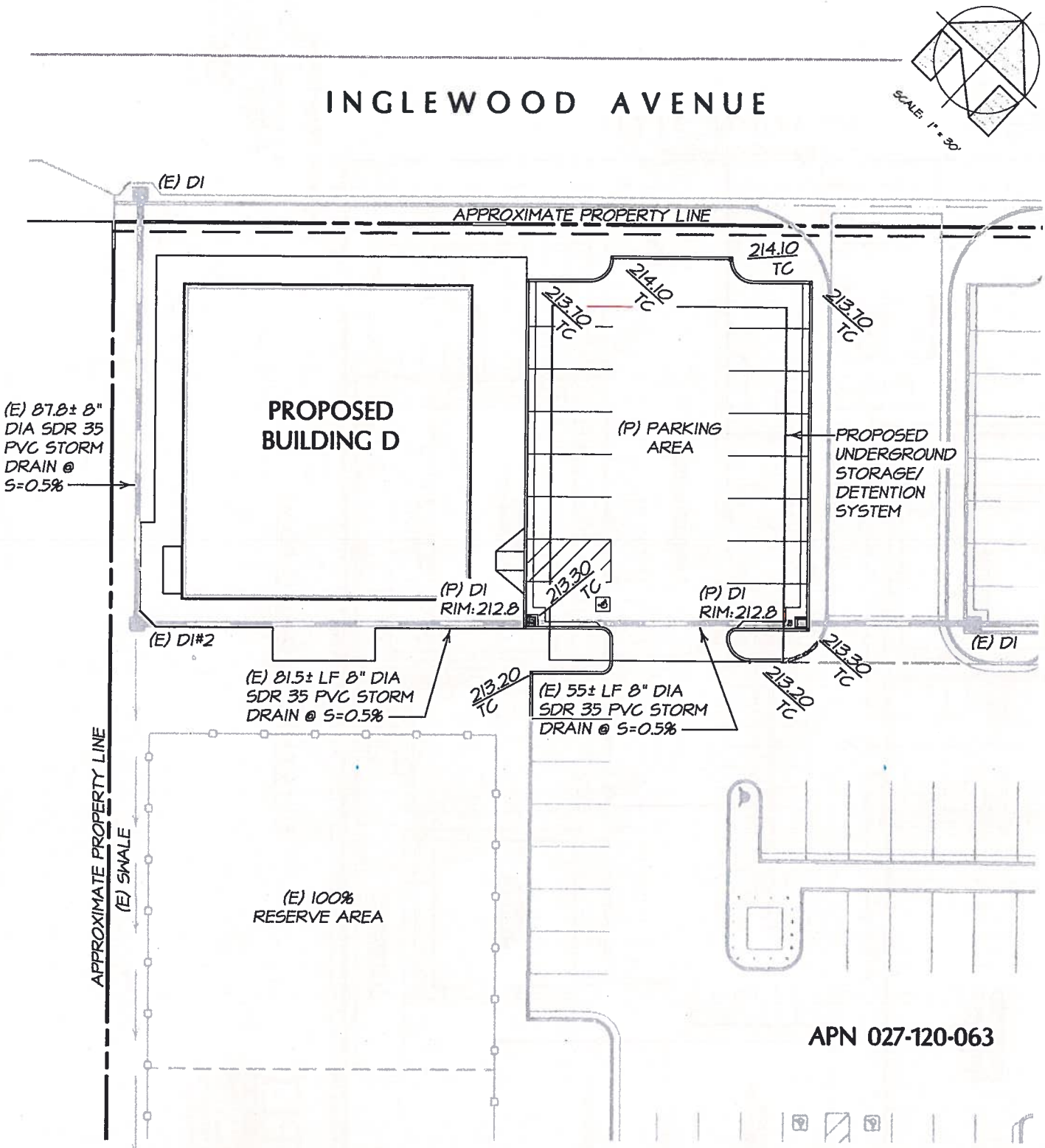
Sheet 1 of 1



PROPOSED STORM DRAIN IMPROVEMENTS

SCALE: 1" = 30'

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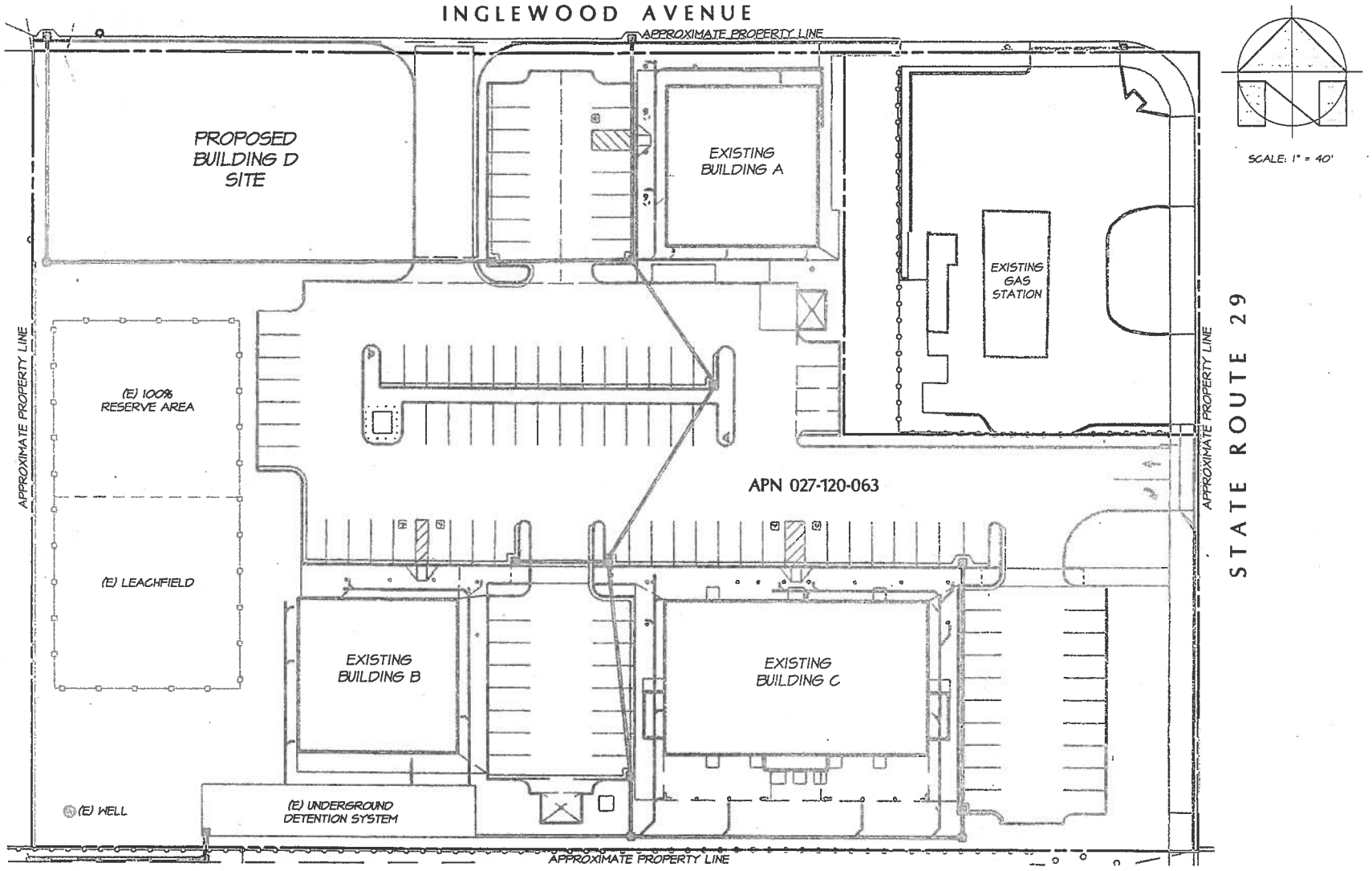
Sheet 1 of 1



EXISTING CONDITIONS

SCALE: 1" = 40'

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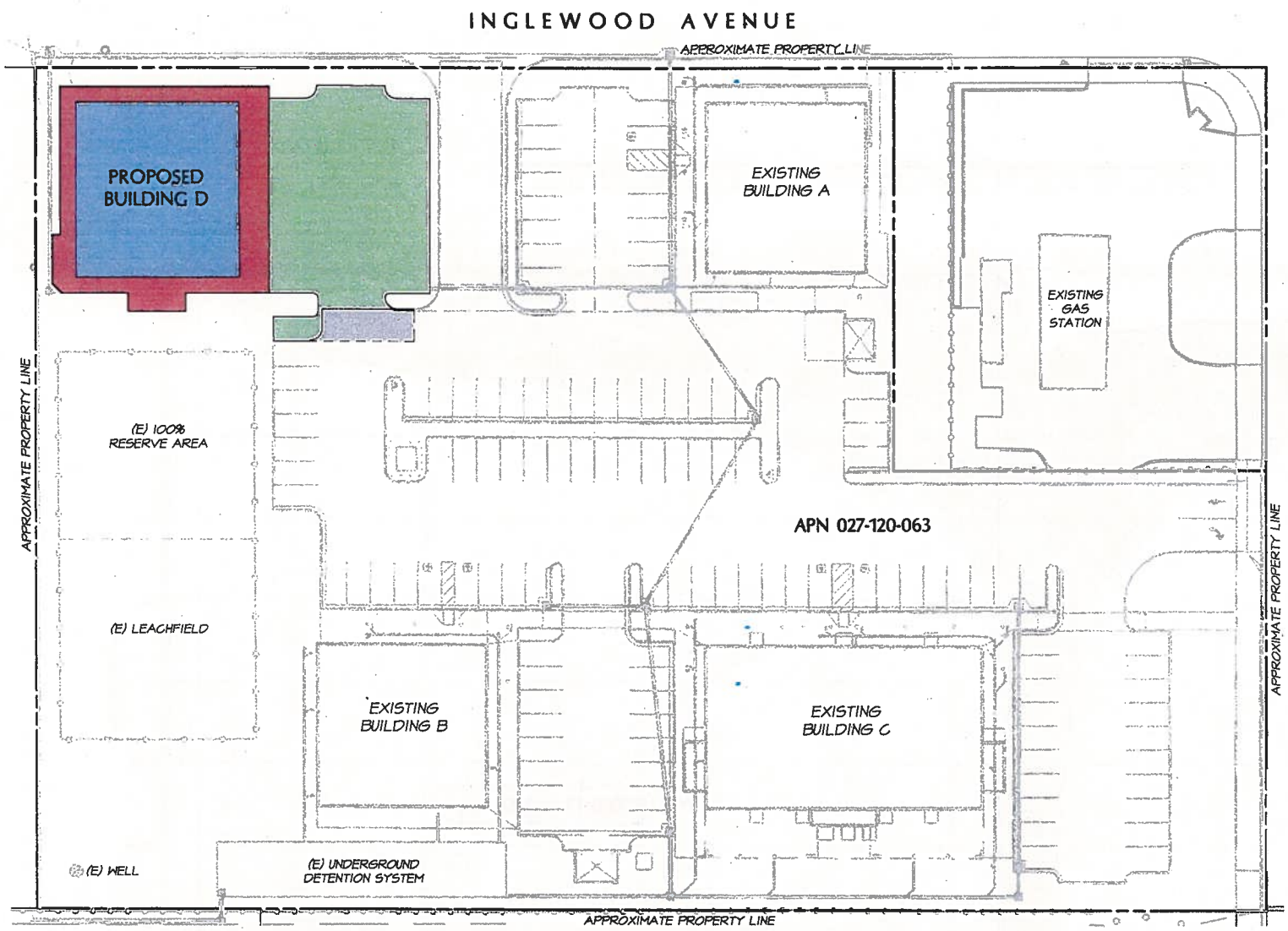
Sheet 1 of 2



SCALE: 1" = 40'

IMPERVIOUS AREAS:

	BUILDING D	=4,095 SQ FT
	PARKING LOT	=4,985 SQ FT
	SIDEWALK	=2,329 SQ FT
	TOTAL NEW IMPERVIOUS	=11,409 SQ FT

PROPOSED CONDITIONS

SCALE: 1" = 40'

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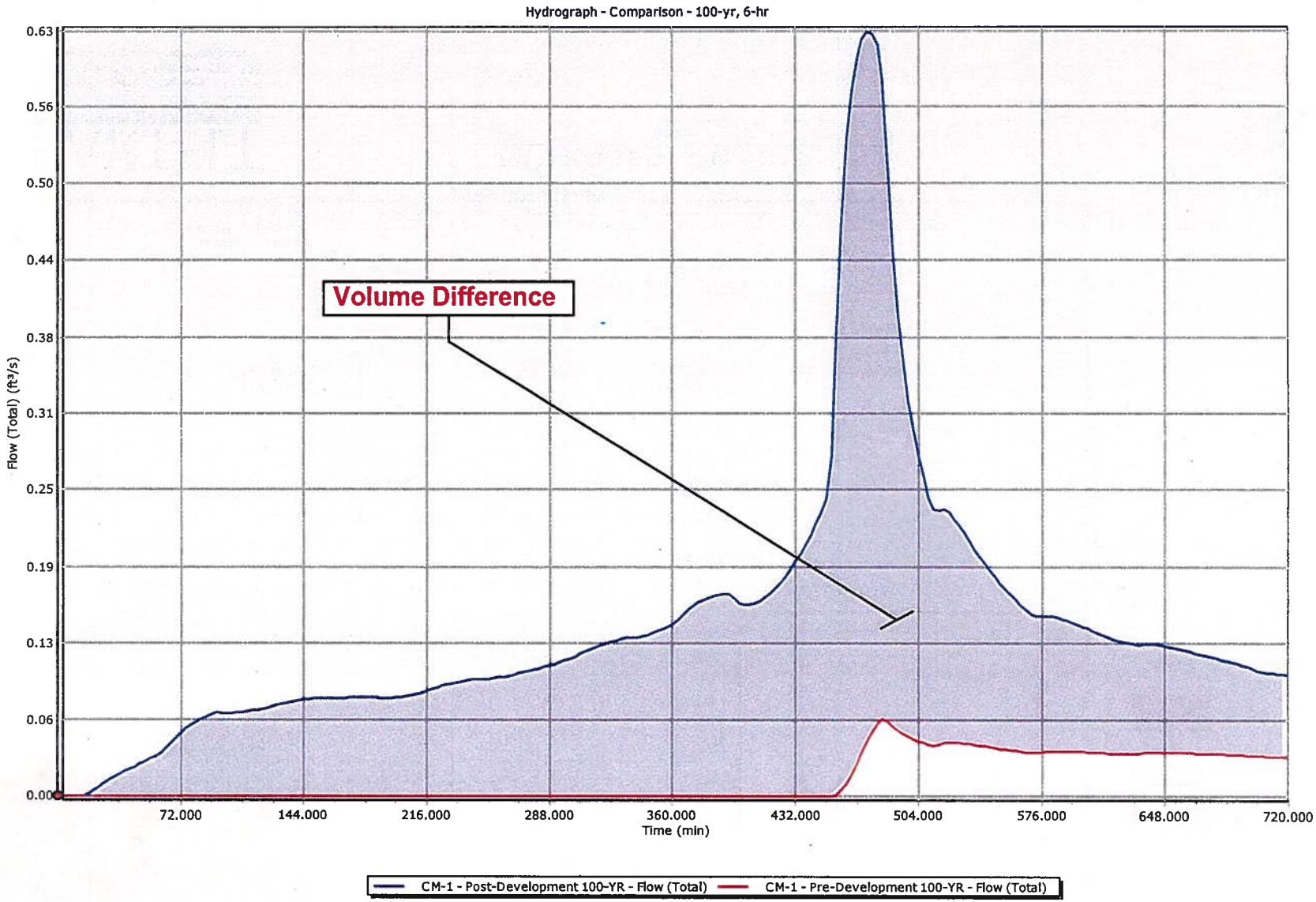
Sheet 2 of 2


Hydrograph - Comparison - 100-yr, 6-hr
Volume Difference
Flow (Total) (ft³/s)
0.63
0.56
0.50
0.44
0.38
0.31
0.25
0.19
0.13
0.06
0.00
72.000
144.000
216.000
288.000
360.000
432.000
504.000
576.000
648.000
720.000
Time (min)
CM-1 - Post-Development 100-YR - Flow (Total)
CM-1 - Pre-Development 100-YR - Flow (Total)

Project Summary	
Title	Inglewood Village Business Park - Building "D" - Preliminary Hydrology Study
Engineer	Michael Grimes, RCE
Company	Bartelt Engineering
Date	3/15/2012

Notes	Building "D" development Pre- vs. Post-D analysis for 100-yr, 6-hr 2-yr, 24-hr analysis ----------Version History---------- v0.9 - Preliminary Analysis

Table of Contents

Subsection: User Notifications

User Notifications?	No user notifications generated.

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)
CM-1	Post-Development 100-YR	100	6,039.000	474.000	0.62
CM-1	Pre-Development 100 -YR	100	597.000	483.000	0.06

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)
O-1	Post-Development 100-YR	100	6,039.000	474.000	0.62
O-1	Pre-Development 100 -YR	100	597.000	483.000	0.06

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 100 years
Storm Event: 100-yr (UB)

Time-Depth Curve: 100-yr (UB)	
Label	100-yr (UB)
Start Time	0.000 min
Increment	6.000 min
End Time	1,440.000 min
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 6.000 min
Time on left represents time for first value in each row.

Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.1	0.1
30.000	0.1	0.1	0.1	0.2	0.2
60.000	0.2	0.2	0.3	0.3	0.3
90.000	0.4	0.4	0.4	0.4	0.5
120.000	0.5	0.5	0.6	0.6	0.6
150.000	0.7	0.7	0.7	0.8	0.8
180.000	0.8	0.9	0.9	0.9	0.9
210.000	1.0	1.0	1.1	1.1	1.1
240.000	1.2	1.2	1.2	1.3	1.3
270.000	1.4	1.4	1.4	1.5	1.5
300.000	1.6	1.6	1.7	1.7	1.8
330.000	1.8	1.8	1.9	2.0	2.0
360.000	2.1	2.1	2.2	2.2	2.3
390.000	2.4	2.4	2.5	2.5	2.6
420.000	2.7	2.8	2.8	2.9	3.0
450.000	3.1	3.3	3.5	3.8	4.0
480.000	4.3	4.4	4.5	4.6	4.7
510.000	4.8	4.9	5.0	5.1	5.1
540.000	5.2	5.3	5.3	5.4	5.4
570.000	5.5	5.6	5.6	5.7	5.7
600.000	5.8	5.8	5.9	5.9	6.0
630.000	6.0	6.1	6.1	6.2	6.2
660.000	6.2	6.3	6.3	6.4	6.4
690.000	6.4	6.5	6.5	6.6	6.6
720.000	6.6	6.7	6.7	6.8	6.8
750.000	6.8	6.9	6.9	6.9	7.0
780.000	7.0	7.0	7.1	7.1	7.2
810.000	7.2	7.2	7.3	7.3	7.3
840.000	7.4	7.4	7.4	7.5	7.5
870.000	7.5	7.6	7.6	7.6	7.7
900.000	7.7	7.7	7.8	7.8	7.8
930.000	7.9	7.9	7.9	7.9	8.0
960.000	8.0	8.0	8.1	8.1	8.1
990.000	8.2	8.2	8.2	8.3	8.3

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 100 years
Storm Event: 100-yr (UB)

CUMULATIVE RAINFALL (in)
Output Time Increment = 6.000 min
Time on left represents time for first value in each row.

Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
1,020.000	8.3	8.3	8.4	8.4	8.4
1,050.000	8.5	8.5	8.5	8.5	8.6
1,080.000	8.6	8.6	8.7	8.7	8.7
1,110.000	8.7	8.8	8.8	8.8	8.8
1,140.000	8.9	8.9	8.9	8.9	9.0
1,170.000	9.0	9.0	9.1	9.1	9.1
1,200.000	9.1	9.2	9.2	9.2	9.2
1,230.000	9.2	9.3	9.3	9.3	9.3
1,260.000	9.4	9.4	9.4	9.4	9.5
1,290.000	9.5	9.5	9.5	9.5	9.6
1,320.000	9.6	9.6	9.6	9.7	9.7
1,350.000	9.7	9.7	9.7	9.8	9.8
1,380.000	9.8	9.8	9.8	9.9	9.9
1,410.000	9.9	9.9	9.9	10.0	10.0
1,440.000	10.0	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 100 years
Storm Event: 100-yr (UB)

Time-Depth Curve: 100-yr (UB)	
Label	100-yr (UB)
Start Time	0.000 min
Increment	6.000 min
End Time	1,440.000 min
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 6.000 min
Time on left represents time for first value in each row.

Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.1	0.1
30.000	0.1	0.1	0.1	0.2	0.2
60.000	0.2	0.2	0.3	0.3	0.3
90.000	0.4	0.4	0.4	0.4	0.5
120.000	0.5	0.5	0.6	0.6	0.6
150.000	0.7	0.7	0.7	0.8	0.8
180.000	0.8	0.9	0.9	0.9	0.9
210.000	1.0	1.0	1.1	1.1	1.1
240.000	1.2	1.2	1.2	1.3	1.3
270.000	1.4	1.4	1.4	1.5	1.5
300.000	1.6	1.6	1.7	1.7	1.8
330.000	1.8	1.8	1.9	2.0	2.0
360.000	2.1	2.1	2.2	2.2	2.3
390.000	2.4	2.4	2.5	2.5	2.6
420.000	2.7	2.8	2.8	2.9	3.0
450.000	3.1	3.3	3.5	3.8	4.0
480.000	4.3	4.4	4.5	4.6	4.7
510.000	4.8	4.9	5.0	5.1	5.1
540.000	5.2	5.3	5.3	5.4	5.4
570.000	5.5	5.6	5.6	5.7	5.7
600.000	5.8	5.8	5.9	5.9	6.0
630.000	6.0	6.1	6.1	6.2	6.2
660.000	6.2	6.3	6.3	6.4	6.4
690.000	6.4	6.5	6.5	6.6	6.6
720.000	6.6	6.7	6.7	6.8	6.8
750.000	6.8	6.9	6.9	6.9	7.0
780.000	7.0	7.0	7.1	7.1	7.2
810.000	7.2	7.2	7.3	7.3	7.3
840.000	7.4	7.4	7.4	7.5	7.5
870.000	7.5	7.6	7.6	7.6	7.7
900.000	7.7	7.7	7.8	7.8	7.8
930.000	7.9	7.9	7.9	7.9	8.0
960.000	8.0	8.0	8.1	8.1	8.1
990.000	8.2	8.2	8.2	8.3	8.3

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 100 years
Storm Event: 100-yr (UB)

CUMULATIVE RAINFALL (in)
Output Time Increment = 6.000 min
Time on left represents time for first value in each row.

Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
1,020.000	8.3	8.3	8.4	8.4	8.4
1,050.000	8.5	8.5	8.5	8.5	8.6
1,080.000	8.6	8.6	8.7	8.7	8.7
1,110.000	8.7	8.8	8.8	8.8	8.8
1,140.000	8.9	8.9	8.9	8.9	9.0
1,170.000	9.0	9.0	9.1	9.1	9.1
1,200.000	9.1	9.2	9.2	9.2	9.2
1,230.000	9.2	9.3	9.3	9.3	9.3
1,260.000	9.4	9.4	9.4	9.4	9.5
1,290.000	9.5	9.5	9.5	9.5	9.6
1,320.000	9.6	9.6	9.6	9.7	9.7
1,350.000	9.7	9.7	9.7	9.8	9.8
1,380.000	9.8	9.8	9.8	9.9	9.9
1,410.000	9.9	9.9	9.9	10.0	10.0
1,440.000	10.0	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	100-yr (UB)
Return Event	100 years
Duration	720.000 min
Depth	10.0 in
Time of Concentration (Composite)	10.000 min
Area (User Defined)	11,409.000 ft²

Computational Time Increment	1.333 min
Time to Peak (Computed)	474.667 min
Flow (Peak, Computed)	0.62 ft³/s
Output Increment	3.000 min
Time to Flow (Peak Interpolated Output)	474.000 min
Flow (Peak Interpolated Output)	0.62 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	11,409.000 ft²
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	6.6 in
Runoff Volume (Pervious)	6,285.711 ft³

Hydrograph Volume (Area under Hydrograph curve)	
Volume	6,039.000 ft³

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	10.000 min
Computational Time Increment	1.333 min
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670

SCS Unit Hydrograph Parameters	
Unit peak, qp	1.78 ft³/s
Unit peak time, Tp	6.667 min
Unit receding limb, Tr	26.667 min
Total unit time, Tb	33.333 min

Storm Event	100-yr (UB)
Return Event	100 years
Duration	720.000 min
Depth	10.0 in
Time of Concentration (Composite)	10.000 min
Area (User Defined)	11,409.000 ft²

Computational Time Increment	1.333 min
Time to Peak (Computed)	482.667 min
Flow (Peak, Computed)	0.06 ft³/s
Output Increment	3.000 min
Time to Flow (Peak Interpolated Output)	483.000 min
Flow (Peak Interpolated Output)	0.06 ft³/s

Drainage Area	
SCS CN (Composite)	39.000
Area (User Defined)	11,409.000 ft²
Maximum Retention (Pervious)	15.6 in
Maximum Retention (Pervious, 20 percent)	3.1 in

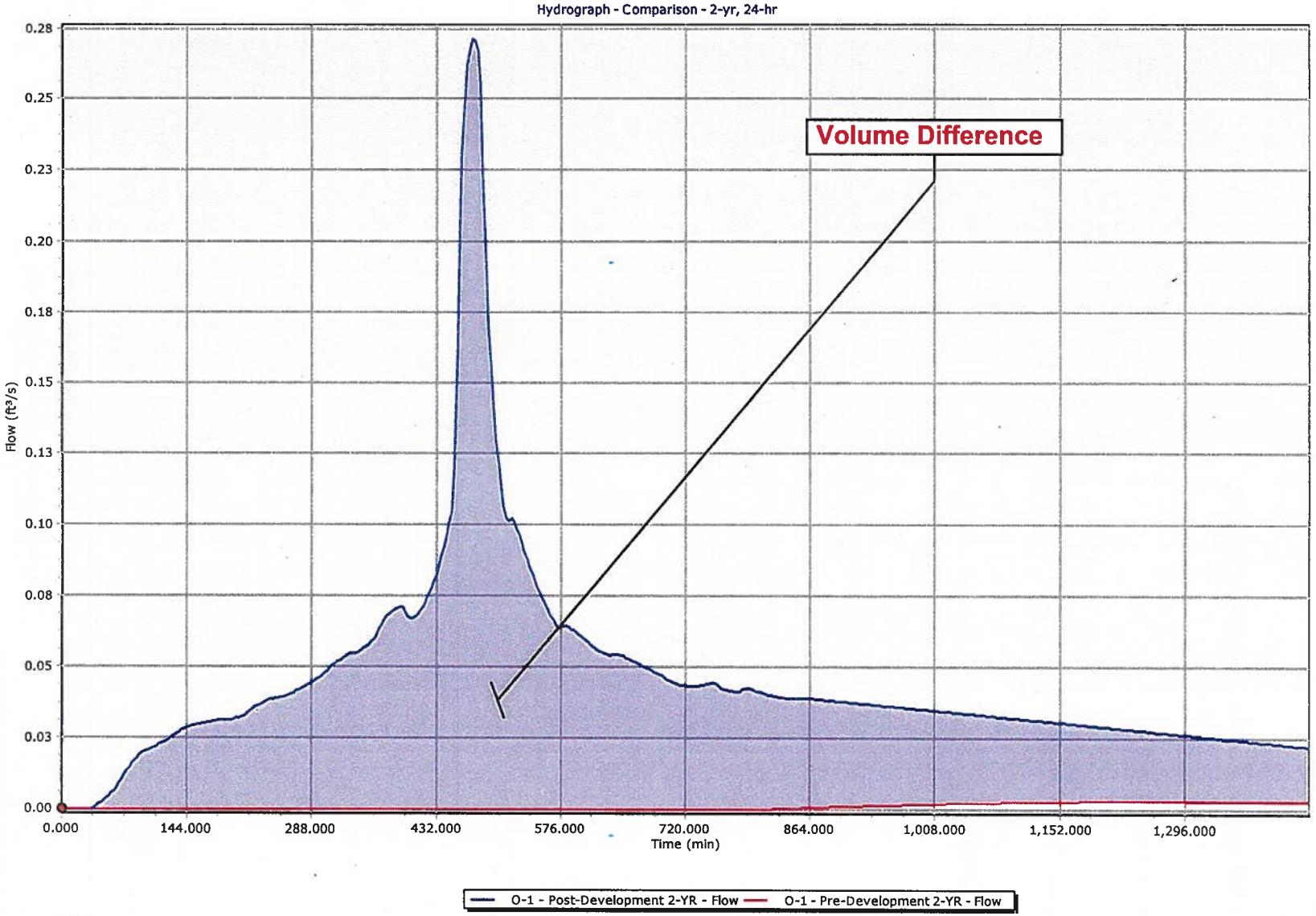
Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.7 in
Runoff Volume (Pervious)	674.887 ft³

Hydrograph Volume (Area under Hydrograph curve)	
Volume	597.000 ft³

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	10.000 min
Computational Time Increment	1.333 min
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670

SCS Unit Hydrograph Parameters	
Unit peak, qp	1.78 ft³/s
Unit peak time, Tp	6.667 min
Unit receding limb, Tr	26.667 min
Total unit time, Tb	33.333 min

Index


Hydrograph - Comparison - 2-yr, 24-hr
Volume Difference
Flow (ft³/s)
0.28
0.25
0.23
0.20
0.18
0.15
0.13
0.10
0.08
0.05
0.03
0.00
0.000
144.000
288.000
432.000
576.000
720.000
864.000
1,008.000
1,152.000
1,296.000
Time (min)
O-1 - Post-Development 2-YR - Flow
O-1 - Pre-Development 2-YR - Flow

Project Summary	
Title	Inglewood Village Business Park - Building "D" - Preliminary Hydrology Study
Engineer	Michael Grimes, RCE
Company	Bartelt Engineering
Date	3/15/2012

Notes	Building "D" development Pre- vs. Post-D analysis for 100-yr, 6-hr 2-yr, 24-hr analysis ----------Version History---------- v0.9 - Preliminary Analysis

Table of Contents

Subsection: User Notifications

User Notifications?	No user notifications generated.

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)
CM-1	Pre-Development 2-YR	2	88.000	1,365.000	0.00
CM-1	Post-Development 2-YR	2	3,939.000	474.000	0.27

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)
O-1	Pre-Development 2-YR	2	88.000	1,365.000	0.00
O-1	Post-Development 2-YR	2	3,939.000	474.000	0.27

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 2 years
Storm Event: 2-yr (UB)

Time-Depth Curve: 2-yr (UB)	
Label	2-yr (UB)
Start Time	0.000 min
Increment	6.000 min
End Time	1,440.000 min
Return Event	2 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 6.000 min
Time on left represents time for first value in each row.

Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
30.000	0.0	0.1	0.1	0.1	0.1
60.000	0.1	0.1	0.1	0.1	0.1
90.000	0.2	0.2	0.2	0.2	0.2
120.000	0.2	0.2	0.2	0.3	0.3
150.000	0.3	0.3	0.3	0.3	0.3
180.000	0.4	0.4	0.4	0.4	0.4
210.000	0.4	0.4	0.5	0.5	0.5
240.000	0.5	0.5	0.5	0.6	0.6
270.000	0.6	0.6	0.6	0.6	0.7
300.000	0.7	0.7	0.7	0.7	0.8
330.000	0.8	0.8	0.8	0.9	0.9
360.000	0.9	0.9	1.0	1.0	1.0
390.000	1.0	1.1	1.1	1.1	1.1
420.000	1.2	1.2	1.2	1.3	1.3
450.000	1.4	1.5	1.6	1.7	1.8
480.000	1.9	1.9	2.0	2.0	2.1
510.000	2.1	2.1	2.2	2.2	2.3
540.000	2.3	2.3	2.3	2.4	2.4
570.000	2.4	2.4	2.5	2.5	2.5
600.000	2.5	2.6	2.6	2.6	2.6
630.000	2.6	2.7	2.7	2.7	2.7
660.000	2.7	2.8	2.8	2.8	2.8
690.000	2.8	2.8	2.9	2.9	2.9
720.000	2.9	2.9	2.9	3.0	3.0
750.000	3.0	3.0	3.0	3.0	3.1
780.000	3.1	3.1	3.1	3.1	3.1
810.000	3.2	3.2	3.2	3.2	3.2
840.000	3.2	3.2	3.3	3.3	3.3
870.000	3.3	3.3	3.3	3.3	3.4
900.000	3.4	3.4	3.4	3.4	3.4
930.000	3.4	3.5	3.5	3.5	3.5
960.000	3.5	3.5	3.5	3.6	3.6
990.000	3.6	3.6	3.6	3.6	3.6

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 2 years
Storm Event: 2-yr (UB)

CUMULATIVE RAINFALL (in)
Output Time Increment = 6.000 min
Time on left represents time for first value in each row.

Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
1,020.000	3.6	3.7	3.7	3.7	3.7
1,050.000	3.7	3.7	3.7	3.8	3.8
1,080.000	3.8	3.8	3.8	3.8	3.8
1,110.000	3.8	3.8	3.9	3.9	3.9
1,140.000	3.9	3.9	3.9	3.9	3.9
1,170.000	4.0	4.0	4.0	4.0	4.0
1,200.000	4.0	4.0	4.0	4.0	4.0
1,230.000	4.1	4.1	4.1	4.1	4.1
1,260.000	4.1	4.1	4.1	4.1	4.2
1,290.000	4.2	4.2	4.2	4.2	4.2
1,320.000	4.2	4.2	4.2	4.2	4.2
1,350.000	4.3	4.3	4.3	4.3	4.3
1,380.000	4.3	4.3	4.3	4.3	4.3
1,410.000	4.3	4.4	4.4	4.4	4.4
1,440.000	4.4	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 2 years
Storm Event: 2-yr (UB)

Time-Depth Curve: 2-yr (UB)	
Label	2-yr (UB)
Start Time	0.000 min
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End Time	1,440.000 min
Return Event	2 years

CUMULATIVE RAINFALL (in)
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Time on left represents time for first value in each row.

Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
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30.000	0.0	0.1	0.1	0.1	0.1
60.000	0.1	0.1	0.1	0.1	0.1
90.000	0.2	0.2	0.2	0.2	0.2
120.000	0.2	0.2	0.2	0.3	0.3
150.000	0.3	0.3	0.3	0.3	0.3
180.000	0.4	0.4	0.4	0.4	0.4
210.000	0.4	0.4	0.5	0.5	0.5
240.000	0.5	0.5	0.5	0.6	0.6
270.000	0.6	0.6	0.6	0.6	0.7
300.000	0.7	0.7	0.7	0.7	0.8
330.000	0.8	0.8	0.8	0.9	0.9
360.000	0.9	0.9	1.0	1.0	1.0
390.000	1.0	1.1	1.1	1.1	1.1
420.000	1.2	1.2	1.2	1.3	1.3
450.000	1.4	1.5	1.6	1.7	1.8
480.000	1.9	1.9	2.0	2.0	2.1
510.000	2.1	2.1	2.2	2.2	2.3
540.000	2.3	2.3	2.3	2.4	2.4
570.000	2.4	2.4	2.5	2.5	2.5
600.000	2.5	2.6	2.6	2.6	2.6
630.000	2.6	2.7	2.7	2.7	2.7
660.000	2.7	2.8	2.8	2.8	2.8
690.000	2.8	2.8	2.9	2.9	2.9
720.000	2.9	2.9	2.9	3.0	3.0
750.000	3.0	3.0	3.0	3.0	3.1
780.000	3.1	3.1	3.1	3.1	3.1
810.000	3.2	3.2	3.2	3.2	3.2
840.000	3.2	3.2	3.3	3.3	3.3
870.000	3.3	3.3	3.3	3.3	3.4
900.000	3.4	3.4	3.4	3.4	3.4
930.000	3.4	3.5	3.5	3.5	3.5
960.000	3.5	3.5	3.5	3.6	3.6
990.000	3.6	3.6	3.6	3.6	3.6

Subsection: Time-Depth Curve
Label: Time-Depth -NOAA-IVBP

Return Event: 2 years
Storm Event: 2-yr (UB)

CUMULATIVE RAINFALL (in)
Output Time Increment = 6.000 min
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Time (min)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
1,020.000	3.6	3.7	3.7	3.7	3.7
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1,080.000	3.8	3.8	3.8	3.8	3.8
1,110.000	3.8	3.8	3.9	3.9	3.9
1,140.000	3.9	3.9	3.9	3.9	3.9
1,170.000	4.0	4.0	4.0	4.0	4.0
1,200.000	4.0	4.0	4.0	4.0	4.0
1,230.000	4.1	4.1	4.1	4.1	4.1
1,260.000	4.1	4.1	4.1	4.1	4.2
1,290.000	4.2	4.2	4.2	4.2	4.2
1,320.000	4.2	4.2	4.2	4.2	4.2
1,350.000	4.3	4.3	4.3	4.3	4.3
1,380.000	4.3	4.3	4.3	4.3	4.3
1,410.000	4.3	4.4	4.4	4.4	4.4
1,440.000	4.4	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	2-yr (UB)
Return Event	2 years
Duration	1,440.000 min
Depth	4.4 in
Time of Concentration (Composite)	10.000 min
Area (User Defined)	11,409.000 ft²

Computational Time Increment	1.333 min
Time to Peak (Computed)	474.667 min
Flow (Peak, Computed)	0.27 ft³/s
Output Increment	3.000 min
Time to Flow (Peak Interpolated Output)	474.000 min
Flow (Peak Interpolated Output)	0.27 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	11,409.000 ft²
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	4.2 in
Runoff Volume (Pervious)	3,949.693 ft³

Hydrograph Volume (Area under Hydrograph curve)	
Volume	3,939.000 ft³

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	10.000 min
Computational Time Increment	1.333 min
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670

Subsection: Unit Hydrograph Summary
Label: CM-1

Return Event: 2 years
Storm Event: 2-yr (UB)

SCS Unit Hydrograph Parameters	
Unit peak, qp	1.78 ft³/s
Unit peak time, Tp	6.667 min
Unit receding limb, Tr	26.667 min
Total unit time, Tb	33.333 min

Storm Event	2-yr (UB)
Return Event	2 years
Duration	1,440.000 min
Depth	4.4 in
Time of Concentration (Composite)	10.000 min
Area (User Defined)	11,409.000 ft²

Computational Time Increment	1.333 min
Time to Peak (Computed)	1,365.333 min
Flow (Peak, Computed)	0.00 ft³/s
Output Increment	3.000 min
Time to Flow (Peak Interpolated Output)	1,365.000 min
Flow (Peak Interpolated Output)	0.00 ft³/s

Drainage Area	
SCS CN (Composite)	39.000
Area (User Defined)	11,409.000 ft²
Maximum Retention (Pervious)	15.6 in
Maximum Retention (Pervious, 20 percent)	3.1 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.1 in
Runoff Volume (Pervious)	89.560 ft³

Hydrograph Volume (Area under Hydrograph curve)	
Volume	88.000 ft³

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	10.000 min
Computational Time Increment	1.333 min
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670

Subsection: Unit Hydrograph Summary
Label: CM-1

Return Event: 2 years
Storm Event: 2-yr (UB)

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Unit peak, qp	1.78 ft³/s
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Unit receding limb, Tr	26.667 min
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Index

NOAA Atlas 14, Volume 6, Version 2
Location name: St Helena, California, US*
Coordinates: 38.4872, -122.4499
Elevation: 214 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.136 (0.121-0.154)	0.165 (0.147-0.188)	0.205 (0.181-0.233)	0.237 (0.208-0.273)	0.282 (0.238-0.337)	0.317 (0.261-0.388)	0.353 (0.283-0.444)	0.390 (0.303-0.508)	0.442 (0.327-0.603)	0.483 (0.344-0.686)
10-min	0.195 (0.173-0.221)	0.237 (0.211-0.270)	0.293 (0.260-0.335)	0.340 (0.298-0.391)	0.404 (0.341-0.483)	0.454 (0.374-0.556)	0.505 (0.405-0.637)	0.559 (0.434-0.728)	0.634 (0.469-0.865)	0.693 (0.494-0.983)
15-min	0.236 (0.210-0.268)	0.287 (0.255-0.326)	0.355 (0.314-0.405)	0.411 (0.360-0.473)	0.488 (0.412-0.584)	0.549 (0.452-0.672)	0.611 (0.490-0.770)	0.676 (0.525-0.880)	0.767 (0.568-1.05)	0.838 (0.597-1.19)
30-min	0.352 (0.313-0.400)	0.429 (0.381-0.488)	0.531 (0.470-0.605)	0.614 (0.539-0.707)	0.730 (0.616-0.873)	0.820 (0.676-1.00)	0.914 (0.732-1.15)	1.01 (0.785-1.32)	1.15 (0.849-1.56)	1.25 (0.892-1.78)
60-min	0.521 (0.463-0.591)	0.634 (0.563-0.721)	0.784 (0.694-0.894)	0.908 (0.797-1.04)	1.08 (0.911-1.29)	1.21 (0.999-1.49)	1.35 (1.08-1.70)	1.50 (1.16-1.95)	1.69 (1.25-2.31)	1.85 (1.32-2.63)
2-hr	0.797 (0.709-0.905)	0.966 (0.858-1.10)	1.19 (1.05-1.35)	1.36 (1.19-1.57)	1.60 (1.35-1.91)	1.77 (1.46-2.17)	1.95 (1.57-2.46)	2.14 (1.66-2.78)	2.38 (1.76-3.24)	2.56 (1.83-3.64)
3-hr	1.02 (0.912-1.16)	1.24 (1.10-1.41)	1.52 (1.34-1.73)	1.74 (1.52-2.00)	2.03 (1.71-2.42)	2.25 (1.85-2.75)	2.46 (1.97-3.10)	2.68 (2.08-3.49)	2.97 (2.20-4.05)	3.18 (2.27-4.51)
6-hr	1.55 (1.38-1.76)	1.88 (1.67-2.14)	2.30 (2.03-2.62)	2.62 (2.30-3.02)	3.05 (2.58-3.65)	3.37 (2.78-4.13)	3.68 (2.95-4.64)	3.99 (3.10-5.20)	4.40 (3.26-6.00)	4.70 (3.35-6.67)
12-hr	2.21 (1.97-2.52)	2.72 (2.41-3.09)	3.35 (2.97-3.82)	3.85 (3.38-4.44)	4.51 (3.81-5.40)	5.00 (4.13-6.13)	5.49 (4.40-6.92)	5.97 (4.64-7.78)	6.61 (4.89-9.01)	7.08 (5.04-10.0)
24-hr	3.10 (2.79-3.52)	3.87 (3.47-4.39)	4.85 (4.35-5.52)	5.63 (5.01-6.46)	6.67 (5.77-7.85)	7.44 (6.33-8.92)	8.21 (6.85-10.0)	8.98 (7.32-11.2)	10.0 (7.88-13.0)	10.8 (8.24-14.4)
2-day	4.07 (3.66-4.62)	5.19 (4.66-5.89)	6.60 (5.92-7.51)	7.72 (6.87-8.85)	9.19 (7.96-10.8)	10.3 (8.76-12.3)	11.4 (9.48-13.9)	12.5 (10.2-15.6)	13.9 (10.9-18.0)	14.9 (11.4-19.9)
3-day	4.69 (4.22-5.33)	6.04 (5.42-6.86)	7.74 (6.94-8.81)	9.08 (8.08-10.4)	10.8 (9.39-12.8)	12.1 (10.3-14.6)	13.4 (11.2-16.4)	14.7 (12.0-18.4)	16.4 (12.9-21.3)	17.7 (13.5-23.6)
4-day	5.20 (4.68-5.91)	6.71 (6.03-7.63)	8.63 (7.73-9.82)	10.1 (9.02-11.6)	12.1 (10.5-14.3)	13.6 (11.6-16.3)	15.0 (12.5-18.4)	16.4 (13.4-20.6)	18.3 (14.4-23.8)	19.7 (15.1-26.3)
7-day	6.47 (5.82-7.34)	8.28 (7.44-9.41)	10.6 (9.49-12.1)	12.4 (11.0-14.2)	14.8 (12.8-17.4)	16.6 (14.1-19.9)	18.4 (15.3-22.4)	20.1 (16.4-25.2)	22.4 (17.7-29.1)	24.2 (18.5-32.3)
10-day	7.38 (6.64-8.38)	9.41 (8.45-10.7)	12.0 (10.7-13.6)	14.0 (12.5-16.1)	16.7 (14.5-19.7)	18.7 (15.9-22.4)	20.6 (17.2-25.2)	22.6 (18.4-28.3)	25.2 (19.8-32.6)	27.1 (20.8-36.2)
20-day	9.75 (8.77-11.1)	12.4 (11.2-14.1)	15.8 (14.1-18.0)	18.4 (16.4-21.1)	21.8 (18.9-25.7)	24.3 (20.7-29.1)	26.7 (22.3-32.7)	29.1 (23.7-36.5)	32.2 (25.4-41.8)	34.6 (26.4-46.1)
30-day	11.6 (10.4-13.2)	14.8 (13.3-16.8)	18.7 (16.8-21.3)	21.7 (19.4-24.9)	25.6 (22.2-30.2)	28.5 (24.2-34.1)	31.2 (26.0-38.2)	33.9 (27.6-42.4)	37.3 (29.4-48.4)	39.8 (30.5-53.1)
45-day	14.1 (12.7-16.0)	17.9 (16.1-20.4)	22.6 (20.2-25.7)	26.1 (23.3-30.0)	30.6 (26.5-36.1)	33.8 (28.8-40.6)	36.9 (30.8-45.1)	39.9 (32.5-49.9)	43.6 (34.3-56.5)	46.3 (35.4-61.7)
60-day	16.7 (15.0-19.0)	21.1 (19.0-24.0)	26.5 (23.7-30.2)	30.5 (27.2-35.0)	35.5 (30.8-41.9)	39.1 (33.3-46.9)	42.5 (35.4-51.9)	45.7 (37.2-57.2)	49.7 (39.1-64.4)	52.5 (40.2-70.0)

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

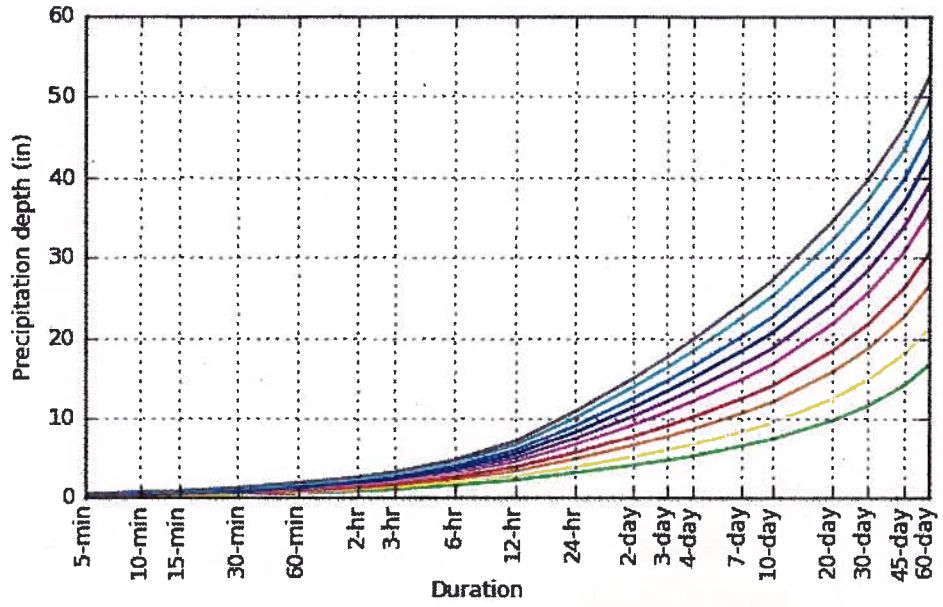
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

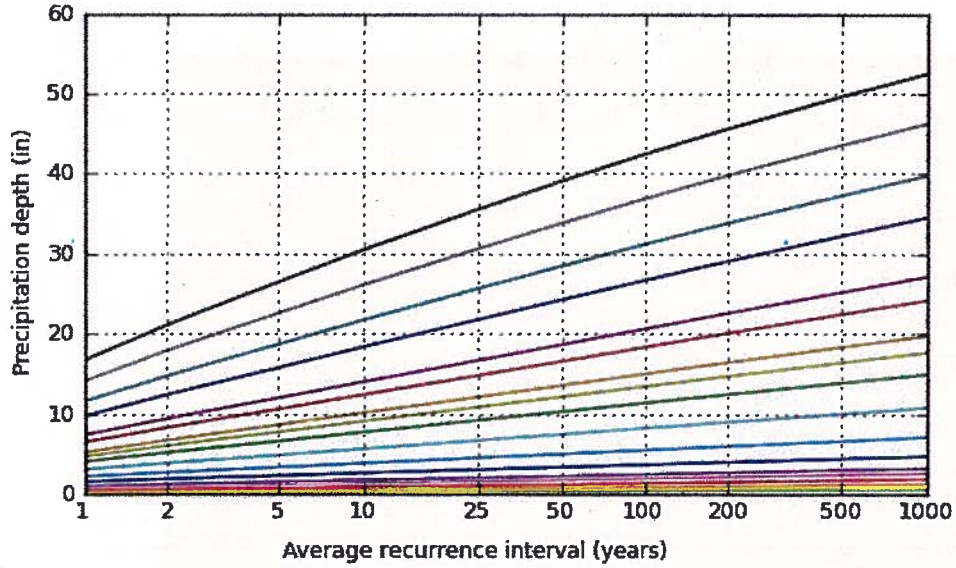
Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Coordinates: 38.4872, -122.4499





Average recurrence interval (years)

1
2
5
10
25
50
100
200
500
1000

NOAA/NWS/OHD/HDSC

Created (GMT): Thu Mar 8 20:01:05 2012

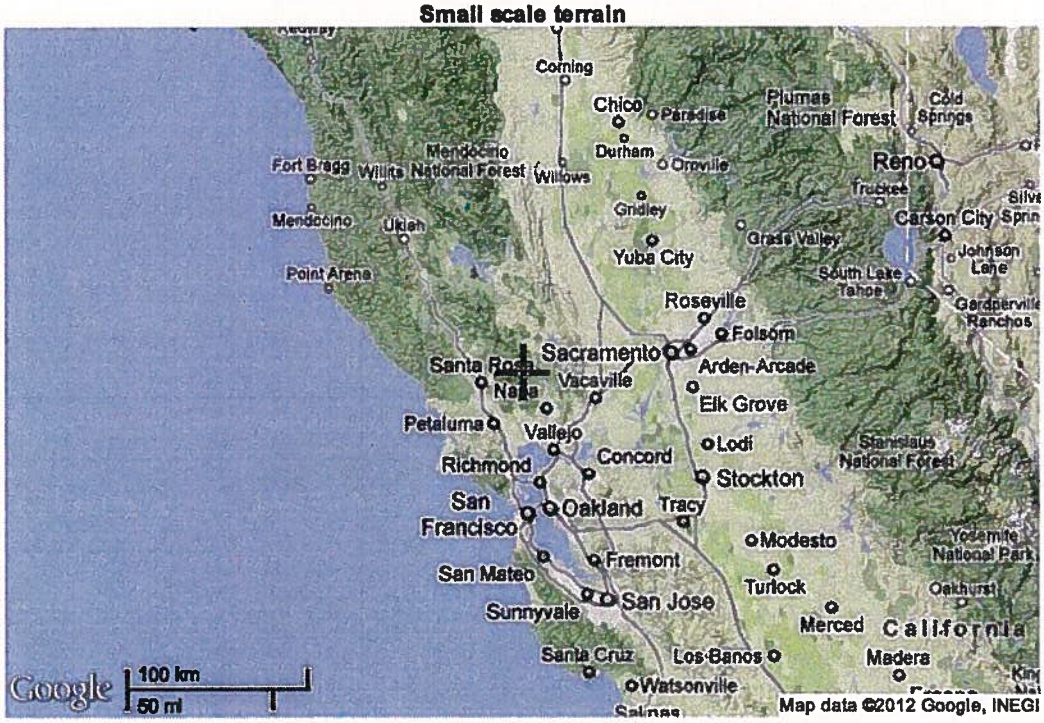
Duration

5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

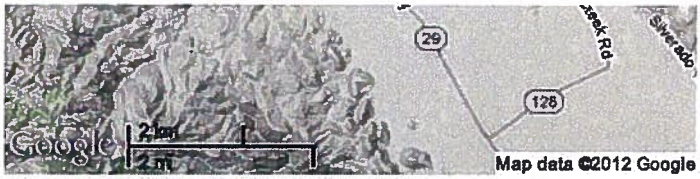
Back to Top

Maps & aerials

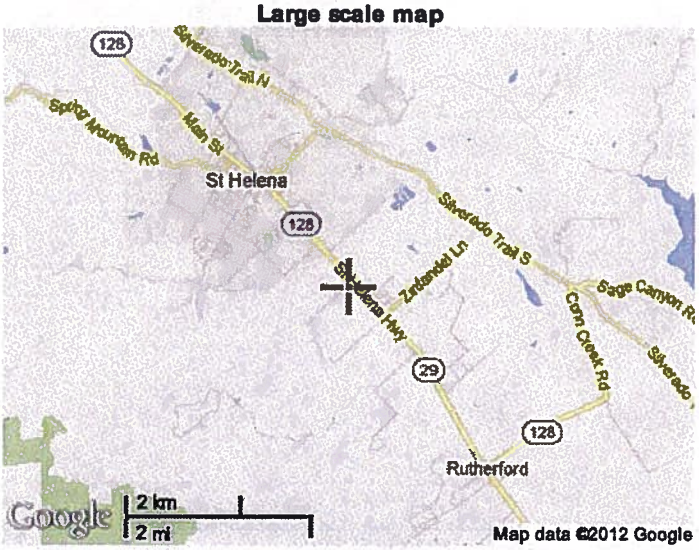
Small scale terrain



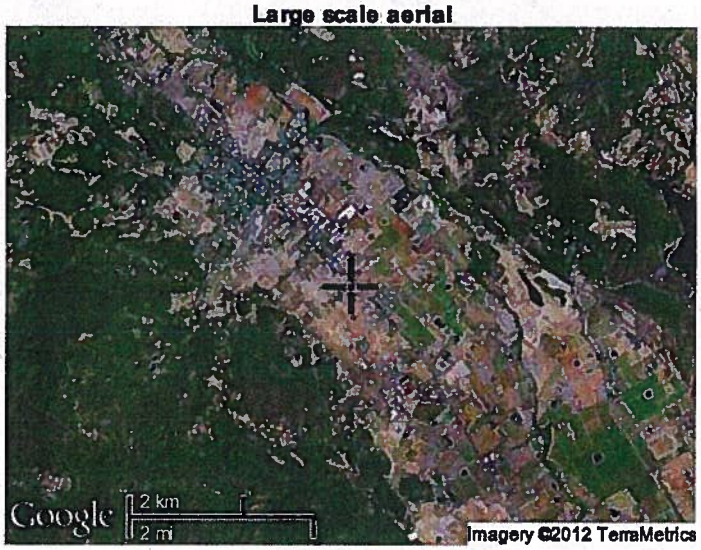
Large scale terrain



Large scale map



Large scale aerial

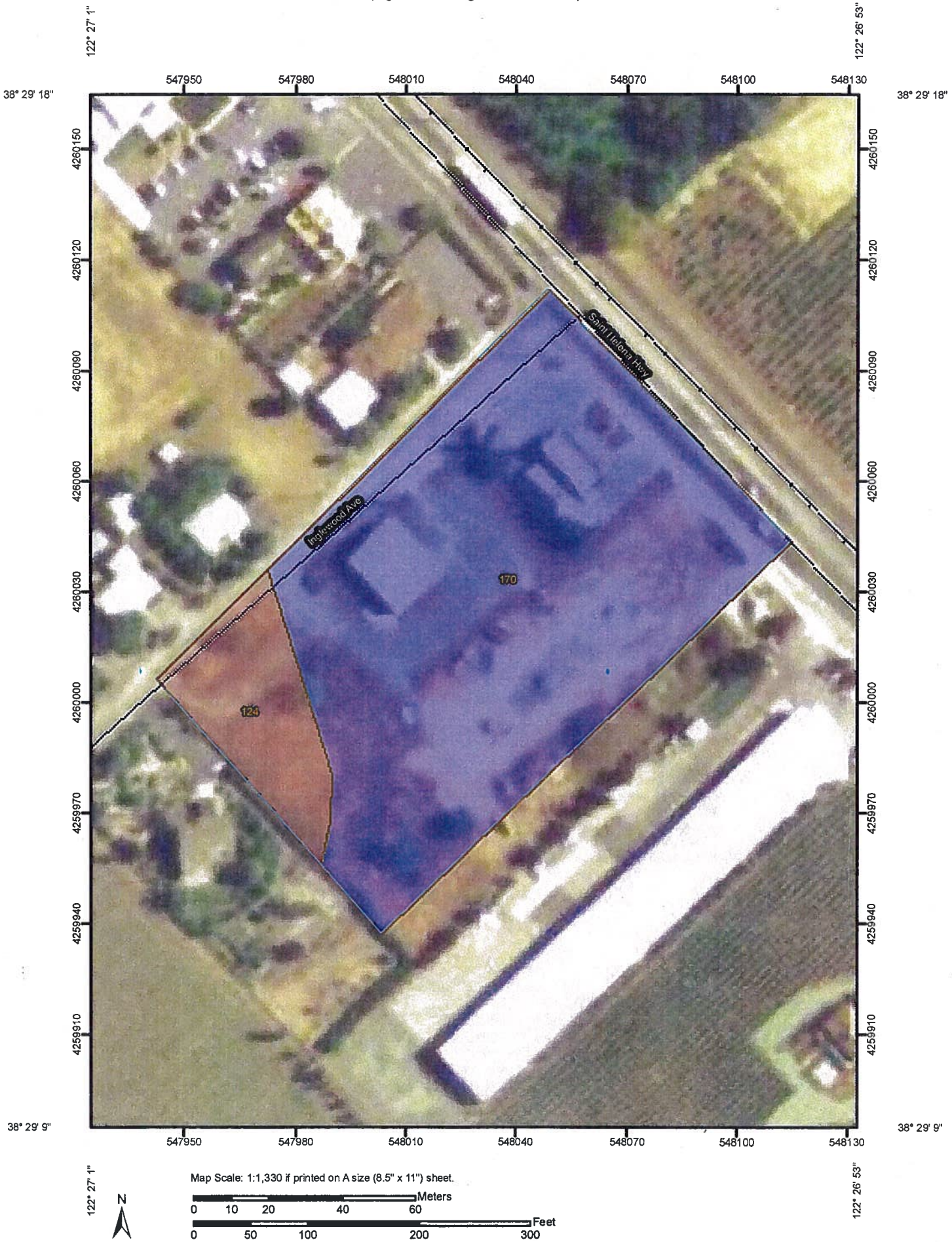


Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Hydrologic Soil Group—Napa County, California
(Inglewood Village Business Park)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:1,330 if printed on A size (8.5" × 11") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

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

Soil Survey Area: Napa County, California
Survey Area Data: Version 4, Dec 10, 2007

Date(s) aerial images were photographed: 6/22/2005

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

Hydrologic Soil Group— Summary by Map Unit — Napa County, California (CA055)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
124	Cortina very gravelly loam, 0 to 5 percent slopes	A	0.4	12.0%
170	Pleasanton loam, 0 to 2 percent slopes	B	3.1	88.0%
Totals for Area of Interest			**3.5**	**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