APN 0438-112-05

Apple Valley, CA 92308

Hydrology Report

Prepared for:
Apple Valley Heights County Water District
Daniel Smith
760-524-2037

Original: November 4, 2022

Prepared under the supervision of:

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CIVIL
STATE OF CALIFORNIA

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Discussion

OVERVIEW

APN 0438-341-05 is a 0.5-acre lot located on north side of Rancho Street in between Central Road and Flora Vista Street in Apple Valley, California. The parcel is currently undeveloped with land cover consisting of desert grasses and shrubs. The parcel is proposed to be developed into utility storage facility with 1 storage building. The lot lies within a low-lying valley that drains a 791.9-acre watershed. According to FEMA the site is located within Flood Zone D which is an area of undetermined flood hazard.

The 791.9-acre watershed includes residential and undeveloped hillside grass and brush coverages (See Land use – Soil Exhibit). The watershed also includes a combination of Hydraulic Soil Type A, B &C. Residential lot sizes averaged 1 acre or 20% imperviousness. The watershed head waters drain north and concentrate in canyons. Flows drain north and concentrate in the valley and then drain west to site which will be concentration point for this study.

PURPOSE

The purpose of this report is to quantify the 100-year flow rate that is tributary to the site and verify improvements will be raised adequately above the 100-year water surface. Unit Hydrograph hydrology will be applied to the drainage area to determine the 100-year flow rate. Hydraulic sections will be cut through the site and AES software will be used to quantify the extent of flooding and determine the 100-year maximum water surface to verify the proposed finished floor elevation is adequately raised above the 100-year water surface.

CRITERIA

The criteria utilized in this report for hydrology-based calculations are set forth by the San Bernardino County Hydrology Manual. AES software was used to perform computations. Unit Hydrograph Hydrology was applied since the watershed is greater than 640 acres to predict peak flow rates. AES software was used to perform hydraulic calculations.

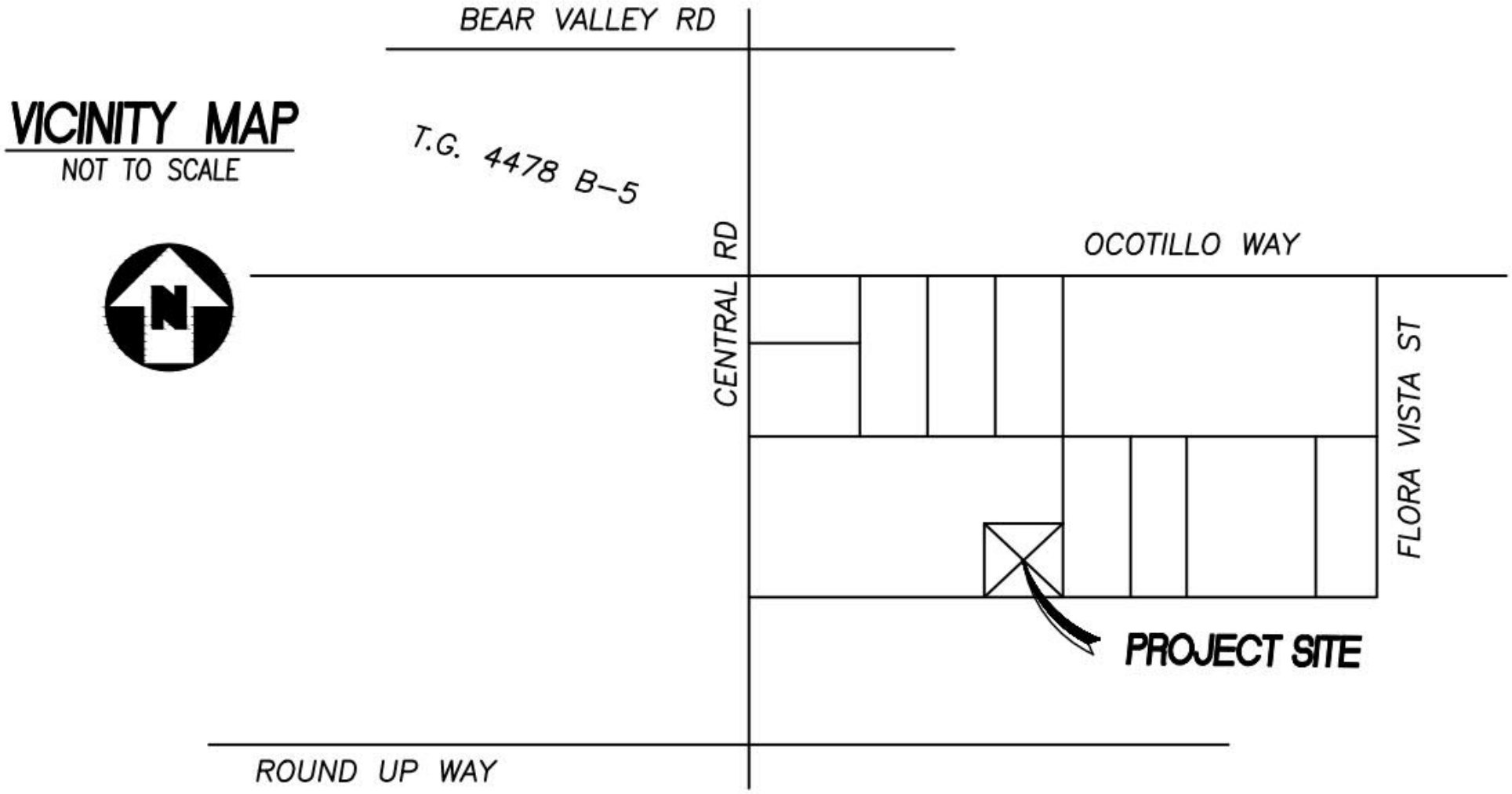
RESULTS

Results indicate the 791.9-acre watershed will produce 1479.87 cfs clear flow during the 100-year storm event. Given the size and characteristics of the watershed there is potential for sediment and debris to be generated. Therefore 1479.87 cfs was bulked by 1.5 to set a design flow rate of 2219.8 cfs. Two sections (See Flood Exhibit) were cut through the proposed project and hydraulic calculations were applies. Section A was cut on the upstream side of the proposed building and was determined to have a maximum 100-year water surface of 101.66 feet. Section B was cut on the downstream side of the proposed building and was determined to have a maximum 100-year water surface of 99.98 feet. Section A has the highest water surface elevation at 101.66 feet. The finished floor elevation of the proposed building is 103.33 feet. Therefore 1.67 feet of freeboard is provided. Therefore, this report concludes that the proposed building finished floor is adequately raised above the 100-year water surface. Calculations and exhibits accompany this discussion to further illustrate findings.

Reference Material

VICINITY MAP

NOT TO SCALE



National Flood Hazard Layer FIRMette

FEMA

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/31/2022 at 1:51 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

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NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth | Units: English | Time series type: Partial duration

Select location

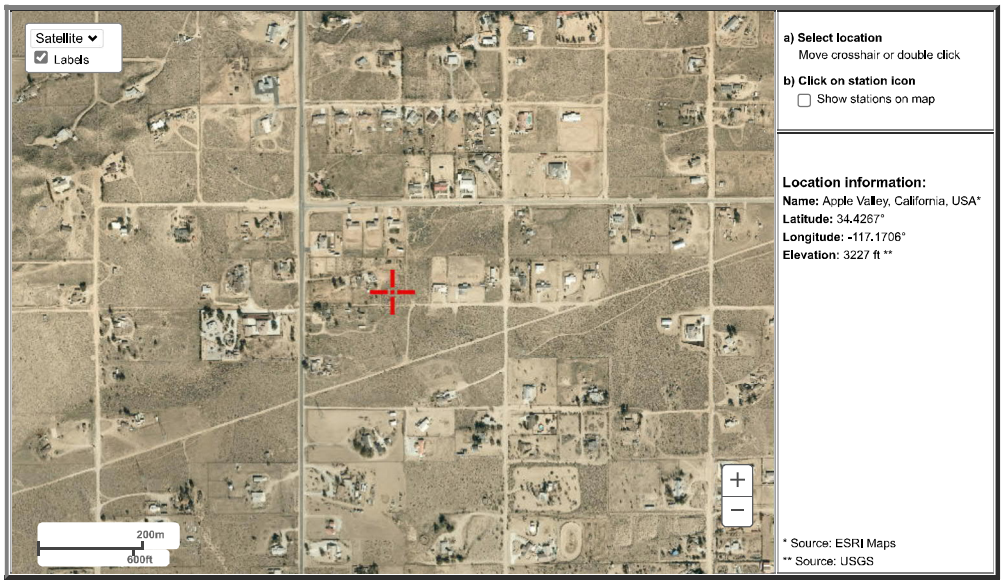
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) By station (list of CA stations): Select station

c) By address Search

2) Use map (if ESRI interactive map is not loading, try adding the host: **https://js.arcgis.com/** to the firewall, or contact us at hdsc.questions@noaa.gov):



POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular | PF graphical | Supplementary information | Print page

PDS-based 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	0.087 (0.072-0.107)	0.120 (0.099-0.147)	0.166 (0.136-0.203)	0.205 (0.167-0.253)	0.260 (0.206-0.333)	0.306 (0.237-0.399)	0.354 (0.267-0.474)	0.405 (0.298-0.558)	0.479 (0.337-0.686)	0.538 (0.366-0.798)
10-min	0.125 (0.103-0.153)	0.172 (0.142-0.211)	0.238 (0.196-0.291)	0.293 (0.239-0.363)	0.373 (0.295-0.477)	0.438 (0.339-0.572)	0.507 (0.383-0.679)	0.581 (0.427-0.799)	0.686 (0.483-0.984)	0.771 (0.525-1.14)
15-min	0.151 (0.125-0.185)	0.208 (0.172-0.255)	0.287 (0.236-0.352)	0.355 (0.290-0.439)	0.452 (0.357-0.577)	0.530 (0.410-0.692)	0.613 (0.463-0.821)	0.703 (0.516-0.967)	0.830 (0.585-1.19)	0.932 (0.635-1.38)
30-min	0.215 (0.178-0.263)	0.296 (0.244-0.362)	0.408 (0.336-0.501)	0.504 (0.412-0.624)	0.642 (0.507-0.821)	0.754 (0.583-0.984)	0.872 (0.659-1.17)	0.999 (0.734-1.38)	1.18 (0.831-1.69)	1.33 (0.902-1.97)
60-min	0.287 (0.237-0.350)	0.395 (0.326-0.483)	0.544 (0.448-0.668)	0.672 (0.549-0.831)	0.856 (0.676-1.09)	1.00 (0.777-1.31)	1.16 (0.878-1.56)	1.33 (0.978-1.83)	1.57 (1.11-2.25)	1.77 (1.20-2.62)
2-hr	0.410 (0.339-0.501)	0.545 (0.450-0.667)	0.732 (0.603-0.899)	0.892 (0.729-1.10)	1.12 (0.896-1.44)	1.31 (1.01-1.71)	1.51 (1.14-2.01)	1.72 (1.26-2.36)	2.01 (1.42-2.88)	2.25 (1.53-3.34)
3-hr	0.503 (0.416-0.615)	0.661 (0.546-0.809)	0.879 (0.724-1.08)	1.07 (0.870-1.32)	1.33 (1.05-1.71)	1.55 (1.20-2.02)	1.78 (1.34-2.38)	2.02 (1.48-2.78)	2.37 (1.67-3.39)	2.64 (1.80-3.92)
6-hr	0.696 (0.575-0.851)	0.907 (0.749-1.11)	1.20 (0.986-1.47)	1.44 (1.18-1.79)	1.80 (1.42-2.30)	2.08 (1.61-2.71)	2.37 (1.79-3.17)	2.69 (1.97-3.70)	3.13 (2.21-4.49)	3.49 (2.37-5.17)
12-hr	0.903 (0.746-1.10)	1.20 (0.989-1.47)	1.60 (1.32-1.96)	1.93 (1.58-2.39)	2.40 (1.90-3.07)	2.77 (2.15-3.62)	3.16 (2.39-4.23)	3.57 (2.62-4.91)	4.13 (2.91-5.93)	4.58 (3.12-6.80)
24-hr	1.19 (1.06-1.38)	1.62 (1.44-1.87)	2.20 (1.94-2.54)	2.68 (2.35-3.12)	3.34 (2.83-4.02)	3.86 (3.20-4.74)	4.40 (3.56-5.54)	4.96 (3.91-6.42)	5.73 (4.34-7.74)	6.34 (4.64-8.86)
2-day	1.42 (1.26-1.63)	1.96 (1.73-2.26)	2.68 (2.37-3.10)	3.29 (2.88-3.83)	4.12 (3.49-4.96)	4.77 (3.96-5.87)	5.45 (4.42-6.86)	6.16 (4.86-7.98)	7.14 (5.40-9.64)	7.92 (5.79-11.1)
3-day	1.53 (1.36-1.77)	2.14 (1.89-2.46)	2.95 (2.61-3.41)	3.62 (3.17-4.22)	4.56 (3.86-5.49)	5.29 (4.39-6.51)	6.06 (4.91-7.63)	6.86 (5.41-8.89)	7.98 (6.03-10.8)	8.87 (6.48-12.4)
4-day	1.64 (1.45-1.88)	2.29 (2.03-2.64)	3.17 (2.80-3.66)	3.90 (3.42-4.54)	4.92 (4.17-5.92)	5.72 (4.75-7.03)	6.55 (5.31-8.25)	7.43 (5.85-9.62)	8.65 (6.55-11.7)	9.63 (7.04-13.5)
7-day	1.81 (1.61-2.09)	2.53 (2.24-2.91)	3.51 (3.10-4.05)	4.33 (3.79-5.04)	5.47 (4.64-6.59)	6.38 (5.30-7.85)	7.33 (5.94-9.23)	8.34 (6.57-10.8)	9.74 (7.37-13.1)	10.9 (7.94-15.2)
10-day	1.93 (1.71-2.22)	2.69 (2.38-3.10)	3.74 (3.30-4.32)	4.61 (4.04-5.38)	5.86 (4.96-7.05)	6.84 (5.68-8.41)	7.88 (6.38-9.92)	8.97 (7.07-11.6)	10.5 (7.95-14.2)	11.7 (8.58-16.4)
20-day	2.27 (2.01-2.61)	3.17 (2.81-3.66)	4.43 (3.91-5.12)	5.49 (4.81-6.40)	7.01 (5.94-8.44)	8.22 (6.83-10.1)	9.50 (7.70-12.0)	10.9 (8.55-14.1)	12.8 (9.65-17.2)	14.3 (10.4-19.9)
30-day	2.62 (2.32-3.01)	3.66 (3.24-4.22)	5.12 (4.52-5.91)	6.35 (5.57-7.40)	8.13 (6.89-9.78)	9.55 (7.92-11.7)	11.0 (8.94-13.9)	12.6 (9.95-16.3)	14.9 (11.2-20.0)	16.6 (12.2-23.2)
45-day	3.10 (2.75-3.57)	4.33 (3.84-4.99)	6.05 (5.34-6.99)	7.52 (6.59-8.76)	9.63 (8.16-11.6)	11.3 (9.41-13.9)	13.1 (10.6-16.5)	15.0 (11.8-19.5)	17.7 (13.4-23.9)	19.8 (14.5-27.7)
60-day	3.49 (3.10-4.02)	4.84 (4.28-5.57)	6.72 (5.93-7.76)	8.33 (7.30-9.71)	10.7 (9.03-12.8)	12.5 (10.4-15.4)	14.5 (11.8-18.3)	16.6 (13.1-21.5)	19.6 (14.8-26.4)	21.9 (16.0-30.6)

[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.

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS

Figure C-4

Hydrograph

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_____________________________________________________________________________
*****************************************************************************

            F L O O D    R O U T I N G    A N A L Y S I S
          USING COUNTY HYDROLOGY MANUAL OF SAN BERNARDINO(1986)
         (c) Copyright 1989-2011 Advanced Engineering Software (aes)
             Ver. 18.0  Release Date: 05/01/2011  License ID 1501

                          Analysis prepared by:




 ************************** DESCRIPTION OF STUDY **************************
* APN 0438-112-05                                                         *
* Developed Condition                                                     *
* 100 Year Storm Event                                                    *
 *************************************************************************

  FILE NAME: 0438.DAT
  TIME/DATE OF STUDY: 14:05 10/15/2022


*****************************************************************************
  FLOW PROCESS FROM NODE      0.00 TO NODE      1.00 IS CODE =   1
-----------------------------------------------------------------------------
  >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
=============================================================================

      (UNIT-HYDROGRAPH ADDED TO STREAM #1)

         WATERCOURSE LENGTH =   11161.000 FEET
         LENGTH FROM CONCENTRATION POINT TO CENTROID =    5321.000 FEET
         ELEVATION VARIATION ALONG WATERCOURSE =    1250.000 FEET
         BASIN FACTOR = 0.030
         WATERSHED AREA =     791.900 ACRES
         BASEFLOW =   0.000 CFS/SQUARE-MILE
         WATERCOURSE "LAG" TIME =    0.285 HOURS
          CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
          THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
          MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
         FOOTHILL S-GRAPH SELECTED
         MAXIMUM WATERSHED LOSS RATE(INCH/HOUR) =  0.120
         LOW LOSS FRACTION = 0.113
         *HYDROGRAPH MODEL #1 SPECIFIED*

         SPECIFIED PEAK  5-MINUTES RAINFALL(INCH)=  0.35
         SPECIFIED PEAK 30-MINUTES RAINFALL(INCH)=  0.87
         SPECIFIED PEAK  1-HOUR RAINFALL(INCH) =  1.16
         SPECIFIED PEAK  3-HOUR RAINFALL(INCH) =  1.78
         SPECIFIED PEAK  6-HOUR RAINFALL(INCH) =  2.37
         SPECIFIED PEAK 24-HOUR RAINFALL(INCH) =  4.40
```

*USER SPECIFIED PRECIPITATION DEPTH-AREA REDUCTION FACTORS:
5-MINUTE FACTOR = 0.990
30-MINUTE FACTOR = 0.990
1-HOUR FACTOR = 0.990
3-HOUR FACTOR = 0.990
6-HOUR FACTOR = 0.990
24-HOUR FACTOR = 0.990

UNIT HYDROGRAPH TIME UNIT = 5.000 MINUTES
UNIT INTERVAL PERCENTAGE OF LAG-TIME = 29.197

RUNOFF HYDROGRAPH LISTING LIMITS:
MODEL TIME(HOURS) FOR BEGINNING OF RESULTS = 0.00
MODEL TIME(HOURS) FOR END OF RESULTS = 24.00

UNIT HYDROGRAPH DETERMINATION

INTERVAL NUMBER	"S" GRAPH MEAN VALUES	UNIT HYDROGRAPH ORDINATES(CFS)
1	2.096	200.738
2	8.700	632.431
3	21.301	1206.878
4	49.311	2682.453
5	65.785	1577.763
6	74.318	817.202
7	80.348	577.542
8	85.018	447.201
9	88.591	342.218
10	91.379	266.954
11	93.636	216.188
12	95.336	162.837
13	96.547	115.946
14	97.489	90.199
15	98.068	55.481
16	98.220	14.549
17	98.371	14.453
18	98.522	14.479
19	98.673	14.453
20	98.824	14.453
21	98.975	14.491
22	99.126	14.428
23	99.277	14.428
24	99.427	14.428
25	99.578	14.428
26	99.729	14.428
27	99.879	14.428
28	100.000	11.563

UNIT PERIOD (NUMBER)	UNIT RAINFALL (INCHES)	UNIT SOIL-LOSS (INCHES)	EFFECTIVE RAINFALL (INCHES)
1	0.0068	0.0008	0.0060
2	0.0068	0.0008	0.0060
3	0.0068	0.0008	0.0060
4	0.0068	0.0008	0.0060
5	0.0068	0.0008	0.0061
6	0.0068	0.0008	0.0061
7	0.0069	0.0008	0.0061
8	0.0069	0.0008	0.0061
9	0.0069	0.0008	0.0061
10	0.0069	0.0008	0.0061
11	0.0070	0.0008	0.0062
12	0.0070	0.0008	0.0062
13	0.0070	0.0008	0.0062
14	0.0070	0.0008	0.0062
15	0.0070	0.0008	0.0063
16	0.0071	0.0008	0.0063
17	0.0071	0.0008	0.0063
18	0.0071	0.0008	0.0063
19	0.0071	0.0008	0.0063
20	0.0072	0.0008	0.0063
21	0.0072	0.0008	0.0064
22	0.0072	0.0008	0.0064
23	0.0072	0.0008	0.0064
24	0.0072	0.0008	0.0064
25	0.0073	0.0008	0.0065
26	0.0073	0.0008	0.0065
27	0.0073	0.0008	0.0065
28	0.0073	0.0008	0.0065
29	0.0074	0.0008	0.0065
30	0.0074	0.0008	0.0066
31	0.0074	0.0008	0.0066
32	0.0074	0.0008	0.0066
33	0.0075	0.0008	0.0066
34	0.0075	0.0008	0.0066
35	0.0075	0.0009	0.0067
36	0.0075	0.0009	0.0067
37	0.0076	0.0009	0.0067
38	0.0076	0.0009	0.0067
39	0.0076	0.0009	0.0068
40	0.0077	0.0009	0.0068
41	0.0077	0.0009	0.0068
42	0.0077	0.0009	0.0068
43	0.0077	0.0009	0.0069
44	0.0078	0.0009	0.0069
45	0.0078	0.0009	0.0069
46	0.0078	0.0009	0.0069
47	0.0079	0.0009	0.0070
48	0.0079	0.0009	0.0070
49	0.0079	0.0009	0.0070
50	0.0079	0.0009	0.0070

51	0.0080	0.0009	0.0071
52	0.0080	0.0009	0.0071
53	0.0081	0.0009	0.0071
54	0.0081	0.0009	0.0072
55	0.0081	0.0009	0.0072
56	0.0081	0.0009	0.0072
57	0.0082	0.0009	0.0073
58	0.0082	0.0009	0.0073
59	0.0082	0.0009	0.0073
60	0.0083	0.0009	0.0073
61	0.0083	0.0009	0.0074
62	0.0083	0.0009	0.0074
63	0.0084	0.0009	0.0074
64	0.0084	0.0010	0.0075
65	0.0085	0.0010	0.0075
66	0.0085	0.0010	0.0075
67	0.0085	0.0010	0.0076
68	0.0086	0.0010	0.0076
69	0.0086	0.0010	0.0076
70	0.0086	0.0010	0.0077
71	0.0087	0.0010	0.0077
72	0.0087	0.0010	0.0077
73	0.0088	0.0010	0.0078
74	0.0088	0.0010	0.0078
75	0.0089	0.0010	0.0079
76	0.0089	0.0010	0.0079
77	0.0089	0.0010	0.0079
78	0.0090	0.0010	0.0080
79	0.0090	0.0010	0.0080
80	0.0091	0.0010	0.0080
81	0.0091	0.0010	0.0081
82	0.0091	0.0010	0.0081
83	0.0092	0.0010	0.0082
84	0.0092	0.0010	0.0082
85	0.0093	0.0011	0.0082
86	0.0093	0.0011	0.0083
87	0.0094	0.0011	0.0083
88	0.0094	0.0011	0.0084
89	0.0095	0.0011	0.0084
90	0.0095	0.0011	0.0085
91	0.0096	0.0011	0.0085
92	0.0096	0.0011	0.0085
93	0.0097	0.0011	0.0086
94	0.0097	0.0011	0.0086
95	0.0098	0.0011	0.0087
96	0.0099	0.0011	0.0087
97	0.0099	0.0011	0.0088
98	0.0100	0.0011	0.0088
99	0.0100	0.0011	0.0089
100	0.0101	0.0011	0.0089
101	0.0102	0.0011	0.0090
102	0.0102	0.0012	0.0091
103	0.0103	0.0012	0.0091
104	0.0103	0.0012	0.0092
105	0.0104	0.0012	0.0092

106	0.0105	0.0012	0.0093
107	0.0106	0.0012	0.0094
108	0.0106	0.0012	0.0094
109	0.0107	0.0012	0.0095
110	0.0107	0.0012	0.0095
111	0.0108	0.0012	0.0096
112	0.0109	0.0012	0.0097
113	0.0110	0.0012	0.0097
114	0.0110	0.0012	0.0098
115	0.0111	0.0013	0.0099
116	0.0112	0.0013	0.0099
117	0.0113	0.0013	0.0100
118	0.0114	0.0013	0.0101
119	0.0115	0.0013	0.0102
120	0.0115	0.0013	0.0102
121	0.0116	0.0013	0.0103
122	0.0117	0.0013	0.0104
123	0.0118	0.0013	0.0105
124	0.0119	0.0013	0.0106
125	0.0120	0.0014	0.0107
126	0.0121	0.0014	0.0107
127	0.0122	0.0014	0.0108
128	0.0123	0.0014	0.0109
129	0.0124	0.0014	0.0110
130	0.0125	0.0014	0.0111
131	0.0127	0.0014	0.0112
132	0.0127	0.0014	0.0113
133	0.0129	0.0015	0.0114
134	0.0130	0.0015	0.0115
135	0.0131	0.0015	0.0117
136	0.0132	0.0015	0.0117
137	0.0134	0.0015	0.0119
138	0.0135	0.0015	0.0120
139	0.0137	0.0015	0.0121
140	0.0138	0.0016	0.0122
141	0.0140	0.0016	0.0124
142	0.0141	0.0016	0.0125
143	0.0143	0.0016	0.0127
144	0.0144	0.0016	0.0128
145	0.0135	0.0015	0.0120
146	0.0136	0.0015	0.0121
147	0.0139	0.0016	0.0123
148	0.0140	0.0016	0.0124
149	0.0142	0.0016	0.0126
150	0.0144	0.0016	0.0127
151	0.0146	0.0017	0.0130
152	0.0148	0.0017	0.0131
153	0.0151	0.0017	0.0134
154	0.0152	0.0017	0.0135
155	0.0155	0.0018	0.0138
156	0.0157	0.0018	0.0139
157	0.0160	0.0018	0.0142
158	0.0162	0.0018	0.0144
159	0.0166	0.0019	0.0147
160	0.0168	0.0019	0.0149

161	0.0172	0.0019	0.0152
162	0.0174	0.0020	0.0154
163	0.0179	0.0020	0.0158
164	0.0181	0.0020	0.0160
165	0.0186	0.0021	0.0165
166	0.0189	0.0021	0.0167
167	0.0194	0.0022	0.0172
168	0.0197	0.0022	0.0175
169	0.0192	0.0022	0.0171
170	0.0196	0.0022	0.0174
171	0.0203	0.0023	0.0180
172	0.0207	0.0023	0.0184
173	0.0215	0.0024	0.0191
174	0.0220	0.0025	0.0195
175	0.0230	0.0026	0.0204
176	0.0235	0.0027	0.0209
177	0.0248	0.0028	0.0220
178	0.0254	0.0029	0.0225
179	0.0269	0.0030	0.0239
180	0.0277	0.0031	0.0246
181	0.0296	0.0033	0.0263
182	0.0307	0.0035	0.0272
183	0.0332	0.0038	0.0295
184	0.0347	0.0039	0.0308
185	0.0404	0.0046	0.0358
186	0.0427	0.0048	0.0378
187	0.0483	0.0055	0.0428
188	0.0520	0.0059	0.0461
189	0.0756	0.0085	0.0671
190	0.0837	0.0095	0.0742
191	0.1123	0.0100	0.1023
192	0.1464	0.0100	0.1364
193	0.3505	0.0100	0.3405
194	0.0948	0.0100	0.0848
195	0.0565	0.0064	0.0502
196	0.0452	0.0051	0.0401
197	0.0364	0.0041	0.0323
198	0.0319	0.0036	0.0283
199	0.0286	0.0032	0.0254
200	0.0261	0.0030	0.0232
201	0.0241	0.0027	0.0214
202	0.0225	0.0025	0.0199
203	0.0211	0.0024	0.0187
204	0.0199	0.0023	0.0177
205	0.0201	0.0023	0.0178
206	0.0191	0.0022	0.0170
207	0.0183	0.0021	0.0163
208	0.0176	0.0020	0.0156
209	0.0170	0.0019	0.0151
210	0.0164	0.0019	0.0145
211	0.0158	0.0018	0.0141
212	0.0154	0.0017	0.0136
213	0.0149	0.0017	0.0132
214	0.0145	0.0016	0.0129
215	0.0141	0.0016	0.0125

216	0.0137	0.0016	0.0122
217	0.0145	0.0016	0.0129
218	0.0142	0.0016	0.0126
219	0.0139	0.0016	0.0123
220	0.0136	0.0015	0.0120
221	0.0133	0.0015	0.0118
222	0.0131	0.0015	0.0116
223	0.0128	0.0014	0.0114
224	0.0126	0.0014	0.0112
225	0.0124	0.0014	0.0110
226	0.0122	0.0014	0.0108
227	0.0120	0.0014	0.0106
228	0.0118	0.0013	0.0104
229	0.0116	0.0013	0.0103
230	0.0114	0.0013	0.0101
231	0.0112	0.0013	0.0100
232	0.0111	0.0013	0.0098
233	0.0109	0.0012	0.0097
234	0.0108	0.0012	0.0096
235	0.0106	0.0012	0.0094
236	0.0105	0.0012	0.0093
237	0.0104	0.0012	0.0092
238	0.0102	0.0012	0.0091
239	0.0101	0.0011	0.0090
240	0.0100	0.0011	0.0089
241	0.0099	0.0011	0.0088
242	0.0098	0.0011	0.0087
243	0.0097	0.0011	0.0086
244	0.0096	0.0011	0.0085
245	0.0095	0.0011	0.0084
246	0.0094	0.0011	0.0083
247	0.0093	0.0010	0.0082
248	0.0092	0.0010	0.0081
249	0.0091	0.0010	0.0081
250	0.0090	0.0010	0.0080
251	0.0089	0.0010	0.0079
252	0.0088	0.0010	0.0078
253	0.0087	0.0010	0.0078
254	0.0087	0.0010	0.0077
255	0.0086	0.0010	0.0076
256	0.0085	0.0010	0.0075
257	0.0084	0.0010	0.0075
258	0.0084	0.0009	0.0074
259	0.0083	0.0009	0.0074
260	0.0082	0.0009	0.0073
261	0.0082	0.0009	0.0072
262	0.0081	0.0009	0.0072
263	0.0080	0.0009	0.0071
264	0.0080	0.0009	0.0071
265	0.0079	0.0009	0.0070
266	0.0078	0.0009	0.0070
267	0.0078	0.0009	0.0069
268	0.0077	0.0009	0.0069
269	0.0077	0.0009	0.0068
270	0.0076	0.0009	0.0068

271	0.0076	0.0009	0.0067
272	0.0075	0.0008	0.0067
273	0.0075	0.0008	0.0066
274	0.0074	0.0008	0.0066
275	0.0074	0.0008	0.0065
276	0.0073	0.0008	0.0065
277	0.0073	0.0008	0.0064
278	0.0072	0.0008	0.0064
279	0.0072	0.0008	0.0064
280	0.0071	0.0008	0.0063
281	0.0071	0.0008	0.0063
282	0.0070	0.0008	0.0062
283	0.0070	0.0008	0.0062
284	0.0069	0.0008	0.0062
285	0.0069	0.0008	0.0061
286	0.0069	0.0008	0.0061
287	0.0068	0.0008	0.0061
288	0.0068	0.0008	0.0060

TOTAL STORM RAINFALL(INCHES) = 4.36
TOTAL SOIL-LOSS(INCHES) = 0.45
TOTAL EFFECTIVE RAINFALL(INCHES) = 3.90

TOTAL SOIL-LOSS VOLUME(ACRE-FEET) = 29.8731
TOTAL STORM RUNOFF VOLUME(ACRE-FEET) = 257.4536

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2 4 - H O U R S T O R M
R U N O F F H Y D R O G R A P H

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HYDROGRAPH IN FIVE-MINUTE UNIT INTERVALS(CFS)
(Note: Time indicated is at END of Each Unit Intervals)

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	375.0	750.0	1125.0	1500.0
0.083	0.0083	1.20	Q	.	.	.	.
0.167	0.0427	5.00	Q	.	.	.	.
0.250	0.1270	12.24	Q	.	.	.	.
0.333	0.3222	28.35	Q	.	.	.	.
0.417	0.5831	37.88	VQ	.	.	.	.
0.500	0.8785	42.89	VQ	.	.	.	.
0.583	1.1985	46.47	VQ	.	.	.	.
0.667	1.5379	49.29	VQ	.	.	.	.
0.750	1.8925	51.48	VQ	.	.	.	.
0.833	2.2591	53.23	VQ	.	.	.	.
0.917	2.6357	54.68	VQ	.	.	.	.
1.000	3.0202	55.83	VQ	.	.	.	.
1.083	3.4106	56.69	VQ	.	.	.	.
1.167	3.8059	57.40	VQ	.	.	.	.
1.250	4.2047	57.90	VQ	.	.	.	.
1.333	4.6053	58.17	VQ	.	.	.	.

1.417	5.0078	58.43	VQ	.	.	.	.
1.500	5.4121	58.70	VQ	.	.	.	.
1.583	5.8182	58.97	VQ	.	.	.	.
1.667	6.2262	59.24	VQ	.	.	.	.
1.750	6.6361	59.51	.Q	.	.	.	.
1.833	7.0478	59.79	.Q	.	.	.	.
1.917	7.4615	60.06	.Q	.	.	.	.
2.000	7.8771	60.35	.Q	.	.	.	.
2.083	8.2946	60.62	.Q	.	.	.	.
2.167	8.7141	60.91	.Q	.	.	.	.
2.250	9.1355	61.19	.Q	.	.	.	.
2.333	9.5588	61.46	.Q	.	.	.	.
2.417	9.9834	61.66	.Q	.	.	.	.
2.500	10.4095	61.87	.Q	.	.	.	.
2.583	10.8370	62.07	.Q	.	.	.	.
2.667	11.2659	62.28	.Q	.	.	.	.
2.750	11.6963	62.48	.Q	.	.	.	.
2.833	12.1281	62.70	.Q	.	.	.	.
2.917	12.5613	62.91	.Q	.	.	.	.
3.000	12.9961	63.13	.QV	.	.	.	.
3.083	13.4324	63.34	.QV	.	.	.	.
3.167	13.8702	63.57	.QV	.	.	.	.
3.250	14.3095	63.78	.QV	.	.	.	.
3.333	14.7503	64.02	.QV	.	.	.	.
3.417	15.1927	64.24	.QV	.	.	.	.
3.500	15.6367	64.47	.QV	.	.	.	.
3.583	16.0823	64.69	.QV	.	.	.	.
3.667	16.5295	64.93	.QV	.	.	.	.
3.750	16.9783	65.16	.QV	.	.	.	.
3.833	17.4288	65.41	.QV	.	.	.	.
3.917	17.8808	65.64	.QV	.	.	.	.
4.000	18.3346	65.89	.QV	.	.	.	.
4.083	18.7901	66.13	.QV	.	.	.	.
4.167	19.2473	66.39	.QV	.	.	.	.
4.250	19.7061	66.63	.Q V	.	.	.	.
4.333	20.1668	66.89	.Q V	.	.	.	.
4.417	20.6292	67.14	.Q V	.	.	.	.
4.500	21.0934	67.40	.Q V	.	.	.	.
4.583	21.5594	67.66	.Q V	.	.	.	.
4.667	22.0272	67.93	.Q V	.	.	.	.
4.750	22.4969	68.19	.Q V	.	.	.	.
4.833	22.9684	68.47	.Q V	.	.	.	.
4.917	23.4418	68.74	.Q V	.	.	.	.
5.000	23.9172	69.02	.Q V	.	.	.	.
5.083	24.3944	69.29	.Q V	.	.	.	.
5.167	24.8736	69.58	.Q V	.	.	.	.
5.250	25.3547	69.86	.Q V	.	.	.	.
5.333	25.8379	70.16	.Q V	.	.	.	.
5.417	26.3231	70.44	.Q V	.	.	.	.
5.500	26.8103	70.75	.Q V	.	.	.	.
5.583	27.2996	71.04	.Q V	.	.	.	.
5.667	27.7910	71.35	.Q V	.	.	.	.
5.750	28.2845	71.65	.Q V	.	.	.	.
5.833	28.7801	71.97	.Q V	.	.	.	.
5.917	29.2779	72.28	.Q V	.	.	.	.

6.000	29.7779	72.60	.Q	V	.	.	.	.
6.083	30.2801	72.92	.Q	V	.	.	.	.
6.167	30.7846	73.25	.Q	V	.	.	.	.
6.250	31.2914	73.58	.Q	V	.	.	.	.
6.333	31.8005	73.92	.Q	V	.	.	.	.
6.417	32.3118	74.25	.Q	V	.	.	.	.
6.500	32.8256	74.60	.Q	V	.	.	.	.
6.583	33.3418	74.94	.Q	V	.	.	.	.
6.667	33.8604	75.31	. Q	V	.	.	.	.
6.750	34.3814	75.65	. Q	V	.	.	.	.
6.833	34.9050	76.03	. Q	V	.	.	.	.
6.917	35.4311	76.38	. Q	V	.	.	.	.
7.000	35.9598	76.77	. Q	V	.	.	.	.
7.083	36.4910	77.13	. Q	V	.	.	.	.
7.167	37.0249	77.53	. Q	V	.	.	.	.
7.250	37.5615	77.90	. Q	V	.	.	.	.
7.333	38.1008	78.31	. Q	V	.	.	.	.
7.417	38.6428	78.70	. Q	V	.	.	.	.
7.500	39.1877	79.11	. Q	V	.	.	.	.
7.583	39.7353	79.51	. Q	V	.	.	.	.
7.667	40.2858	79.94	. Q	V	.	.	.	.
7.750	40.8392	80.35	. Q	V	.	.	.	.
7.833	41.3957	80.80	. Q	V	.	.	.	.
7.917	41.9551	81.22	. Q	V	.	.	.	.
8.000	42.5176	81.68	. Q	V	.	.	.	.
8.083	43.0831	82.11	. Q	V	.	.	.	.
8.167	43.6518	82.58	. Q	V	.	.	.	.
8.250	44.2237	83.03	. Q	V	.	.	.	.
8.333	44.7989	83.52	. Q	V	.	.	.	.
8.417	45.3773	83.98	. Q	V	.	.	.	.
8.500	45.9592	84.49	. Q	V	.	.	.	.
8.583	46.5443	84.97	. Q	V	.	.	.	.
8.667	47.1330	85.48	. Q	V	.	.	.	.
8.750	47.7252	85.98	. Q	V	.	.	.	.
8.833	48.3210	86.52	. Q	V	.	.	.	.
8.917	48.9204	87.03	. Q	V	.	.	.	.
9.000	49.5236	87.58	. Q	V	.	.	.	.
9.083	50.1305	88.12	. Q	V	.	.	.	.
9.167	50.7413	88.69	. Q	V	.	.	.	.
9.250	51.3559	89.24	. Q	V	.	.	.	.
9.333	51.9746	89.84	. Q	V	.	.	.	.
9.417	52.5973	90.41	. Q	V	.	.	.	.
9.500	53.2242	91.03	. Q	V	.	.	.	.
9.583	53.8551	91.62	. Q	V	.	.	.	.
9.667	54.4905	92.26	. Q	V	.	.	.	.
9.750	55.1302	92.88	. Q	V	.	.	.	.
9.833	55.7744	93.54	. Q	V	.	.	.	.
9.917	56.4230	94.18	. Q	V	.	.	.	.
10.000	57.0765	94.88	. Q	V	.	.	.	.
10.083	57.7345	95.54	. Q	V	.	.	.	.
10.167	58.3974	96.26	. Q	V	.	.	.	.
10.250	59.0652	96.96	. Q	V	.	.	.	.
10.333	59.7381	97.71	. Q	V	.	.	.	.
10.417	60.4161	98.44	. Q	V	.	.	.	.
10.500	61.0994	99.22	. Q	V	.	.	.	.

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10.583     61.7880     99.98  . Q      V.          .          .          .
10.667     62.4822    100.80  . Q      V.          .          .          .
10.750     63.1819    101.59  . Q      V.          .          .          .
10.833     63.8874    102.45  . Q      V.          .          .          .
10.917     64.5987    103.28  . Q       V          .          .          .
11.000     65.3162    104.18  . Q       V          .          .          .
11.083     66.0396    105.05  . Q       V          .          .          .
11.167     66.7696    105.99  . Q       V          .          .          .
11.250     67.5059    106.90  . Q       V          .          .          .
11.333     68.2489    107.90  . Q       V          .          .          .
11.417     68.9986    108.86  . Q       V          .          .          .
11.500     69.7555    109.90  . Q       V          .          .          .
11.583     70.5194    110.91  . Q       V          .          .          .
11.667     71.2908    112.01  . Q       .V         .          .          .
11.750     72.0696    113.08  .  Q      .V         .          .          .
11.833     72.8564    114.24  .  Q      .V         .          .          .
11.917     73.6510    115.37  .  Q      .V         .          .          .
12.000     74.4540    116.61  .  Q      .V         .          .          .
12.083     75.2640    117.61  .  Q      .V         .          .          .
12.167     76.0788    118.31  .  Q      .V         .          .          .
12.250     76.8943    118.41  .  Q      .V         .          .          .
12.333     77.7015    117.21  .  Q      . V        .          .          .
12.417     78.5076    117.03  .  Q      . V        .          .          .
12.500     79.3183    117.71  .  Q      . V        .          .          .
12.583     80.1349    118.58  .  Q      . V        .          .          .
12.667     80.9594    119.71  .  Q      . V        .          .          .
12.750     81.7921    120.91  .  Q      . V        .          .          .
12.833     82.6346    122.33  .  Q      . V        .          .          .
12.917     83.4870    123.76  .  Q      . V        .          .          .
13.000     84.3507    125.41  .  Q      .  V       .          .          .
13.083     85.2258    127.07  .  Q      .  V       .          .          .
13.167     86.1138    128.93  .  Q      .  V       .          .          .
13.250     87.0146    130.80  .  Q      .  V       .          .          .
13.333     87.9299    132.90  .  Q      .  V       .          .          .
13.417     88.8595    134.98  .  Q      .  V       .          .          .
13.500     89.8049    137.28  .  Q      .  V       .          .          .
13.583     90.7660    139.54  .  Q      .   V      .          .          .
13.667     91.7445    142.07  .  Q      .   V      .          .          .
13.750     92.7401    144.57  .  Q      .   V      .          .          .
13.833     93.7550    147.36  .  Q      .   V      .          .          .
13.917     94.7889    150.12  .   Q     .   V      .          .          .
14.000     95.8441    153.22  .   Q     .   V      .          .          .
14.083     96.9192    156.10  .   Q     .    V     .          .          .
14.167     98.0138    158.94  .   Q     .    V     .          .          .
14.250     99.1238    161.17  .   Q     .    V     .          .          .
14.333    100.2421    162.37  .   Q     .    V     .          .          .
14.417    101.3763    164.69  .   Q     .    V     .          .          .
14.500    102.5354    168.30  .   Q     .    V     .          .          .
14.583    103.7213    172.19  .   Q     .     V    .          .          .
14.667    104.9393    176.86  .   Q     .     V    .          .          .
14.750    106.1909    181.72  .   Q     .     V    .          .          .
14.833    107.4820    187.47  .   Q     .     V    .          .          .
14.917    108.8140    193.41  .    Q    .     V    .          .          .
15.000    110.1946    200.46  .    Q    .      V   .          .          .
15.083    111.6257    207.80  .    Q    .      V   .          .          .
```

1479.87 x 1.5 = 2219.8 cfs design flow

15.167	113.1171	216.55	. Q . V . . .
15.250	114.6720	225.77	. Q . V . . .
15.333	116.3039	236.95	. Q . V . . .
15.417	118.0209	249.31	. Q . V . . .
15.500	119.8481	265.31	. Q . V . . .
15.583	121.8037	283.96	. Q . V . . .
15.667	123.9390	310.04	. Q . V. . .
15.750	126.2801	339.93	. Q. V. . .
15.833	128.9138	382.42	. Q V . .
15.917	131.9553	441.62	. .Q V . .
16.000	135.7129	545.60	. . Q .V . .
16.083	140.5600	703.80	. . Q .V . .
16.167	146.9900	933.64	. . . V Q . .
16.250	155.0510	1170.45	. . . V .Q .
16.333	165.2429	1479.87	. . . V . Q.
16.417	172.9842	1124.03	. . . V Q. .
16.500	178.6271	819.35	. . .Q V . .
16.583	183.2218	667.15	. . Q . V . .
16.667	187.1050	563.84	. . Q . V. .
16.750	190.4277	482.46	. . Q . V. .
16.833	193.3119	418.78	. .Q . V .
16.917	195.8440	367.66	. Q. . V .
17.000	198.0568	321.30	. Q . . V .
17.083	199.9973	281.77	. Q . . .V .
17.167	201.7284	251.35	. Q . . .V .
17.250	203.2668	223.38	. Q . . .V .
17.333	204.6460	200.27	. Q . . .V .
17.417	205.9497	189.29	. Q . . .V .
17.500	207.1926	180.47	. Q . . . V .
17.583	208.3834	172.91	. Q . . . V .
17.667	209.5289	166.32	. Q . . . V .
17.750	210.6334	160.37	. Q . . . V .
17.833	211.7003	154.92	. Q . . . V .
17.917	212.7327	149.90	. Q . . . V .
18.000	213.7325	145.17	. Q . . . V .
18.083	214.7015	140.69	. Q . . . V .
18.167	215.6433	136.76	. Q . . . V .
18.250	216.5607	133.20	. Q . . . V .
18.333	217.4579	130.27	. Q . . . V .
18.417	218.3178	124.86	. Q . . . V .
18.500	219.1577	121.95	. Q . . . V .
18.583	219.9800	119.40	. Q . . . V .
18.667	220.7859	117.02	. Q . . . V .
18.750	221.5763	114.77	. Q . . . V .
18.833	222.3520	112.63	. Q . . . V .
18.917	223.1136	110.59	. Q . . . V .
19.000	223.8618	108.63	. Q . . . V .
19.083	224.5969	106.74	. Q . . . V .
19.167	225.3196	104.94	. Q . . . V .
19.250	226.0303	103.20	. Q . . . V .
19.333	226.7294	101.50	. Q . . . V .
19.417	227.4173	99.88	. Q . . . V .
19.500	228.0944	98.32	. Q . . . V .
19.583	228.7614	96.84	. Q . . . V .
19.667	229.4186	95.42	. Q . . . V .

19.750	230.0664	94.06	. Q	.	.	.	V .
19.833	230.7052	92.76	. Q	.	.	.	V .
19.917	231.3354	91.51	. Q	.	.	.	V .
20.000	231.9574	90.30	. Q	.	.	.	V .
20.083	232.5713	89.14	. Q	.	.	.	V .
20.167	233.1775	88.03	. Q	.	.	.	V .
20.250	233.7764	86.95	. Q	.	.	.	V .
20.333	234.3680	85.91	. Q	.	.	.	V .
20.417	234.9526	84.89	. Q	.	.	.	V .
20.500	235.5304	83.90	. Q	.	.	.	V .
20.583	236.1017	82.95	. Q	.	.	.	V .
20.667	236.6666	82.03	. Q	.	.	.	V .
20.750	237.2254	81.13	. Q	.	.	.	V .
20.833	237.7782	80.26	. Q	.	.	.	V .
20.917	238.3251	79.42	. Q	.	.	.	V .
21.000	238.8665	78.60	. Q	.	.	.	V .
21.083	239.4024	77.81	. Q	.	.	.	V .
21.167	239.9330	77.04	. Q	.	.	.	V .
21.250	240.4584	76.29	. Q	.	.	.	V .
21.333	240.9787	75.56	. Q	.	.	.	V .
21.417	241.4942	74.85	.Q	.	.	.	V .
21.500	242.0049	74.16	.Q	.	.	.	V .
21.583	242.5110	73.48	.Q	.	.	.	V .
21.667	243.0125	72.82	.Q	.	.	.	V .
21.750	243.5097	72.18	.Q	.	.	.	V .
21.833	244.0025	71.56	.Q	.	.	.	V .
21.917	244.4911	70.95	.Q	.	.	.	V .
22.000	244.9756	70.35	.Q	.	.	.	V .
22.083	245.4561	69.77	.Q	.	.	.	V .
22.167	245.9327	69.20	.Q	.	.	.	V .
22.250	246.4055	68.65	.Q	.	.	.	V .
22.333	246.8745	68.10	.Q	.	.	.	V .
22.417	247.3399	67.57	.Q	.	.	.	V .
22.500	247.8017	67.05	.Q	.	.	.	V .
22.583	248.2599	66.54	.Q	.	.	.	V .
22.667	248.7148	66.04	.Q	.	.	.	V .
22.750	249.1663	65.56	.Q	.	.	.	V .
22.833	249.6145	65.08	.Q	.	.	.	V .
22.917	250.0594	64.61	.Q	.	.	.	V .
23.000	250.5013	64.15	.Q	.	.	.	V .
23.083	250.9400	63.70	.Q	.	.	.	V .
23.167	251.3757	63.26	.Q	.	.	.	V.
23.250	251.8084	62.83	.Q	.	.	.	V.
23.333	252.2382	62.40	.Q	.	.	.	V.
23.417	252.6651	61.99	.Q	.	.	.	V.
23.500	253.0892	61.58	.Q	.	.	.	V.
23.583	253.5105	61.18	.Q	.	.	.	V.
23.667	253.9292	60.79	.Q	.	.	.	V.
23.750	254.3452	60.40	.Q	.	.	.	V.
23.833	254.7585	60.02	.Q	.	.	.	V.
23.917	255.1693	59.65	.Q	.	.	.	V.
24.000	255.5776	59.28	.Q	.	.	.	V.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have

an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1445.0
10%	245.0
20%	85.0
30%	50.0
40%	35.0
50%	25.0
60%	20.0
70%	15.0
80%	5.0
90%	5.0

END OF FLOODSCx ROUTING ANALYSIS

Hydraulic Calculations

Q100 Water Surface - Section A

---

* ENTERED INFORMATION FOR SUBCHANNEL NUMBER 1 :

NODE NUMBER	"X" COORDINATE	"Y" COORDINATE
1	0.00	104.00
2	33.50	103.00
3	114.00	102.00
4	121.60	102.00
5	223.00	102.00
6	247.00	101.00
7	434.00	101.00
8	482.00	100.00
9	486.00	99.40
10	491.00	100.00
11	559.80	101.00
12	624.40	102.00
13	678.80	103.00
14	729.10	104.00

SUBCHANNEL SLOPE(FEET/FEET) = 0.022000

SUBCHANNEL MANNINGS FRICTION FACTOR = 0.025000

.....

SUBCHANNEL FLOW(CFS) = 2243.4

SUBCHANNEL FLOW AREA(SQUARE FEET) = 296.02

SUBCHANNEL FLOW VELOCITY(FEET/SEC.) = 7.579

SUBCHANNEL FROUDE NUMBER = 1.496

SUBCHANNEL FLOW TOP-WIDTH(FEET) = 371.32

SUBCHANNEL HYDRAULIC DEPTH(FEET) = 0.80

TOTAL IRREGULAR CHANNEL FLOW(CFS) WANTED = 2219.80

COMPUTED IRREGULAR CHANNEL FLOW(CFS) = 2243.44

ESTIMATED IRREGULAR CHANNEL NORMAL DEPTH WATER SURFACE ELEVATION..... 101.66

NOTE: WATER SURFACE IS BELOW EXTREME LEFT AND RIGHT BANK ELEVATIONS.

Q100 Water Surface - Section B

---

* ENTERED INFORMATION FOR SUBCHANNEL NUMBER 1 :

NODE NUMBER	"X" COORDINATE	"Y" COORDINATE
1	0.00	105.00
2	17.20	104.00
3	33.90	103.00
4	50.20	102.00
5	91.60	101.00
6	171.60	101.00
7	300.00	100.00
8	387.00	99.00
9	453.80	99.00
10	487.80	98.00
11	489.60	97.70
12	491.00	98.00
13	493.00	99.00
14	558.40	99.00
15	635.00	100.00
16	691.00	101.00
17	731.00	102.00

SUBCHANNEL SLOPE(FEET/FEET) = 0.026000

SUBCHANNEL MANNINGS FRICTION FACTOR = 0.025000

.....

SUBCHANNEL FLOW(CFS) = 2231.5

SUBCHANNEL FLOW AREA(SQUARE FEET) = 268.37

SUBCHANNEL FLOW VELOCITY(FEET/SEC.) = 8.315

SUBCHANNEL FROUDE NUMBER = 1.629

SUBCHANNEL FLOW TOP-WIDTH(FEET) = 331.81

SUBCHANNEL HYDRAULIC DEPTH(FEET) = 0.81

TOTAL IRREGULAR CHANNEL FLOW(CFS) WANTED = 2219.80

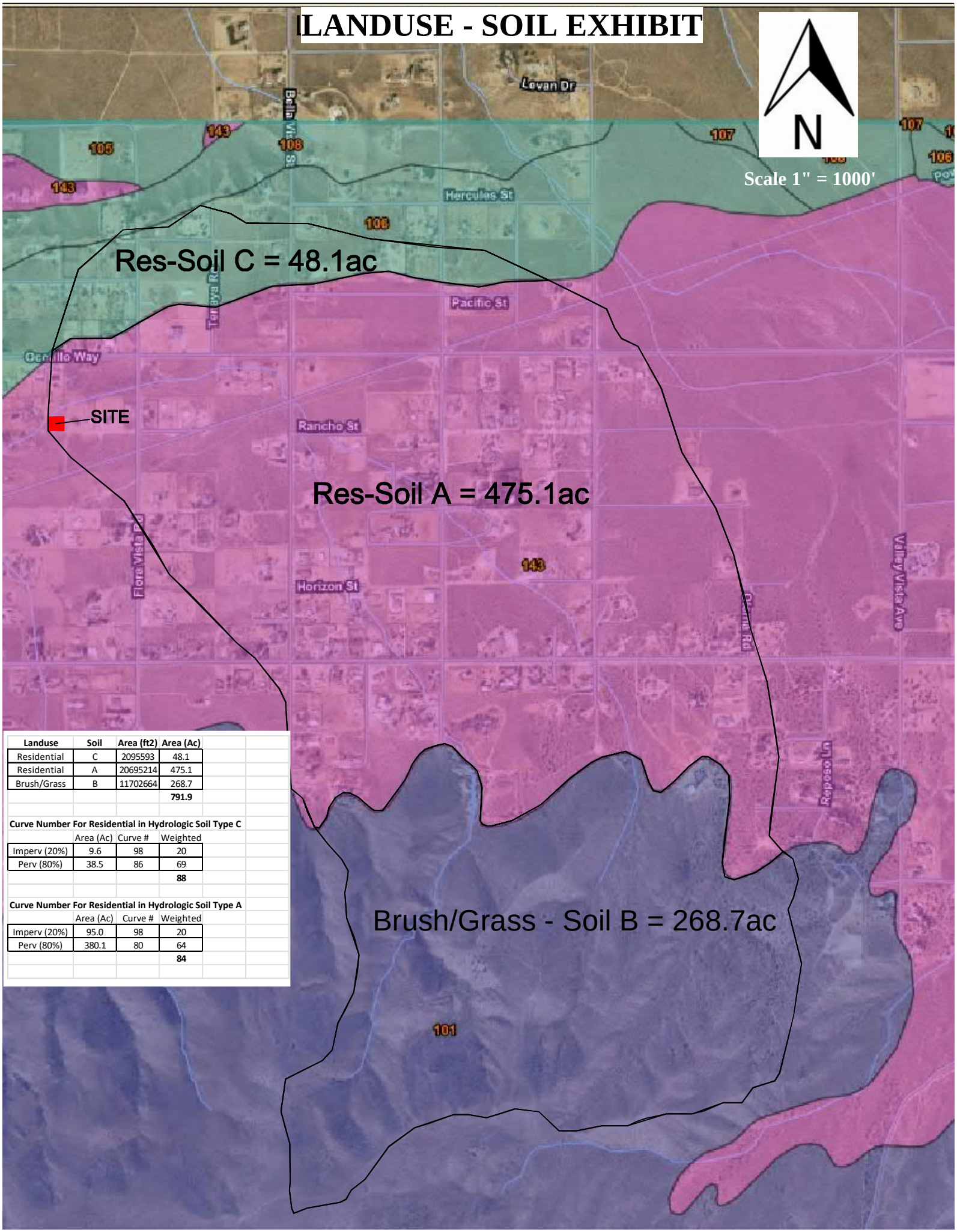
COMPUTED IRREGULAR CHANNEL FLOW(CFS) = 2231.49

ESTIMATED IRREGULAR CHANNEL NORMAL DEPTH WATER SURFACE ELEVATION..... 99.98

NOTE: WATER SURFACE IS BELOW EXTREME LEFT AND RIGHT BANK ELEVATIONS.

Hydrology Exhibits

LANDUSE - SOIL EXHIBIT



Landuse	Soil	Area (ft2)	Area (Ac)
Residential	C	2095593	48.1
Residential	A	20695214	475.1
Brush/Grass	B	11702664	268.7
			791.9

Curve Number For Residential in Hydrologic Soil Type C

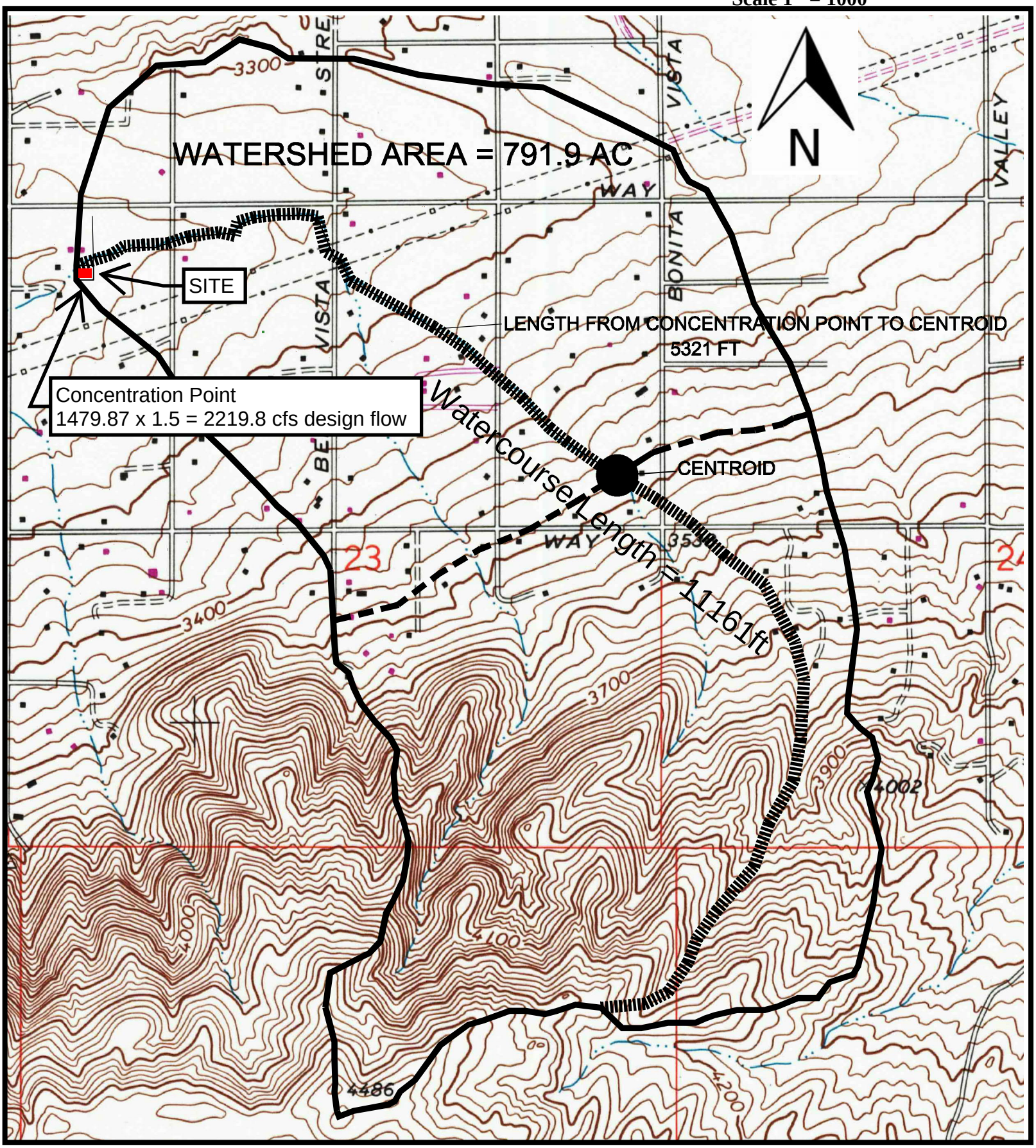
	Area (Ac)	Curve #	Weighted
Imperv (20%)	9.6	98	20
Perv (80%)	38.5	86	69
			88

Curve Number For Residential in Hydrologic Soil Type A

	Area (Ac)	Curve #	Weighted
Imperv (20%)	95.0	98	20
Perv (80%)	380.1	80	64
			84

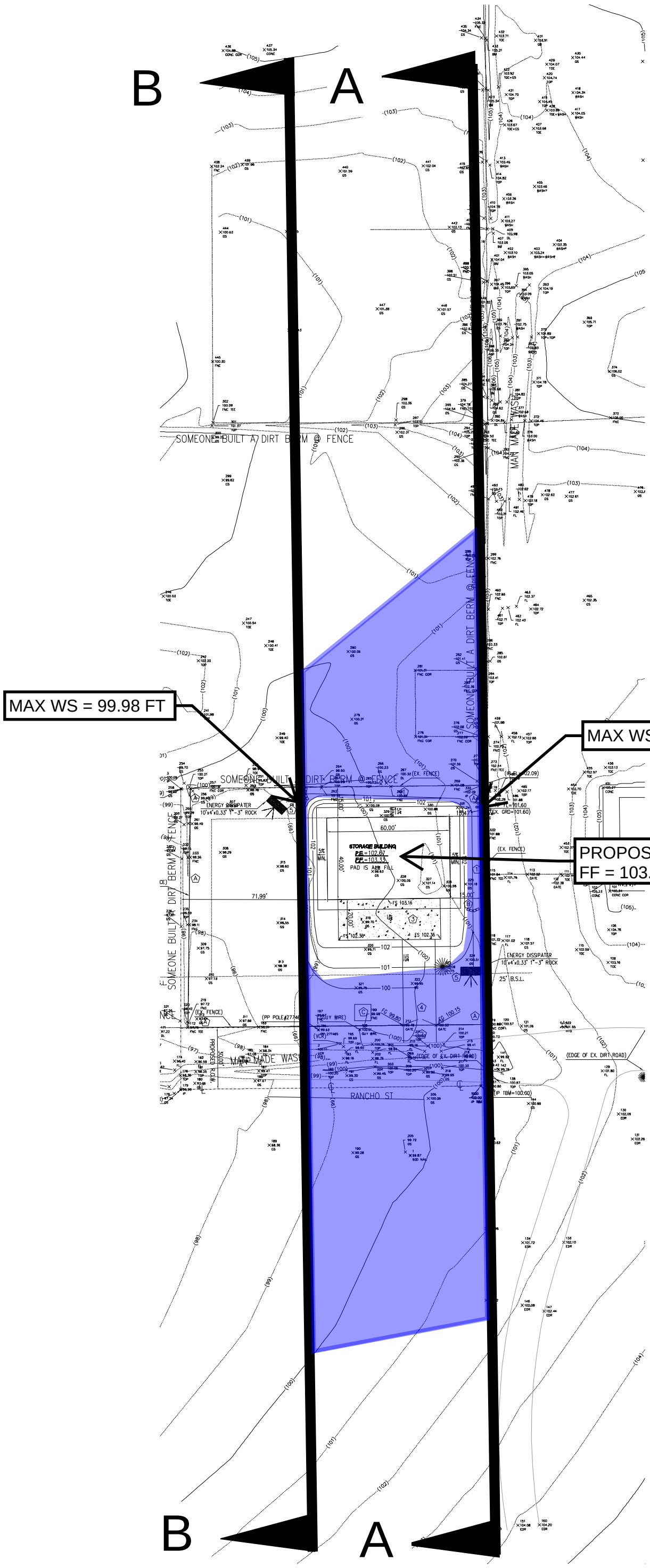
HYDROLOGY EXHIBIT

Scale 1" = 1000'



FLOOD EXHIBIT

100 Year Flood Zone

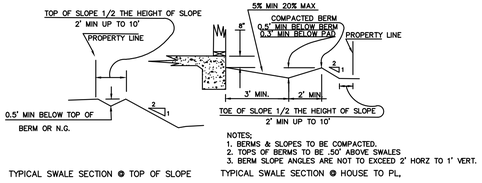


COUNTY OF SAN BERNARDINO
GRADING & EROSION CONTROL PLAN
FOR SINGLE FAMILY RESIDENCE
A.P.N.: 0438-115-05
RANCHO ST APPLE VALLEY, CA 92308

Grading Notes:

1. All grading shall conform to the latest California Building Code (CBC) Chapters 17, 18, Appendix-J and all applicable sections.
2. A grading permit shall be obtained prior to commencement of any work on the site.
3. Issuance of a grading permit does not eliminate the need for permits from other regulatory agencies with regulatory responsibilities for construction activities associated with the work authorized in this plan.
4. All work under this permit shall be limited to work within the property lines. A separate construction, excavation or encroachment permit from the Department of Public Works may be required for any work within the County right-of-way.
5. Approval of these plans does not authorize any work or grading to be performed until the effective property owner's permission has been obtained and valid grading permit has been issued.
6. This plan is for grading purposes only and is not to be used for the purpose of constructing onsite or offsite improvements. Issuance of a permit based on this plan does not constitute approval of driveway locations or sizes, parking lot structural sections or layout, ADA-related requirements, building locations or foundations, walls, curbing, offsite drainage facilities or other items not related directly to the basic grading operation. Onsite improvements shall be constructed in accordance to the approved building permit plans. Offsite improvements shall be constructed in accordance to plans approved for this purpose by the Public Works Department.
7. Maximum cut and fill slope = 2:1 (horizontal to vertical) and maximum vertical height = 30 feet, unless an approved geotechnical report can justify a steeper and taller slope.
8. No fill shall be placed on existing ground until the ground has been cleared of weeds, debris, topsoil and other deleterious material.
9. Fill slopes shall not have less than 90% relative compaction, or as recommended on the approved geotechnical report.
10. It is the grading contractor's responsibility to ensure that adequate compaction has been attained on the entire grading site, including fill areas outside the building pads and on all fill slopes.
11. Unless otherwise recommended in an approved geotechnical report, over-excavation shall be at least 24 inches minimum below the bottom of footings or to competent native soil or bedrock materials, whichever is deeper, as approved by the project's geotechnical engineer or geologist.
12. Earthwork Volumes:
    Cut: 000 (cy), Fill: 693 (cy), 15% Shrinkage. Total Disturbed Area: =21,609 S.F.
13. Earthwork quantities are shown for grading permit purposes only, and San Bernardino County is not responsible for their accuracy.
14. A copy of the grading permit and approved grading plans must be in the possession of a responsible person and available at the site at all times.
15. Any onsite retaining walls shown on the grading plans that are over 4'in height, measured from top of wall to bottom of footing, are for reference only. Retaining walls over 4'in height are not checked, permitted, or inspected per the grading permit. A separate retaining wall permit is required for all retaining walls over 4'in height.
16. Any walls, fences, structures and/or appurtenances adjacent to this project are to be protected in place. If grading operations damage or adversely affect said items in any way, the contractor and/or developer is responsible for working out an acceptable solution to the satisfaction of the affected property owner(s).
17. For sites with protected species or trees, the proposed grading may be subject to a separate permit.
18. Adequate fire access around buildings (including garages) should be provided as approved by County Fire.
19. Existing drainage courses shall not be obstructed, altered, or diverted without prior approval from the County of San Bernardino, Land Development Division. A streambed alteration agreement may also be required from the California Department of Fish and Wildlife.
20. Drainage easements shall not be obstructed, altered or diverted without prior approval of the County of San Bernardino, Land Development Division.
21. Setbacks and building locations shown on this plan are for reference only and must be reviewed and approved under a separate building permit.
22. Utility and septic improvements shown on this plan are for reference only and must be reviewed and approved under a separate building permit.
23. On projects disturbing one acres or more, the following note must be added: A Notice of Intent (NOI) has been, or will be filed with the State Water Resources Control Board (SWRCB) and a Storm Water Pollution Prevention Plan (SWPPP) has been or will be prepared in accordance with the requirements of California General Permit for storm water discharges associated with construction activity (Permit No. CAS000002) for all operations associated with these plans. The permittee shall keep a copy of the SWPPP on site and available for review by County.
    24. In conjunction with the California General Permit for proposed disturbance over one acre, an active Wastewater Discharge ID # (WDID) must be included on the final grading plan.
25. For engineered grading, a final grading certification will be collected by the building inspector at the final building inspection or prior a grading final status on the permit. The final grading certification is to be completed by the Engineer of Record on the approved grading plans.
26. All flood zone requirements must be reflected or accounted for on the grading plans. Elevations or construction notes must be included in the plans to ensure compliance with all applicable first floor elevation requirements per FEMA and San Bernardino County Development Code guidelines.

Note: Additional requirements may be applicable, as determined by the Building Official.



TYPICAL SWALE SECTION @ TOP OF SLOPE

TYPICAL SWALE SECTION @ HOUSE TO PL.

ABBREVIATIONS:

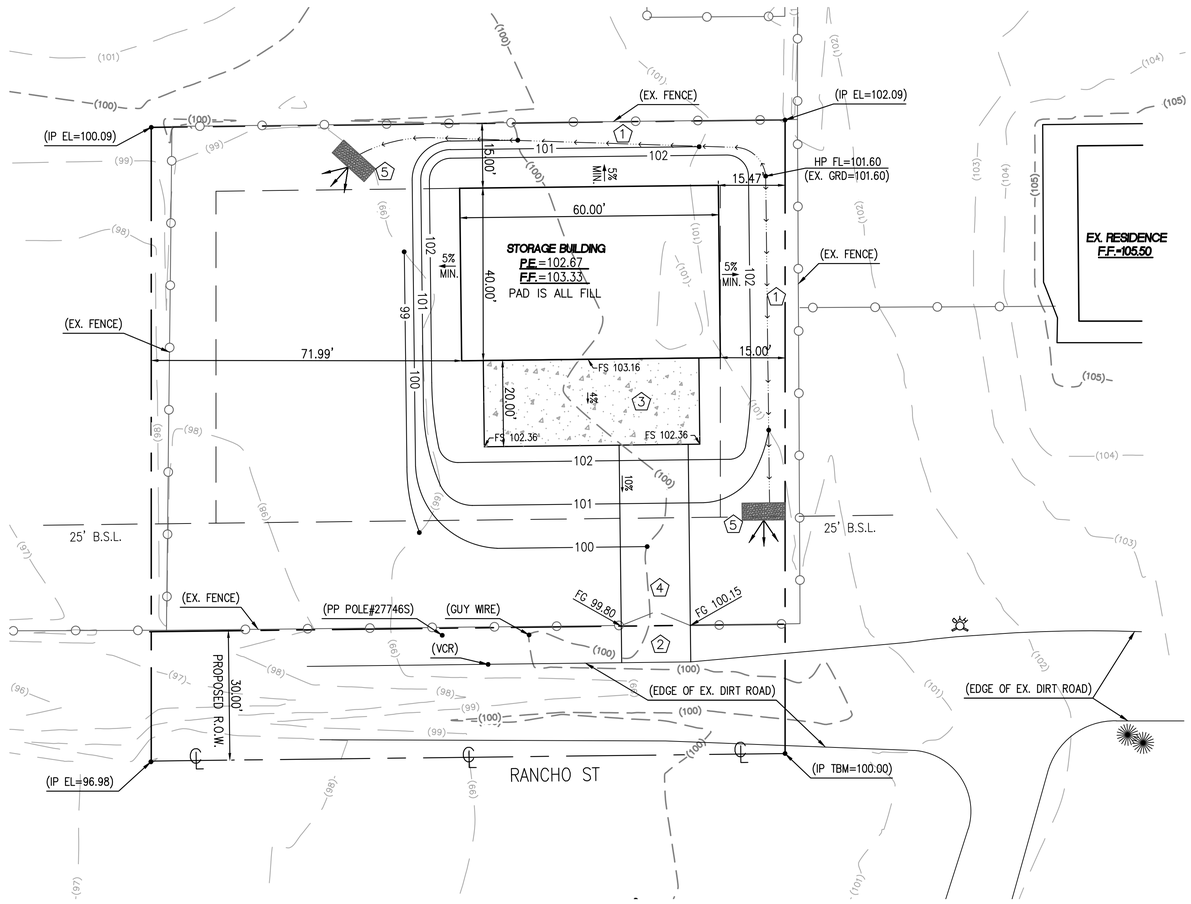
T.C. = TOP OF CURB
F.L. = FLOW LINE
E.P. = EDGE OF PAVEMENT
T.B.M. = TEMPORARY BENCH MARK
P.E. = PAD ELEVATION
P.P. = POWER POLE
(XX.XX) = EXISTING ELEV.
XX.XX = FUTURE GRADE
F.G. = FINISH GRADE
F.F. = FINISH FLOOR

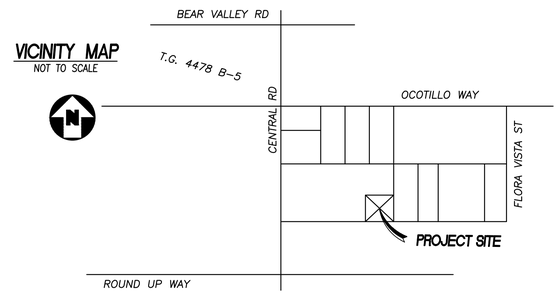
LEGEND

- CENTER LINE
- PROPERTY LINE
- (100) EX. MAJOR CONTOURS LINES
- (101) EX. MINOR CONTOURS LINES
- 102 PROPOSED FINISH CONTOURS
- EX. FENCE
- EDGE OF EXISTING ASPHALT ROAD
- BUILDING BACK SET LINES AND P.U.E.'s
- FLOW LINE 1% MIN. 20% MAX
- NO JOSHUA TREES ON THIS SITE
- CONC. WALKS AND DRIVES

GRADE SHALL SLOPE AWAY FROM STRUCTURE FOR A MINIMUM OF 5% FOR THE FIRST 10' (0.5' IN 10'), ON CONCRETE GRADE SHALL SLOPE AWAY MINIMUM OF 2% FOR THE FIRST 10' (0.2' IN 10')

1. SWALE 1% MIN.
2. EXISTING ALL WEATHER DIRT DRIVE
3. PROPOSED CONC. DRIVE
4. PROPOSED ALL WEATHER DIRT DRIVEWAY
5. 10'x4'x0.33' 1"-3" ROCK ENERGY DISSIPATER





GRAPHIC SCALE
0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

THIS IS NOT A SURVEY

BUILDING PERMIT# SFR-2022-00
GRADING PERMIT# GRAD-2022-00

BEARINGS AND DISTANCES ARE PER RECORD OF SURVEY DONE BY J.E. MILLER

REGISTERED PROFESSIONAL ENGINEER — SHELLY A. JONES — No. 72398 — CIVIL — STATE OF CALIFORNIA

Hydrology Study

Prepared under the supervisor of Shelly Jones
APN 0438-112-05 Dated: 11-04-22
The grading plan design complies with the requirements and suggestion set forth by Shelly Jones

SHELLY JONES: DATE: 11-04-22

UNDERGROUND SERVICE ALERT
CALL: 811
TWO FULL WORKING DAYS BEFORE YOU DIG

Prepared by:
Tim Meyer
18055 Cherry St.
Hesperia, Ca
92345
(760)559-6739

COUNTY OF SAN BERNARDINO
DEPARTMENT OF LAND USE SERVICES

Grading Plan

APN: 0438-112-05
Rancho St Apple Valley, CA 92308
Owner: Apple Valley Heights County Water District
Owner's Agent: Daniel Smith
760-524-2037

SCALE: 1"=20'
DRAWN BY: NAJ
DESIGNED BY: TSM
SHEET 1 OF 2
DATE: 11-04-2022
DRAWING NUMBER# 2022-164