PRELIMINARY HYDROLOGY / HYDRAULICS

PRELIMINARY DRAINAGE STUDY

APN 3064-371-12
HESPERIA, CA 92345

PREPARED FOR:

FREIGHT CO.
11025 TAMARIND AVENUE
BLOOMINGTON, CA 92316
CONTACT: VARINDER SANGHA
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PREPARED BY:

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8061 CHURCH STREET, P.O. BOX 592
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BERNHARD K. MAYER R.C.E. 36866 03/05/21 **DATE**

PROJECT INTRODUCTION

This project consists of the development of an existing 4.378-acre parcel in the City of Hesperia, County of San Bernardino. The parcel is located at the northwest corner from the intersection of U.S. Highway 395 and Avenal Street, having an A.P.N. of 3064-371-12. The pre-developed land cover is classified as “Barren (rock land, eroded and graded land)” with, multiple Joshua trees and no existing structures. The development of the existing parcel will include and offer of dedication along both U.S. Highway 395 and Avenal Street, dedications being 13-feet and 15-feet, respectively. The proposed site will be reduced to a 4.039-acre parcel. The proposed improvements to this parcel include the construction of a 12,000 square-foot warehouse, 1,500 square-foot office area, commercial landscaping/trees, perimeter walls/fencing, concrete curbs and gutters, concrete walkways, asphalt pavement, underground utilities, underground storm drain, catch basin and underground infiltration chambers. Auto-mobile parking will be located along the east and west ends of the warehouse/office building with loading dock access to the warehouse being along the north and south ends. Additional trailer parking will be located at the westerly portion of the site.

Existing impervious area = 0 square-feet
Impervious area being developed = 154,785 square-feet.

PROJECT INFORMATION

EXISTING WATERSHED DESCRIPTION

In pre-developed condition the site drains via sheet flow from the southwest to the northeast. Stormwater flows begin to generate at a high point at the southwesterly corner of the parcel along Avenal Street and flow northeast to a low point at the northeast corner of the parcel and onto U.S. Highway 395. The entire site is determined to be a single drainage area. Stormwater flow patterns can be seen on the Drainage Maps in “Appendix 1” of this report.

PROPOSED WATERSHED DESCRIPTION

The post-developed condition will mimic the same flow pattern as the pre-developed condition. Stormwater will begin to be generated at the southwesterly corner of the proposed asphalt parking lot and sheet flow northeasterly. Flows will then be concentrated in a concrete v-gutter that will flow northerly and then easterly parallel to the northerly property line of this parcel. A catch basin is proposed at the northeasterly corner along U.S. Highway 395. Stormwater will then be captured and transported to the underground infiltration chambers via a 12-inch storm drain pipe. Stormwater flows and volume that exceed the capacity of the 12-inch storm drain and underground infiltration chambers will release into the public right-of-way along Highway 395 in the same manner as the pre-developed condition. Capacities for both the storm drain and underground infiltration chambers can be seen in “Appendix 3” of this report. Stormwater flow patterns can be seen on the Drainage Maps in “Appendix 1” of this report.

METHODOLOGY – RATIONAL METHOD

The following scenario was modeled:

Pre-Developed Condition: 2-year Storm Event
Pre-Developed Condition: 100-year Storm Event

Developed Condition: 2-year Storm Event
Developed Condition: 100-year Storm Event

Rainfall depth was derived from the San Bernardino County Flood Control & Water Conservation District Hydrology Manual's isohyetal maps and precipitation frequency Atlas, NOAA Atlas 14.

Rational Method computations were performed using Advanced Engineering Software (aes), ver. 23.0, based on the Hydrology Manual. Discharge was calculated by the software, based on user input of rainfall, soil type, acreage, and land use parameters.

Printouts of the rational method calculations, as well as applicable plates from the Manual, are included in this report.

CONCLUSIONS

This drainage study and the calculations presented herein demonstrate the following:

The proposed and existing drainage facilities are adequate to carry the runoff produced by 2-year and 100-year storm events

TOTAL RUNOFF LEAVING THE SITE

Existing Condition:

Q_2 =	2.61 cfs	Tc = 16.45 min.
Q_{100} =	11.48 cfs	Tc = 16.45 min.

Proposed Condition:

Q_2 =	5.23 cfs	Tc = 12.41 min.	(+2.62 cfs)
Q_{100} =	15.75 cfs	Tc = 12.41 min.	(+4.27 cfs)

VOLUME MITIGATION

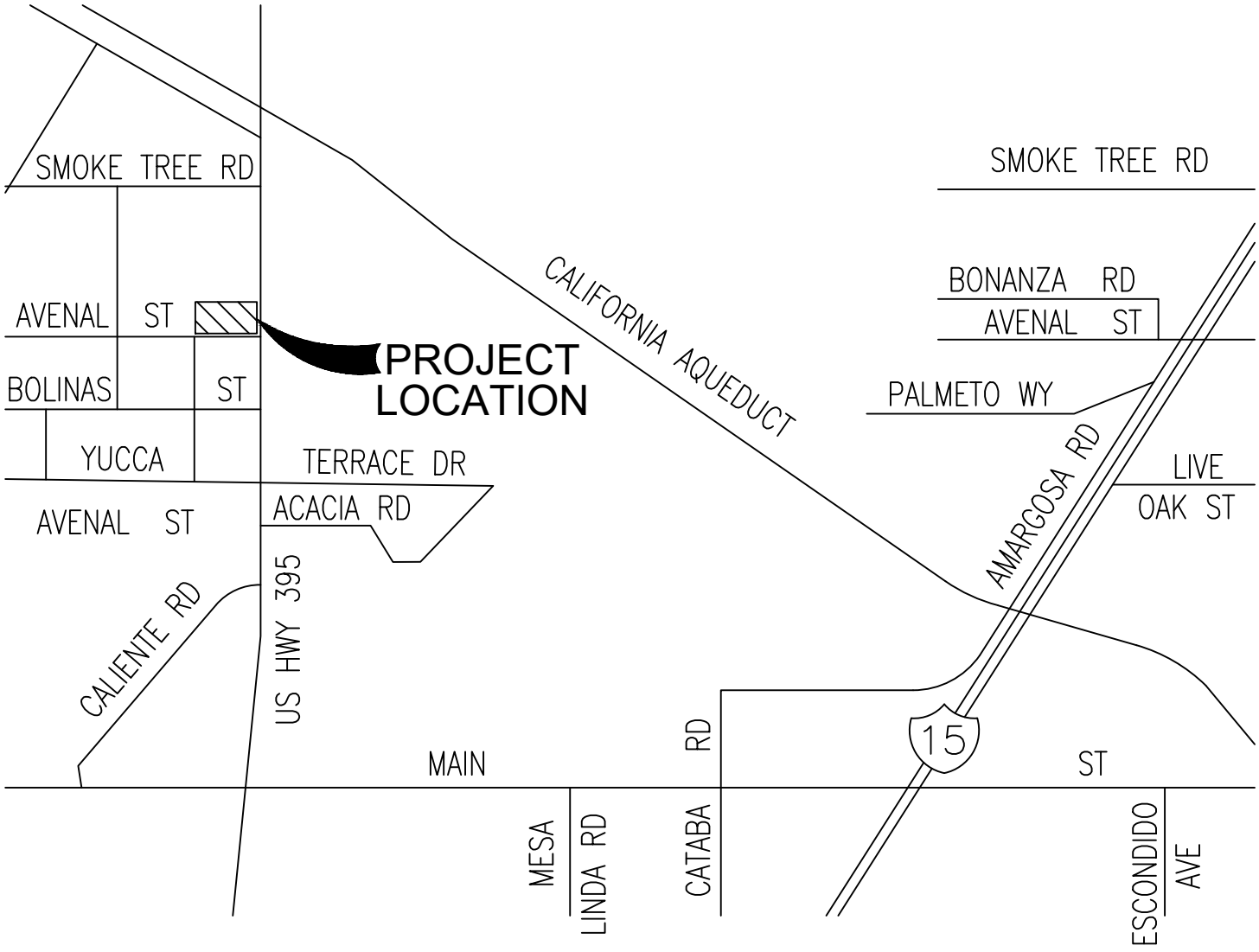
$V_{mitigation}$ = 3,650 ft^3 (see mitigation volume graph on next page)

Infiltration Chambers, V = 11,064 ft^3 (see manufacturer's specs., Appendix 3)

PROVIDED BASIN STORAGE MITIGATION = 11,064 ft^3 > 3,650 ft^3 = OK

APPENDIX – A

- Vicinity Map
- Drainage Areas
- Drainage Maps



VICINITY MAP

NO SCALE

HESPERIA SANGHA - DRAINAGE AREAS					
		FT^2	AC	%	COMPOSITE CN VALUE
PRE-DEVELOPED CONDITION - FULL SITE	A_T=	190696	4.378	---	78
	A_{PERV}=	190696	4.378	100.0%	
	A_{IMP}=	0	0.000	0.0%	
100-110	A_T=	190696	4.378	---	78
	A_{PERV}=	190696	4.378	100.0%	
	A_{IMP}=	0	0.000	0.0%	
POST-DEVELOPED CONDITION - FULL SITE	A_T=	175933	4.039	---	90
	A_{PERV}=	21148	0.485	12.0%	
	A_{IMP}=	154785	3.553	88.0%	
100-110	A_T=	175933	4.039	---	90
	A_{PERV}=	21148	0.485	12.0%	
	A_{IMP}=	154785	3.553	88.0%	
CN VALUES USED: COMMERICIAL LANDSCAPING (32), BARREN (78) AND BLDG/PCC/AC PAVEMENT (98). THIS SITE IS CLASSIFIED AS HYDROLOGIC SOIL GROUP A.					

SCALE: 1"=30'

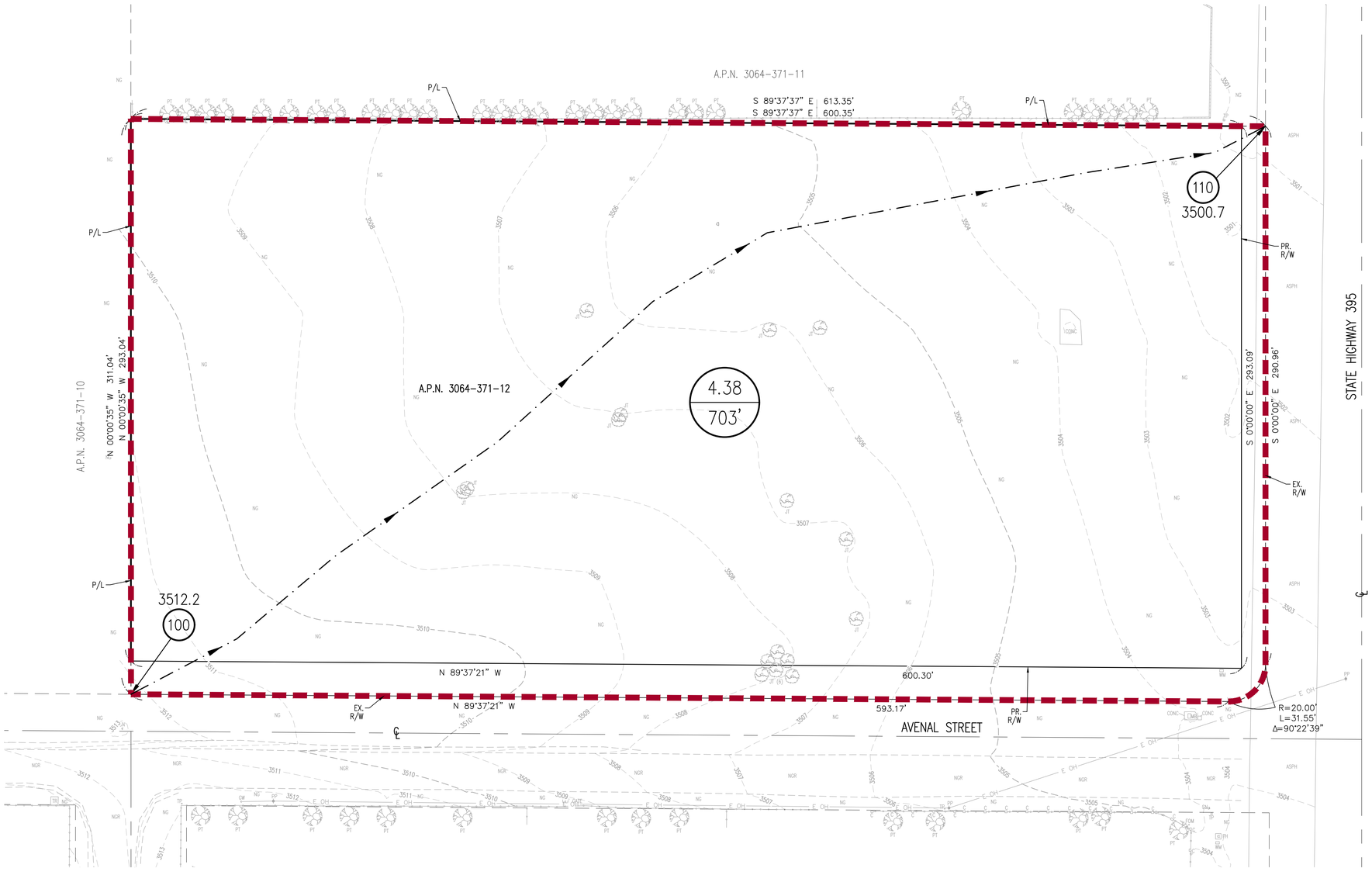
30 0 30 60

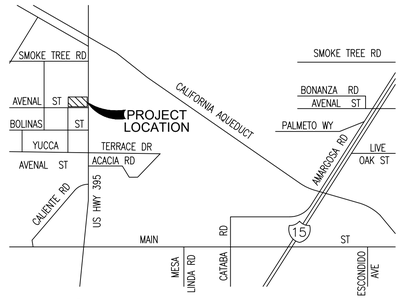
IN THE CITY OF HESPERIA, CALIFORNIA

ON-SITE DRAINAGE MAP
PRE-DEVELOPED CONDITION

FREIGHT CO.

A.P.N. 3064-371-12





VICINITY MAP

NO SCALE

OWNER/APPLICANT:

SANGHA, VARINDER PAUL
11025 TAMARIND AVENUE
BLOOMINGTON, CA 92316
PH: (909) 241-7464

ENGINEER/MAP PREPARER:

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DRAINAGE LEGEND:

DRAINAGE AREA (AC) — 10.00 / 500' — FLOW PATH LENGTH

100 — NODE #

FLOW LINE

WATERSHED BOUNDARY

FLOW PROCESS CHART PRE-DEVELOPED:

FROM NODE	TO NODE	FROM ELEV	TO ELEV	Q (CFS) 2 YR/1 HR	Q (CFS) 100 YR/1 HR
100	110	3512.2	3500.7	2.61	11.48

REGISTERED PROFESSIONAL ENGINEER BERNHARD K. MAYER NO. 36866 Exp. 6-30-22 CIVIL STATE OF CALIFORNIA

SITETECH INC.

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PH: (909) 864-3180, FAX: (909) 864-0850

MARCH 05, 2021

BERNHARD K. MAYER R.C.E. 36866 DATE

CITY OF HESPERIA
ON-SITE DRAINAGE
PRE-DEVELOPED CONDITION

PREPARED FOR: FREIGHT CO.

DATE: MARCH 05, 2021

A.P.N. 3064-371-12

SCALE: 1"=30'

MAILING ADDRESS: 11025 TAMARIND AVENUE BLOOMINGTON, CA 92316

SITE ADDRESS: A.P.N. 3064-371-12 HESPERIA, CA 92345

PHONE: (909) 241-7464

SHEET: 1 OF 1

IN THE CITY OF HESPERIA, CALIFORNIA

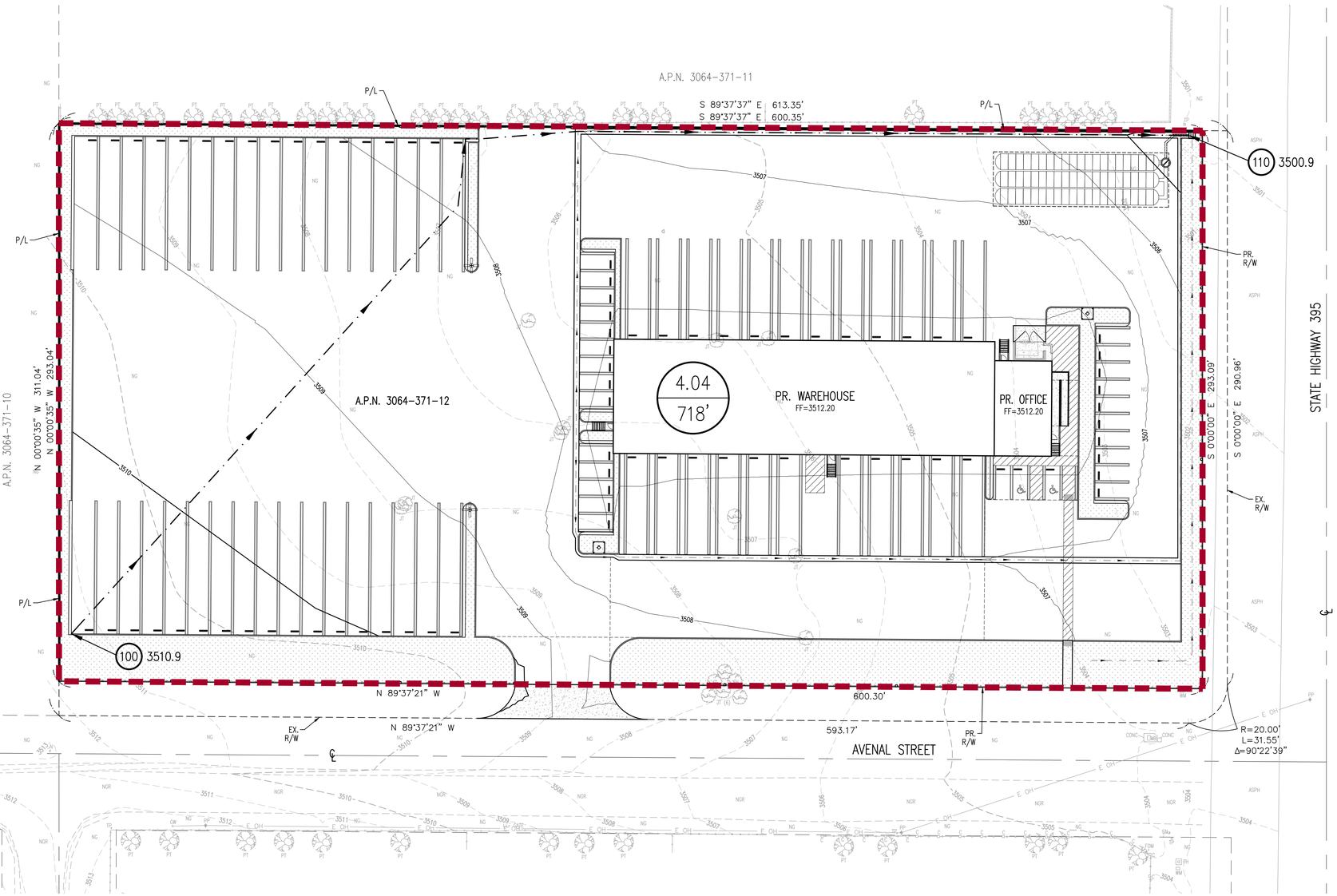
ON-SITE DRAINAGE MAP
POST-DEVELOPED CONDITION

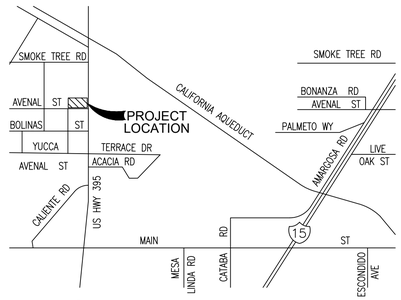
FREIGHT CO.

A.P.N. 3064-371-12

SCALE: 1"=30'

30 0 30 60





N

VICINITY MAP

NO SCALE

OWNER/APPLICANT:

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DRAINAGE LEGEND:

DRAINAGE AREA (AC) — 10.00 / 500' — FLOW PATH LENGTH

100 — NODE #

FLOW LINE

WATERSHED BOUNDARY

FLOW PROCESS CHART POST-DEVELOPED:

FROM NODE	TO NODE	FROM ELEV	TO ELEV	Q (CFS) 2 YR/1 HR	Q (CFS) 100 YR/1 HR
100	110	3510.9	3500.9	5.23	15.75

REGISTERED PROFESSIONAL ENGINEER
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MARCH 05, 2021

BERNHARD K. MAYER R.C.E. 36866 DATE

CITY OF HESPERIA
ON-SITE DRAINAGE
POST-DEVELOPED CONDITION

PREPARED FOR: FREIGHT CO.

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PHONE: (909) 241-7464

SHEET: 1 OF 1

APPENDIX – B

- Hydrology Calculations – Existing Condition
    - 2-year Storm Event
    - 100-year Storm Event

- Hydrology Calculations – Proposed Condition
    - 2-year Storm Event
    - 100-year Storm Event

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4381°, Longitude: -117.4006°
Elevation: 3503.4 ft**
* source: ESRI Maps
** source: USGS

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	**0.082** (0.068-0.100)	**0.118** (0.097-0.144)	**0.165** (0.136-0.202)	**0.204** (0.166-0.252)	**0.256** (0.203-0.328)	**0.297** (0.230-0.388)	**0.339** (0.256-0.453)	**0.382** (0.280-0.525)	**0.441** (0.311-0.632)	**0.487** (0.331-0.723)
10-min	**0.117** (0.097-0.143)	**0.169** (0.139-0.206)	**0.236** (0.195-0.290)	**0.292** (0.239-0.361)	**0.367** (0.290-0.469)	**0.426** (0.330-0.556)	**0.485** (0.367-0.649)	**0.547** (0.402-0.753)	**0.632** (0.445-0.906)	**0.698** (0.475-1.04)
15-min	**0.142** (0.117-0.173)	**0.204** (0.169-0.250)	**0.286** (0.236-0.351)	**0.353** (0.288-0.436)	**0.444** (0.351-0.568)	**0.515** (0.399-0.672)	**0.587** (0.443-0.785)	**0.662** (0.486-0.910)	**0.764** (0.538-1.10)	**0.844** (0.575-1.25)
30-min	**0.217** (0.179-0.264)	**0.312** (0.258-0.381)	**0.437** (0.360-0.535)	**0.539** (0.441-0.666)	**0.678** (0.536-0.867)	**0.786** (0.609-1.03)	**0.897** (0.677-1.20)	**1.01** (0.742-1.39)	**1.17** (0.822-1.67)	**1.29** (0.877-1.91)
60-min	**0.303** (0.251-0.370)	**0.436** (0.360-0.533)	**0.611** (0.503-0.749)	**0.754** (0.616-0.932)	**0.949** (0.750-1.21)	**1.10** (0.851-1.44)	**1.25** (0.947-1.68)	**1.41** (1.04-1.95)	**1.63** (1.15-2.34)	**1.80** (1.23-2.68)
2-hr	**0.436** (0.361-0.532)	**0.594** (0.490-0.726)	**0.807** (0.665-0.989)	**0.986** (0.806-1.22)	**1.24** (0.978-1.58)	**1.44** (1.11-1.88)	**1.65** (1.24-2.20)	**1.87** (1.37-2.57)	**2.18** (1.54-3.13)	**2.44** (1.66-3.62)
3-hr	**0.551** (0.456-0.673)	**0.737** (0.609-0.901)	**0.993** (0.818-1.22)	**1.21** (0.989-1.50)	**1.52** (1.20-1.94)	**1.77** (1.37-2.31)	**2.04** (1.54-2.72)	**2.32** (1.70-3.19)	**2.73** (1.92-3.91)	**3.06** (2.08-4.54)
6-hr	**0.772** (0.639-0.943)	**1.02** (0.845-1.25)	**1.37** (1.13-1.68)	**1.68** (1.37-2.07)	**2.12** (1.67-2.70)	**2.48** (1.92-3.23)	**2.87** (2.17-3.83)	**3.29** (2.42-4.53)	**3.91** (2.75-5.60)	**4.42** (3.01-6.56)
12-hr	**0.987** (0.817-1.21)	**1.35** (1.12-1.65)	**1.86** (1.54-2.29)	**2.31** (1.89-2.85)	**2.95** (2.33-3.77)	**3.48** (2.69-4.54)	**4.05** (3.06-5.42)	**4.67** (3.43-6.43)	**5.58** (3.93-8.00)	**6.34** (4.31-9.41)
24-hr	**1.35** (1.19-1.55)	**1.92** (1.70-2.21)	**2.72** (2.40-3.14)	**3.41** (2.98-3.97)	**4.41** (3.73-5.31)	**5.23** (4.34-6.43)	**6.11** (4.95-7.70)	**7.08** (5.58-9.17)	**8.48** (6.41-11.4)	**9.64** (7.04-13.5)
2-day	**1.51** (1.34-1.74)	**2.13** (1.89-2.46)	**3.02** (2.66-3.49)	**3.79** (3.32-4.41)	**4.92** (4.17-5.92)	**5.86** (4.86-7.20)	**6.88** (5.57-8.66)	**8.00** (6.30-10.4)	**9.65** (7.29-13.0)	**11.0** (8.06-15.4)
3-day	**1.62** (1.43-1.86)	**2.27** (2.01-2.62)	**3.20** (2.83-3.70)	**4.02** (3.52-4.68)	**5.22** (4.43-6.29)	**6.23** (5.17-7.66)	**7.32** (5.93-9.23)	**8.54** (6.73-11.1)	**10.3** (7.80-13.9)	**11.8** (8.64-16.5)
4-day	**1.75** (1.55-2.01)	**2.45** (2.17-2.82)	**3.44** (3.04-3.97)	**4.31** (3.77-5.02)	**5.60** (4.74-6.74)	**6.67** (5.54-8.20)	**7.84** (6.35-9.88)	**9.14** (7.20-11.8)	**11.1** (8.36-14.9)	**12.7** (9.26-17.7)
7-day	**1.94** (1.72-2.24)	**2.69** (2.39-3.11)	**3.75** (3.31-4.33)	**4.67** (4.09-5.44)	**6.03** (5.11-7.26)	**7.16** (5.94-8.80)	**8.39** (6.79-10.6)	**9.74** (7.67-12.6)	**11.7** (8.87-15.8)	**13.4** (9.80-18.7)
10-day	**2.09** (1.85-2.40)	**2.87** (2.54-3.31)	**3.97** (3.51-4.59)	**4.93** (4.32-5.75)	**6.33** (5.37-7.63)	**7.50** (6.22-9.22)	**8.76** (7.10-11.0)	**10.2** (8.00-13.2)	**12.2** (9.21-16.5)	**13.9** (10.2-19.4)
20-day	**2.54** (2.25-2.92)	**3.46** (3.06-3.99)	**4.74** (4.19-5.48)	**5.85** (5.13-6.82)	**7.46** (6.32-8.99)	**8.79** (7.30-10.8)	**10.2** (8.29-12.9)	**11.8** (9.30-15.3)	**14.1** (10.7-19.1)	**16.1** (11.7-22.4)
30-day	**3.00** (2.66-3.45)	**4.06** (3.59-4.68)	**5.52** (4.87-6.38)	**6.78** (5.94-7.90)	**8.60** (7.29-10.4)	**10.1** (8.38-12.4)	**11.7** (9.50-14.8)	**13.5** (10.6-17.5)	**16.1** (12.2-21.8)	**18.3** (13.4-25.6)
45-day	**3.56** (3.16-4.10)	**4.75** (4.20-5.47)	**6.38** (5.63-7.37)	**7.78** (6.82-9.07)	**9.80** (8.31-11.8)	**11.5** (9.52-14.1)	**13.3** (10.7-16.7)	**15.3** (12.0-19.8)	**18.2** (13.7-24.5)	**20.6** (15.1-28.8)
60-day	**4.05** (3.59-4.67)	**5.32** (4.71-6.13)	**7.05** (6.23-8.15)	**8.54** (7.48-9.95)	**10.7** (9.05-12.9)	**12.4** (10.3-15.3)	**14.4** (11.6-18.1)	**16.5** (13.0-21.3)	**19.6** (14.8-26.4)	**22.2** (16.2-31.0)

[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.

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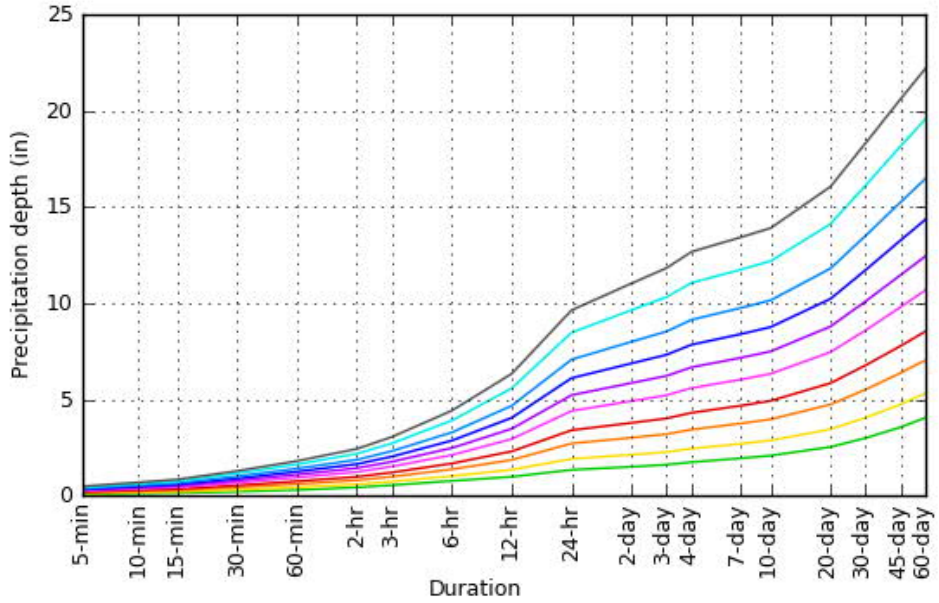
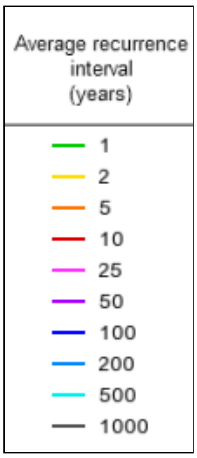
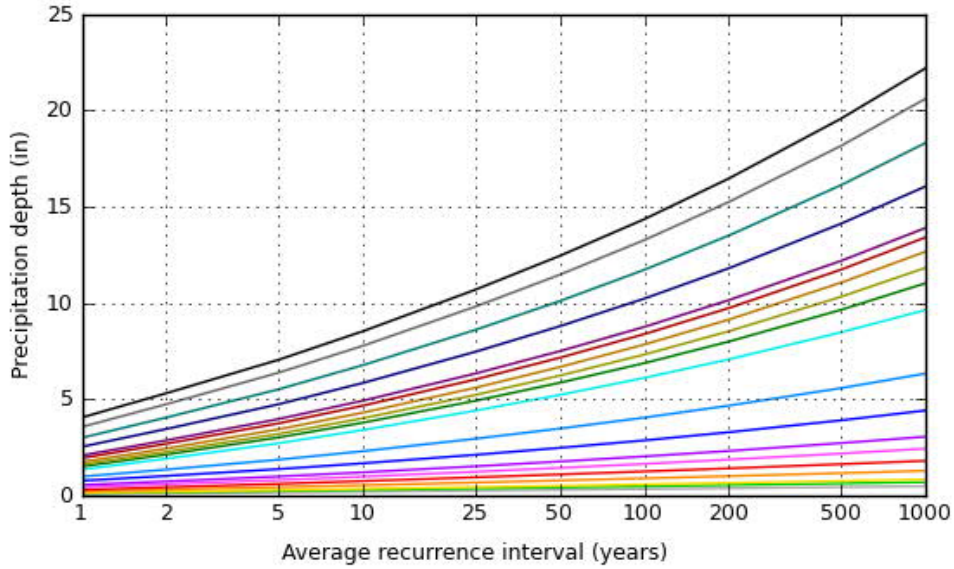
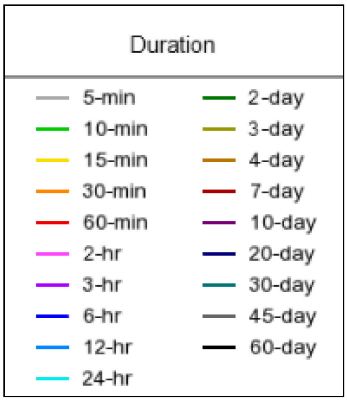
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.4381°, Longitude: -117.4006°









NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Tue Mar 2 22:59:50 2021

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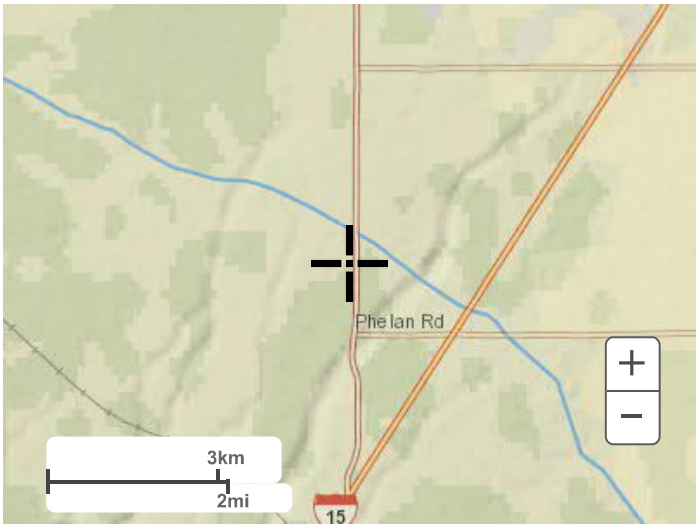
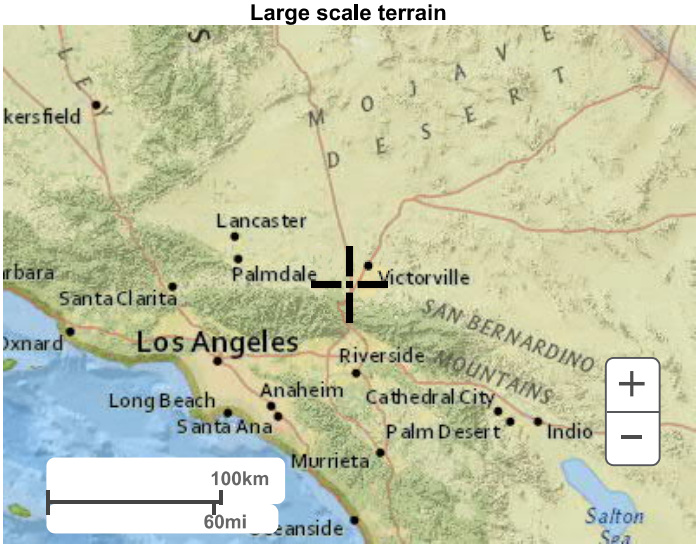
Maps & aerials

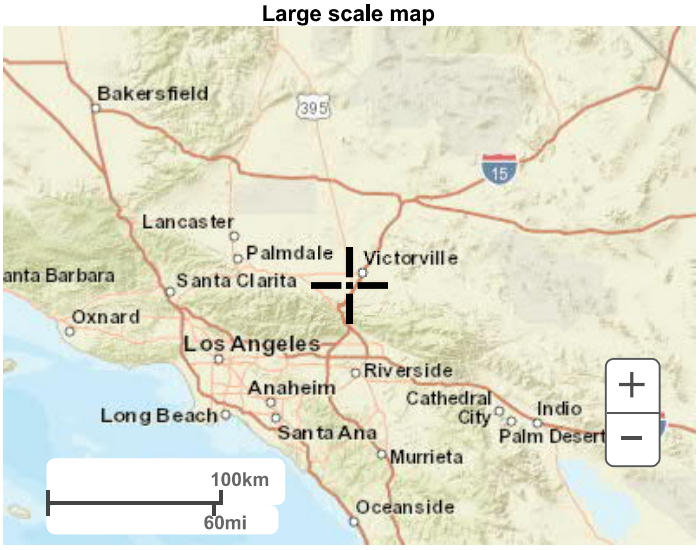
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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

Disclaimer

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (2 of 2)

```
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                          Analysis prepared by:

                              SITETECH, INC.
                        8061 CHURCH STREET, P.O. BOX 592
                               HIGHLAND, CA 92346
                                (909) 864-3180

 ************************* DESCRIPTION OF STUDY *************************
* HESPERIA SANGHA HYDROLOGY                                             *
* PRE-DEVELOPED 2-YEAR 1-HOUR                                           *
* PRELIMINARY DRAINAGE                                                  *
 ************************************************************************

  FILE NAME: EX2Y1H.DAT
  TIME/DATE OF STUDY: 10:14 03/04/2021
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.4360

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   703.00
  ELEVATION DATA: UPSTREAM(FEET) =   3512.20  DOWNSTREAM(FEET) =   3500.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.451
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.079
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                    A        4.38      0.42     1.000    78   16.45
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.61
  TOTAL AREA(ACRES) =      4.38   PEAK FLOW RATE(CFS) =      2.61
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.4  TC(MIN.) =     16.45
  EFFECTIVE AREA(ACRES) =      4.38  AREA-AVERAGED Fm(INCH/HR)=  0.42
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =       2.61
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                          Analysis prepared by:

                              SITETECH, INC.
                        8061 CHURCH STREET, P.O. BOX 592
                               HIGHLAND, CA 92346
                                (909) 864-3180

 ************************* DESCRIPTION OF STUDY *************************
* HESPERIA SANGHA HYDROLOGY                                             *
* POST-DEVELOPED 2-YEAR 1-HOUR                                          *
* PRELIMINARY DRAINAGE                                                  *
 ************************************************************************

  FILE NAME: SANG2P.DAT
  TIME/DATE OF STUDY: 10:56 03/04/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.4360

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   718.00
  ELEVATION DATA: UPSTREAM(FEET) =   3510.90  DOWNSTREAM(FEET) =   3500.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.921
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.537
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      0.98     0.100    32    9.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      5.23
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =      5.23
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      9.92
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       5.23
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                          Analysis prepared by:

                              SITETECH, INC.
                        8061 CHURCH STREET, P.O. BOX 592
                               HIGHLAND, CA 92346
                                (909) 864-3180

 ************************** DESCRIPTION OF STUDY **************************
* HESPERIA SANGHA HYDROLOGY                                               *
* PRE-DEVELOPED 100-YEAR 1-HOUR                                           *
* PRELIMINARY DRAINAGE                                                    *
 *************************************************************************

  FILE NAME: SANG100E.DAT
  TIME/DATE OF STUDY: 10:31 03/04/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   703.00
  ELEVATION DATA: UPSTREAM(FEET) =   3512.20  DOWNSTREAM(FEET) =   3500.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.451
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.092
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   A        4.38      0.18     1.000    93   16.45
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     11.48
  TOTAL AREA(ACRES) =      4.38   PEAK FLOW RATE(CFS) =     11.48
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.4  TC(MIN.) =     16.45
  EFFECTIVE AREA(ACRES) =      4.38  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      11.48
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                          Analysis prepared by:

                              SITETECH, INC.
                        8061 CHURCH STREET, P.O. BOX 592
                               HIGHLAND, CA 92346
                                (909) 864-3180

 ************************* DESCRIPTION OF STUDY *************************
* HESPERIA SANGHA HYDROLOGY                                             *
* POST-DEVELOPED 100-YEAR 1-HOUR                                        *
* PRELIMINARY DRAINAGE                                                  *
 ************************************************************************

  FILE NAME: SANG100P.DAT
  TIME/DATE OF STUDY: 11:02 03/04/2021
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   718.00
  ELEVATION DATA: UPSTREAM(FEET) =   3510.90  DOWNSTREAM(FEET) =   3500.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.921
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.406
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      0.74     0.100    52    9.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     15.75
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =     15.75
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      9.92
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      15.75
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX – C

- Hydraulic Calculations (Hydraflow Express, by Civil3D)
    - Manning Roughness Coefficient
    - 12” Storm Drain Capacity
    - Underground Infiltration Chambers Specs (Stormtech MC-4500)

The Manning's roughness coefficient is used in the Manning's formula to calculate flow in open channels.

Coefficients for some commonly used surface materials:

Surface Material	Manning's Roughness Coefficient - *n* -
Asbestos cement	0.011
Asphalt	0.016
Brass	0.011
Brick	0.015
Canvas	0.012
Cast-iron, new	0.012
Clay tile	0.014
Concrete - steel forms	0.011
Concrete (Cement) - finished	0.012
Concrete - wooden forms	0.015
Concrete - centrifugally spun	0.013
Copper	0.011
Corrugated metal	0.022
Earth, smooth	0.018
Earth channel - clean	0.022
Earth channel - gravelly	0.025
Earth channel - weedy	0.030
Earth channel - stony, cobbles	0.035
Floodplains - pasture, farmland	0.035
Floodplains - light brush	0.050
Floodplains - heavy brush	0.075
Floodplains - trees	0.15
Galvanized iron	0.016
Glass	0.010
Gravel, firm	0.023
Lead	0.011
Masonry	0.025
Metal - corrugated	0.022
Natural streams - clean and straight	0.030
Natural streams - major rivers	0.035
Natural streams - sluggish with deep pools	0.040
Natural channels, very poor condition	0.060
Plastic	0.009
Polyethylene PE - Corrugated with smooth inner walls	0.009 - 0.015
Polyethylene PE - Corrugated with corrugated inner walls	0.018 - 0.025
Polyvinyl Chloride PVC - with smooth inner walls	0.009 - 0.011
Rubble Masonry	0.017
Steel - Coal-tar enamel	0.010
Steel - smooth	0.012
Steel - New unlined	0.011
Steel - Riveted	0.019
Vitrified Sewer	0.013 - 0.015
Wood - planed	0.012
Wood - unplaned	0.013
Wood stove pipe, small diameter	0.011 - 0.012
Wood stove pipe, large diameter	0.012 - 0.013

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Mar 4 2021

12-INCH SD - CATCH BASIN TO CHAMBERS

Circular

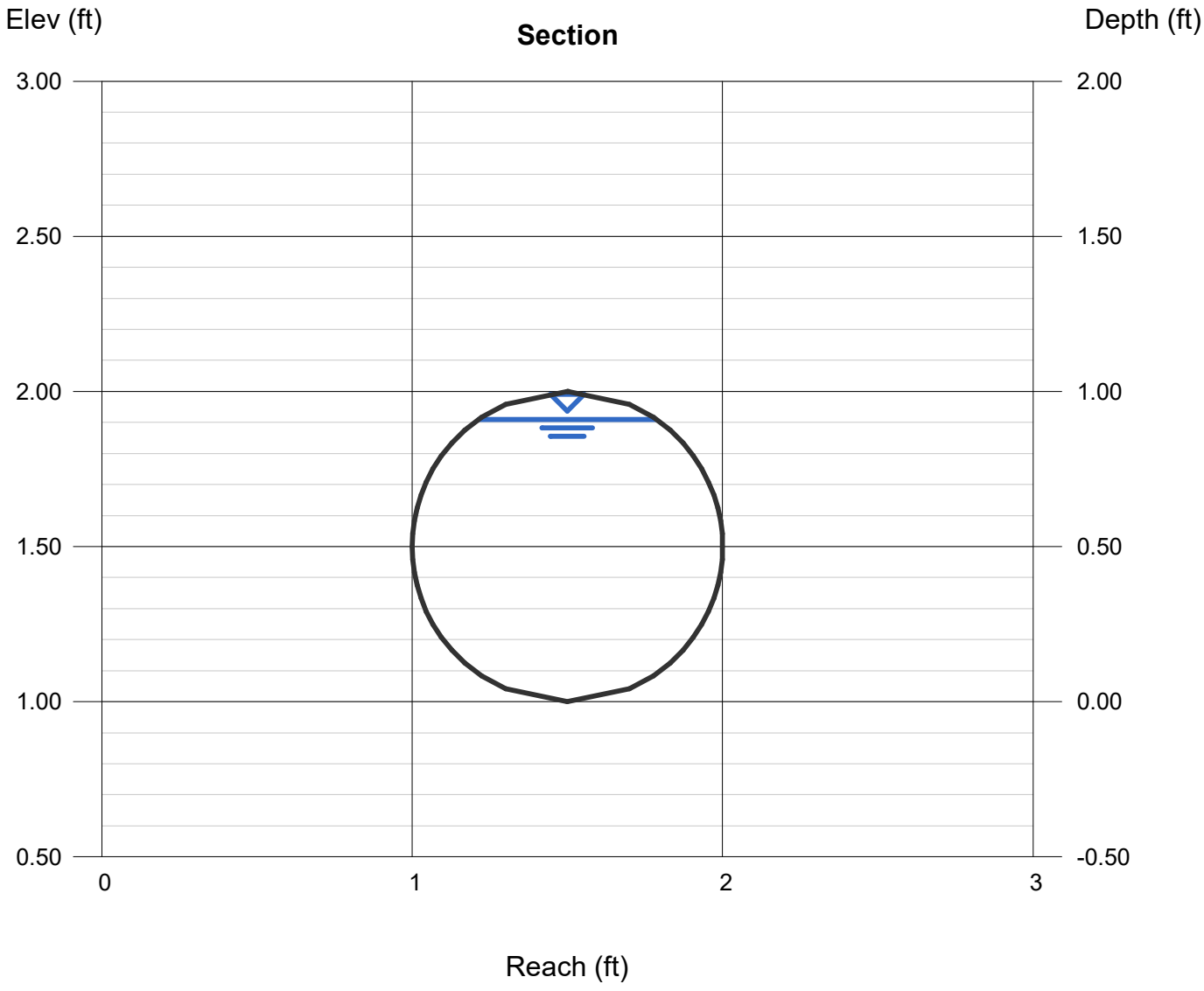
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.84

Highlighted

Depth (ft)	= 0.91
Q (cfs)	= 5.840
Area (sqft)	= 0.75
Velocity (ft/s)	= 7.78
Wetted Perim (ft)	= 2.54
Crit Depth, Yc (ft)	= 0.95
Top Width (ft)	= 0.57
EGL (ft)	= 1.85



PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST™ by StormTech
FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

LANDIN ASSOC HESPERIA SANGHA

HESPERIA, CA

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

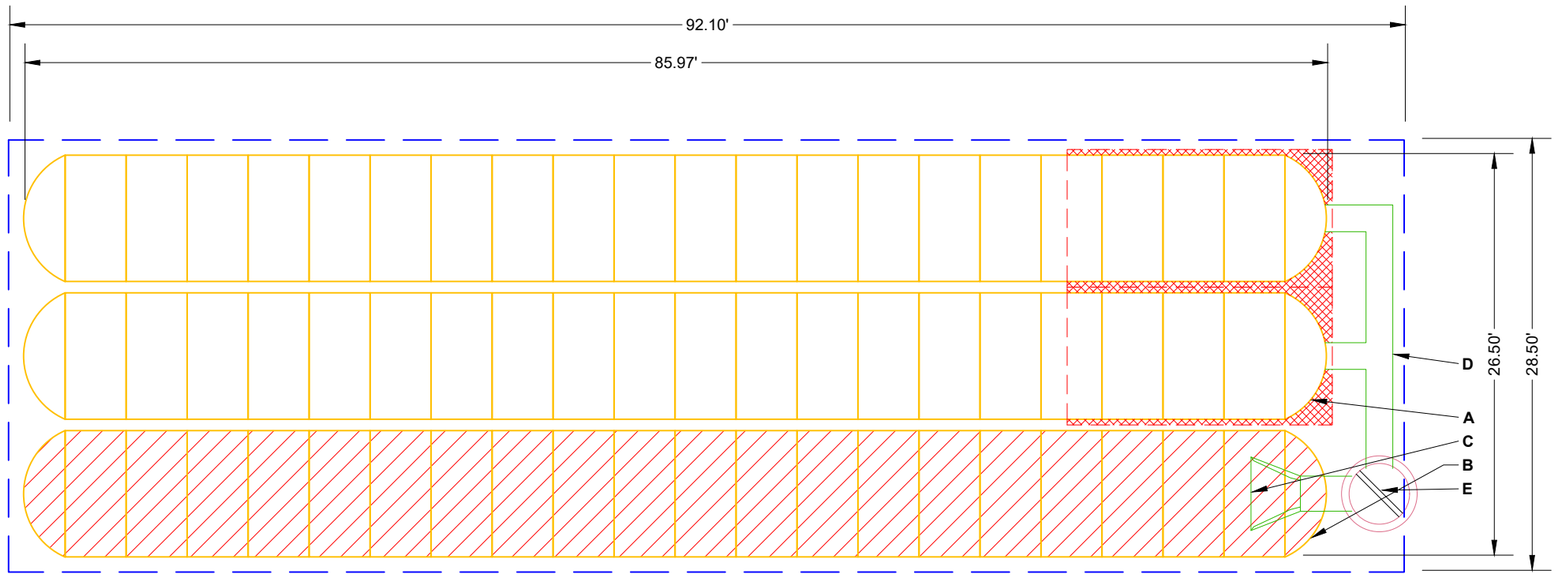
60	STORMTECH MC-4500 CHAMBERS	
6	STORMTECH MC-4500 END CAPS	
12	STONE ABOVE (in)	
9	STONE BELOW (in)	
40	STONE VOID	
11064	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	
2625	SYSTEM AREA (SF)	
241.2	SYSTEM PERIMETER (ft)	

CONCEPTUAL ELEVATIONS

MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
TOP OF STONE:	6.75
TOP OF MC-4500 CHAMBER:	5.75
24" ISOLATOR ROW PLUS INVERT:	0.94
18" x 18" BOTTOM MANIFOLD INVERT:	0.91
BOTTOM OF MC-4500 CHAMBER:	0.75
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	18" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP18B / TYP OF ALL 18" BOTTOM CONNECTIONS	1.97"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC450024RAMP		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.97"	
CONCRETE STRUCTURE W/WEIR	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		11.0 CFS IN



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

LANDIN ASSOC HESPERIA SANGHA
HESPERIA, CA

DRAWN: KW | CHECKED: N/A
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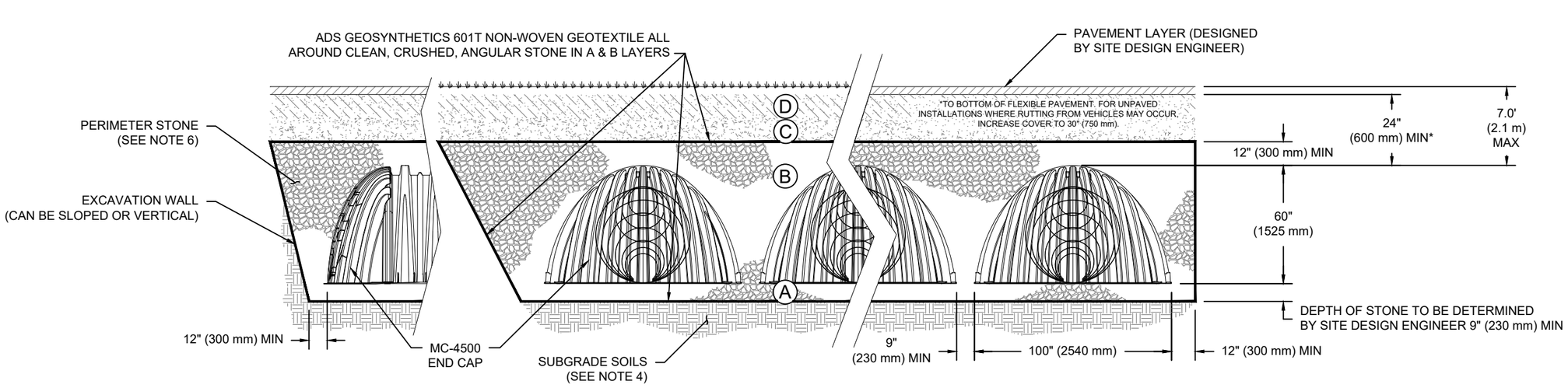
1-800-733-7473

0 10' 20'

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

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2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

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HESPERIA, CA
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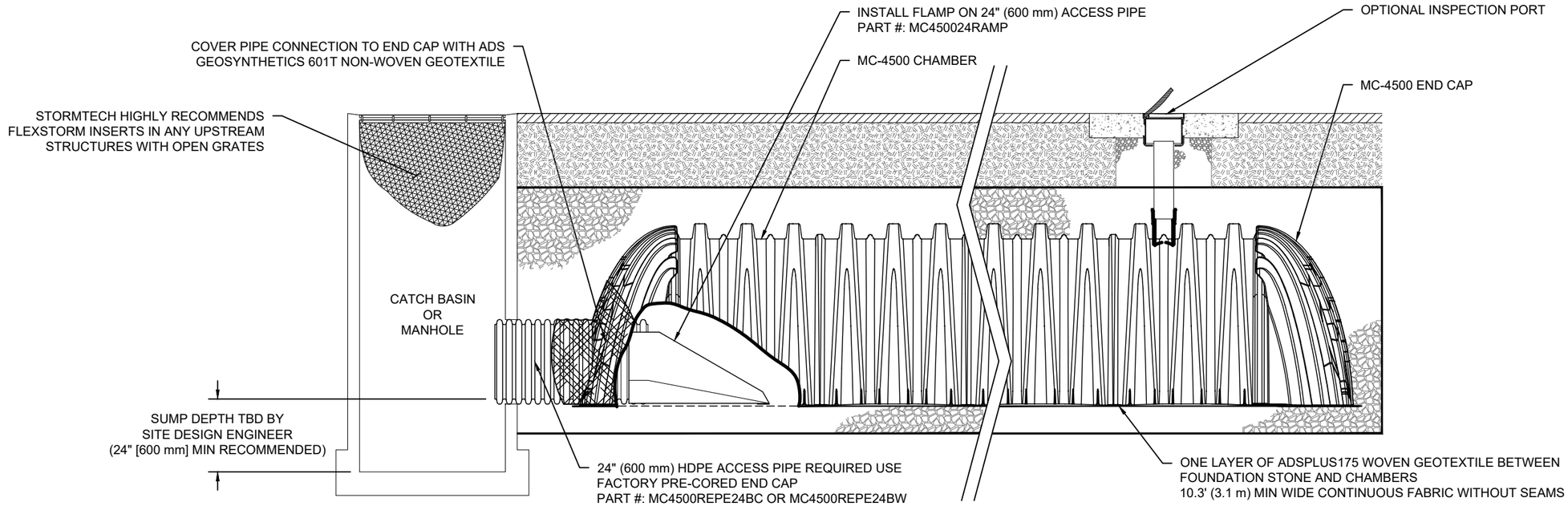

MC-4500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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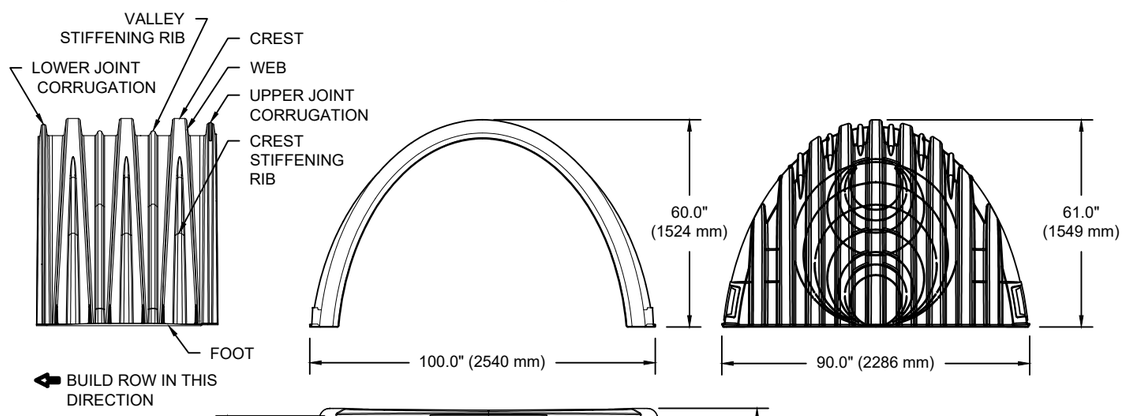
MC-4500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT (NOMINAL)	125.0 lbs.	(56.7 kg)

NOMINAL END CAP SPECIFICATIONS

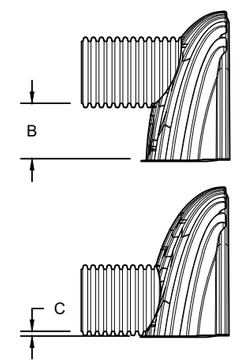
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC4500IEPP06B		---	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC4500IEPP08B		---	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC4500IEPP10B		---	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC4500IEPP12B		---	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC4500IEPP15B		---	1.70" (43 mm)
MC4500IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC4500IEPP18TW			
MC4500IEPP18B		---	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC4500IEPP24TW			
MC4500IEPP24B		---	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

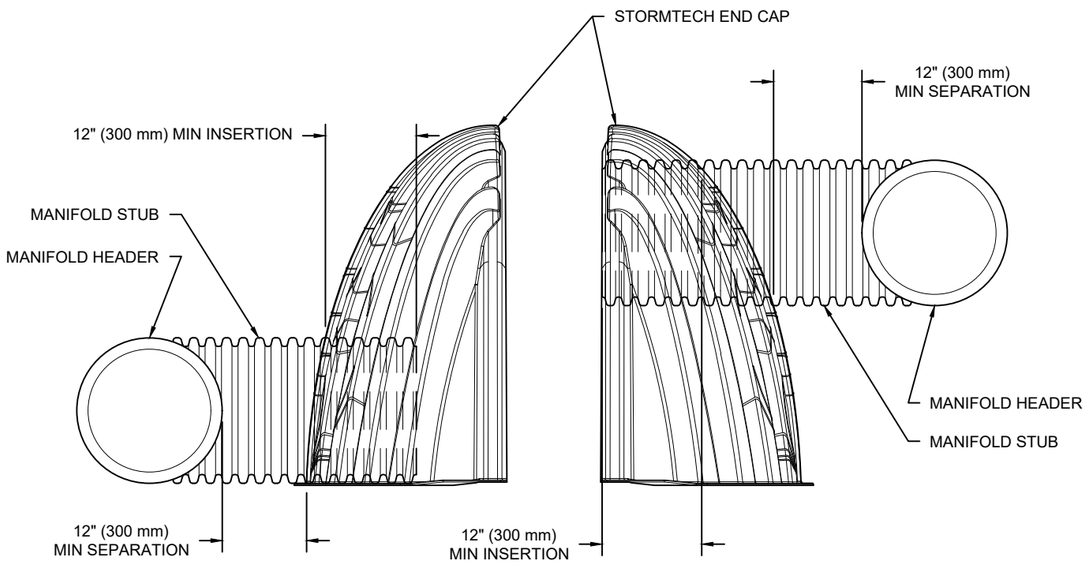
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

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