Appendix E-1

Tamarisk Apartment Complex, Hesperia
APN: 3057-121-08
Preliminary Drainage Report

Allard Engineering

May 6, 2024

ALLARD ENGINEERING

civil engineering land surveying land planning

Tamarisk Apartment Complex, Hesperia

APN: 3057-121-08

Preliminary Drainage Report

May 6, 2024

Prepared For:
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Tel:

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Prepared under the supervision of:

Robert K. Allard

REGISTERED PROFESSIONAL ENGINEER ROBERT K. ALLARD No. 85349 Exp. 6/30/24 CIVIL STATE OF CALIFORNIA

Bobby K Allard, P.E. RCE 85349 Exp. 03-11-2024

Discussion

Introduction

The proposed 4.9 acres of the proposed apartment complex development in the City of Hesperia, County of San Bernardino. The proposed apartment complex development area lies south of Main Street, west of Tamarisk Road, and east of Topaz Avenue.

The site is located within the City of Hesperia Master Plan of Drainage System (Proposed Regional Facility Line H-04-01) which will be built by the City of Hesperia in future. The entire site will drain to the proposed two below surface Stormtech infiltration/retention chamber system at the site. The proposed retention/infiltration chamber systems are sized to qualify for both WQMP volume as well as the retention volume from the site. The proposed infiltration/retention chamber systems will drain out to the existing street gutter in the Tamarisk Road on surface once they reach the capacity and keep draining on Tamarisk Road then to the east into the Main Street.

There are no offsite runoff from upstream tributary areas to the site. Offsite runoff intercepted north of the site by Main Street.

Purpose

The purpose of this Drainage Report is to determine storm water runoff for onsite. Also to show that the proposed retention/infiltration chamber systems are adequately sized to convey the onsite runoff (upto 100-yr storm event) in a safe manner to the existing street gutter in Tamarisk Avenue. Detailed hydrology analysis and calculations are provided with this report for the onsite developed condition and existing condition.

Criteria

The criteria utilized for hydrologic analysis is the San Bernardino County Hydrology Manual, AES rational method hydrology analysis and the City of Hesperia Master Plan of Drainage. AES software (Rational Method Hydrology) was used to quantify onsite runoff and "13.5-cf of retention per 100-sf of impervious area" rule was used to quantify onsite detention volume. AES software were used for the proposed storm drain system onsite.

Findings

The proposed site development (4.9 acres, apartment complex) (APN: 3057-121-08) and its drainage system will comprise of storm drain pipe, ribbon/valley gutters onsite drop/grate inlets with filtration device, and multiple infiltration/retention chamber system. The infiltration/retention chamber system-1,2 are sized to qualify for both WQMP volume as well as the detention volume for the proposed developed site. Detention volume has been calculated based upon the City of Hesperia "13.5-cf of retention per 100-sf of impervious area" rule.

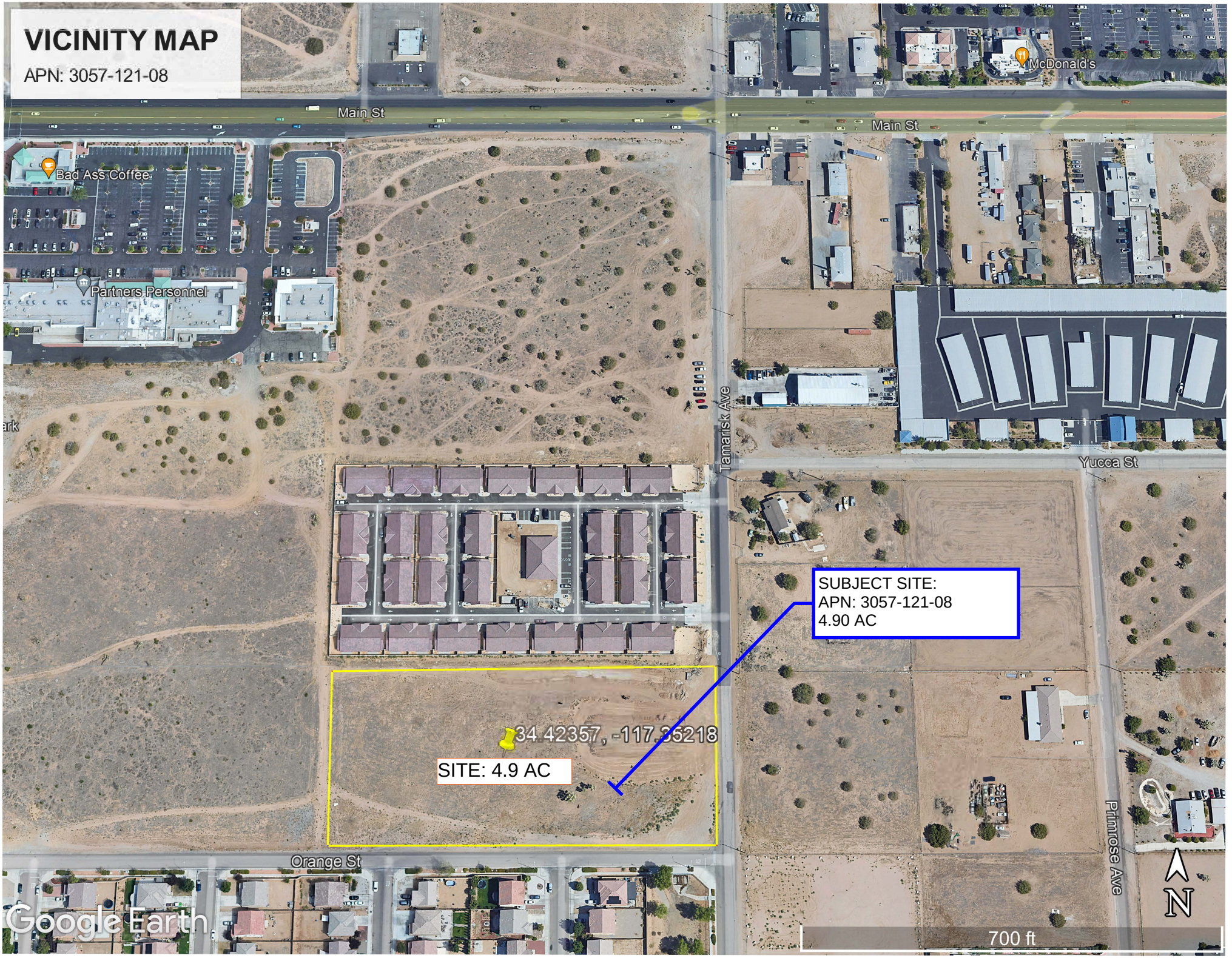
We calculated the runoff quantities of 18.6 cfs onsite in developed ccondition and 12.9 cfs in pre-developed condition using the rational method hydrology analysis for the 100-yr storm event.

The onsite runoff of 18.6 cfs generated from the proposed site in developed condition which is 4.90 acres. The onsite runoff (18.6 cfs) will be drained into the proposed two below surface infiltration/retention chamber system-1,2 for WQ volume (16,314 CF) infiltration and retention/infiltration (25,933 CF) of the

City required detention volume to mitigate HCOC condition. Once all of the retention/infiltration chamber system-1,2 reach their capacity, it will drain out to street gutter in Tamarisk Avenue at the east boundary line of the site. The runoff will follow the existing drainage course on Tamarisk Avenue and ultimately drain to the Mojave River which is the receiving water.

Reference plans/documents, calculations and the exhibits are attached to support these findings.

Reference Material


VICINITY MAP
APN: 3057-121-08
Main St
Main St
McDonald's
Bad Ass Coffee
Partners Personnel
Tamarisk Ave
Yucca St
SUBJECT SITE:
APN: 3057-121-08
4.90 AC
34.42357, -117.35218
SITE: 4.9 AC
Orange St
Primrose Ave
N
700 ft
Google Earth

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4236°, Longitude: -117.3522°
Elevation: 3420 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	0.085 (0.071-0.104)	0.121 (0.100-0.147)	0.168 (0.138-0.205)	0.206 (0.169-0.255)	0.260 (0.205-0.332)	0.302 (0.234-0.394)	0.345 (0.261-0.462)	0.390 (0.287-0.537)	0.453 (0.319-0.650)	0.502 (0.342-0.746)
10-min	0.122 (0.101-0.149)	0.173 (0.143-0.211)	0.240 (0.198-0.294)	0.296 (0.242-0.365)	0.373 (0.295-0.476)	0.433 (0.335-0.565)	0.495 (0.374-0.662)	0.560 (0.411-0.770)	0.649 (0.457-0.931)	0.720 (0.490-1.07)
15-min	0.148 (0.122-0.180)	0.209 (0.173-0.256)	0.290 (0.239-0.356)	0.358 (0.292-0.442)	0.451 (0.356-0.576)	0.523 (0.405-0.683)	0.598 (0.452-0.800)	0.677 (0.497-0.931)	0.785 (0.553-1.13)	0.871 (0.593-1.29)
30-min	0.221 (0.183-0.270)	0.313 (0.258-0.382)	0.434 (0.358-0.532)	0.535 (0.437-0.661)	0.674 (0.533-0.861)	0.782 (0.606-1.02)	0.895 (0.676-1.20)	1.01 (0.743-1.39)	1.17 (0.827-1.68)	1.30 (0.886-1.93)
60-min	0.306 (0.253-0.373)	0.432 (0.357-0.528)	0.601 (0.495-0.736)	0.740 (0.604-0.914)	0.932 (0.737-1.19)	1.08 (0.838-1.41)	1.24 (0.935-1.66)	1.40 (1.03-1.92)	1.62 (1.14-2.33)	1.80 (1.23-2.67)
2-hr	0.442 (0.365-0.539)	0.596 (0.492-0.728)	0.804 (0.663-0.986)	0.979 (0.801-1.21)	1.22 (0.969-1.57)	1.42 (1.10-1.86)	1.63 (1.23-2.17)	1.84 (1.35-2.53)	2.15 (1.51-3.08)	2.39 (1.63-3.54)
3-hr	0.554 (0.459-0.677)	0.737 (0.609-0.900)	0.985 (0.812-1.21)	1.20 (0.977-1.48)	1.49 (1.18-1.91)	1.73 (1.34-2.26)	1.98 (1.50-2.65)	2.25 (1.65-3.10)	2.63 (1.85-3.77)	2.94 (2.00-4.36)
6-hr	0.777 (0.643-0.949)	1.02 (0.846-1.25)	1.36 (1.12-1.67)	1.65 (1.35-2.04)	2.07 (1.64-2.64)	2.40 (1.86-3.14)	2.76 (2.08-3.69)	3.15 (2.31-4.33)	3.70 (2.60-5.30)	4.15 (2.82-6.16)
12-hr	1.00 (0.829-1.22)	1.36 (1.12-1.66)	1.84 (1.52-2.26)	2.26 (1.85-2.79)	2.86 (2.26-3.65)	3.34 (2.58-4.35)	3.85 (2.91-5.14)	4.40 (3.23-6.05)	5.19 (3.65-7.44)	5.83 (3.97-8.66)
24-hr	1.36 (1.20-1.56)	1.90 (1.68-2.19)	2.64 (2.33-3.05)	3.28 (2.87-3.82)	4.18 (3.54-5.03)	4.91 (4.07-6.03)	5.68 (4.60-7.15)	6.51 (5.13-8.44)	7.70 (5.82-10.4)	8.68 (6.34-12.1)
2-day	1.54 (1.37-1.78)	2.16 (1.92-2.49)	3.02 (2.67-3.49)	3.76 (3.29-4.38)	4.83 (4.09-5.81)	5.70 (4.73-7.00)	6.63 (5.37-8.35)	7.64 (6.02-9.89)	9.10 (6.88-12.3)	10.3 (7.53-14.4)
3-day	1.65 (1.47-1.90)	2.32 (2.05-2.67)	3.24 (2.86-3.75)	4.04 (3.54-4.71)	5.20 (4.41-6.26)	6.15 (5.11-7.57)	7.18 (5.82-9.04)	8.30 (6.54-10.7)	9.92 (7.50-13.4)	11.3 (8.24-15.8)
4-day	1.78 (1.58-2.05)	2.50 (2.21-2.88)	3.49 (3.08-4.03)	4.35 (3.81-5.07)	5.60 (4.75-6.74)	6.63 (5.50-8.15)	7.74 (6.27-9.75)	8.95 (7.05-11.6)	10.7 (8.10-14.5)	12.2 (8.90-17.0)
7-day	1.99 (1.76-2.29)	2.76 (2.44-3.18)	3.84 (3.39-4.44)	4.77 (4.18-5.56)	6.12 (5.18-7.37)	7.22 (6.00-8.88)	8.42 (6.82-10.6)	9.72 (7.65-12.6)	11.6 (8.77-15.7)	13.2 (9.62-18.4)
10-day	2.12 (1.88-2.45)	2.94 (2.61-3.39)	4.08 (3.60-4.71)	5.06 (4.43-5.89)	6.47 (5.48-7.79)	7.63 (6.33-9.38)	8.87 (7.19-11.2)	10.2 (8.06-13.2)	12.2 (9.22-16.5)	13.8 (10.1-19.3)
20-day	2.56 (2.27-2.94)	3.53 (3.12-4.07)	4.88 (4.30-5.63)	6.03 (5.28-7.03)	7.70 (6.52-9.27)	9.06 (7.52-11.1)	10.5 (8.53-13.3)	12.1 (9.55-15.7)	14.4 (10.9-19.5)	16.3 (11.9-22.8)
30-day	3.01 (2.66-3.46)	4.13 (3.66-4.76)	5.68 (5.02-6.56)	7.02 (6.14-8.17)	8.94 (7.58-10.8)	10.5 (8.73-12.9)	12.2 (9.89-15.4)	14.1 (11.1-18.2)	16.7 (12.6-22.6)	19.0 (13.8-26.5)
45-day	3.56 (3.16-4.10)	4.84 (4.29-5.58)	6.62 (5.84-7.65)	8.15 (7.14-9.49)	10.4 (8.77-12.5)	12.2 (10.1-15.0)	14.1 (11.4-17.8)	16.2 (12.8-21.0)	19.3 (14.6-26.1)	21.9 (16.0-30.6)
60-day	4.05 (3.59-4.67)	5.43 (4.81-6.26)	7.35 (6.49-8.49)	9.00 (7.88-10.5)	11.4 (9.65-13.7)	13.3 (11.1-16.4)	15.5 (12.5-19.5)	17.8 (14.0-23.1)	21.2 (16.0-28.6)	24.1 (17.6-33.6)

[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.

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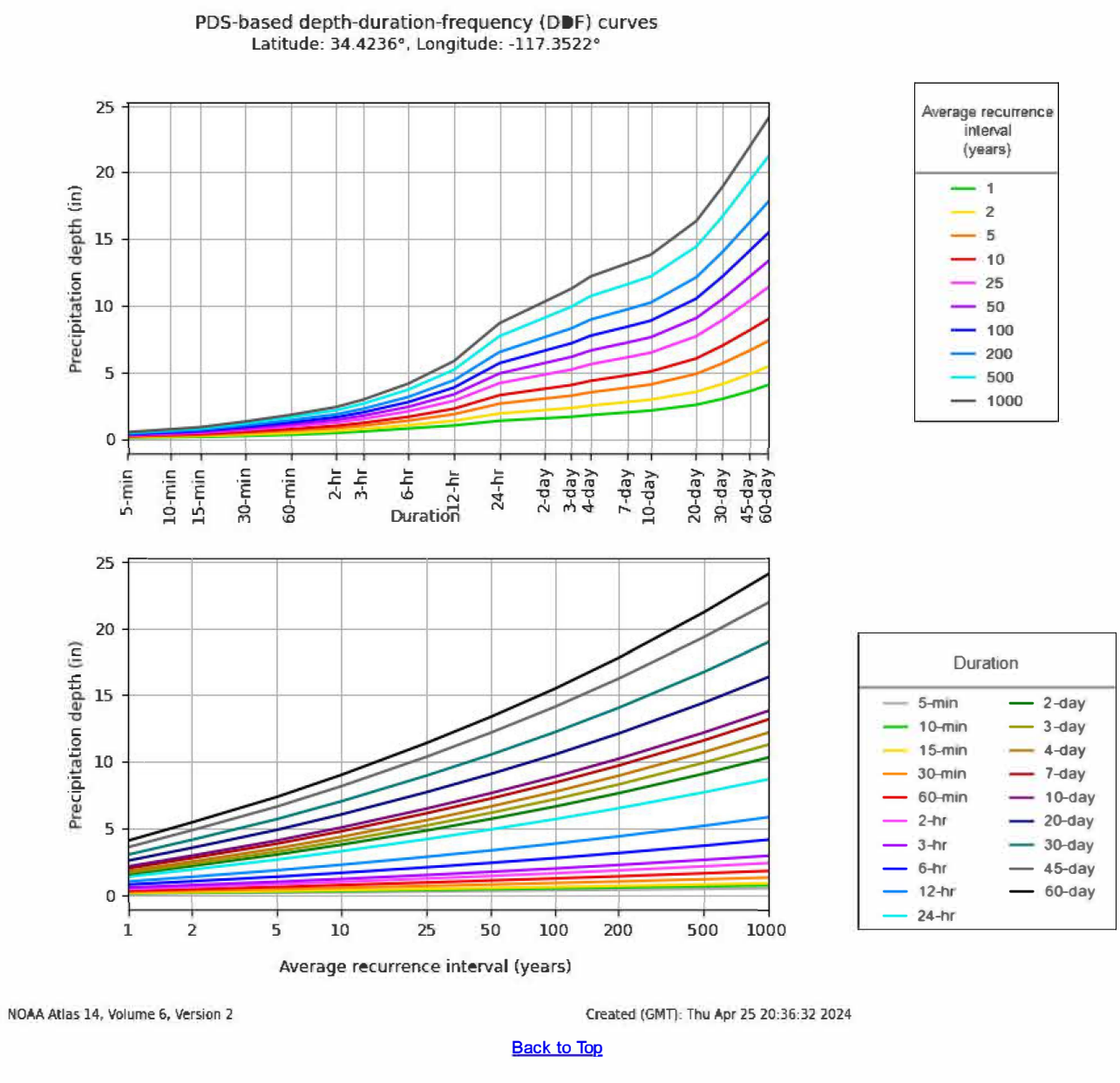
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Apr 25 20:36:32 2024

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Maps & aerials

Small scale terrain

San Bernardino County, California, Mojave River Area

134—HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hks7
Elevation: 200 to 4,000 feet
Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 150 to 250 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hesperia and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hesperia

Setting

Landform: Fan aprons
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 6 inches: loamy fine sand
H2 - 6 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Avg: 3.96"/hr

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R030XE006CA - COARSE LOAMY

Hydric soil rating: No

Minor Components

Wrightwood
Percent of map unit: 5 percent
Hydric soil rating: No

Cajon
Percent of map unit: 5 percent
Hydric soil rating: No

Bull trail
Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils
Percent of map unit: 2 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 15, Aug 30, 2023

Map Scale: 1:1,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 15, Aug 30, 2023

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
134	HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	4.2	100.0%
Totals for Area of Interest		**4.2**	**100.0%**

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.50
		Predominant soil texture	0.25	2	0.50
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.50
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	2	0.50
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.0
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					3.00
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					3.96
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} / K_M$					1.32

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Average Inf. Rate : 3.96 in/hr from USDA WebSoil Report
Design Inf Rate: 3.96/3.0 = 1.32"/hr

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

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.

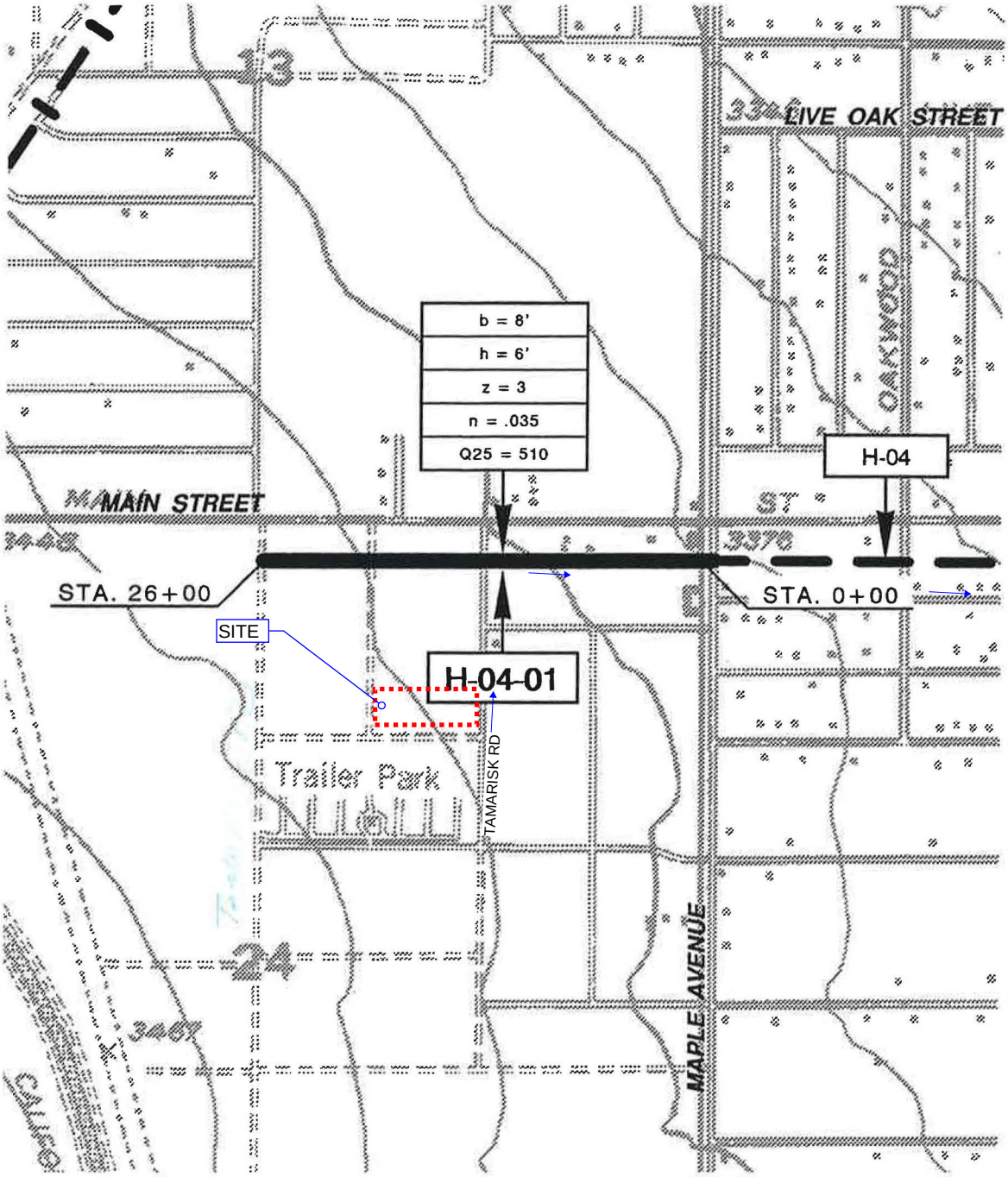
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some 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



LEGEND

- PROPOSED FACILITY
- FACILITY SHOWN ELSEWHERE
- WATERSHED BOUNDARY
- FLOODPLAIN
- FLOODWAY
- DETENTION BASIN

MASTER PLAN OF DRAINAGE

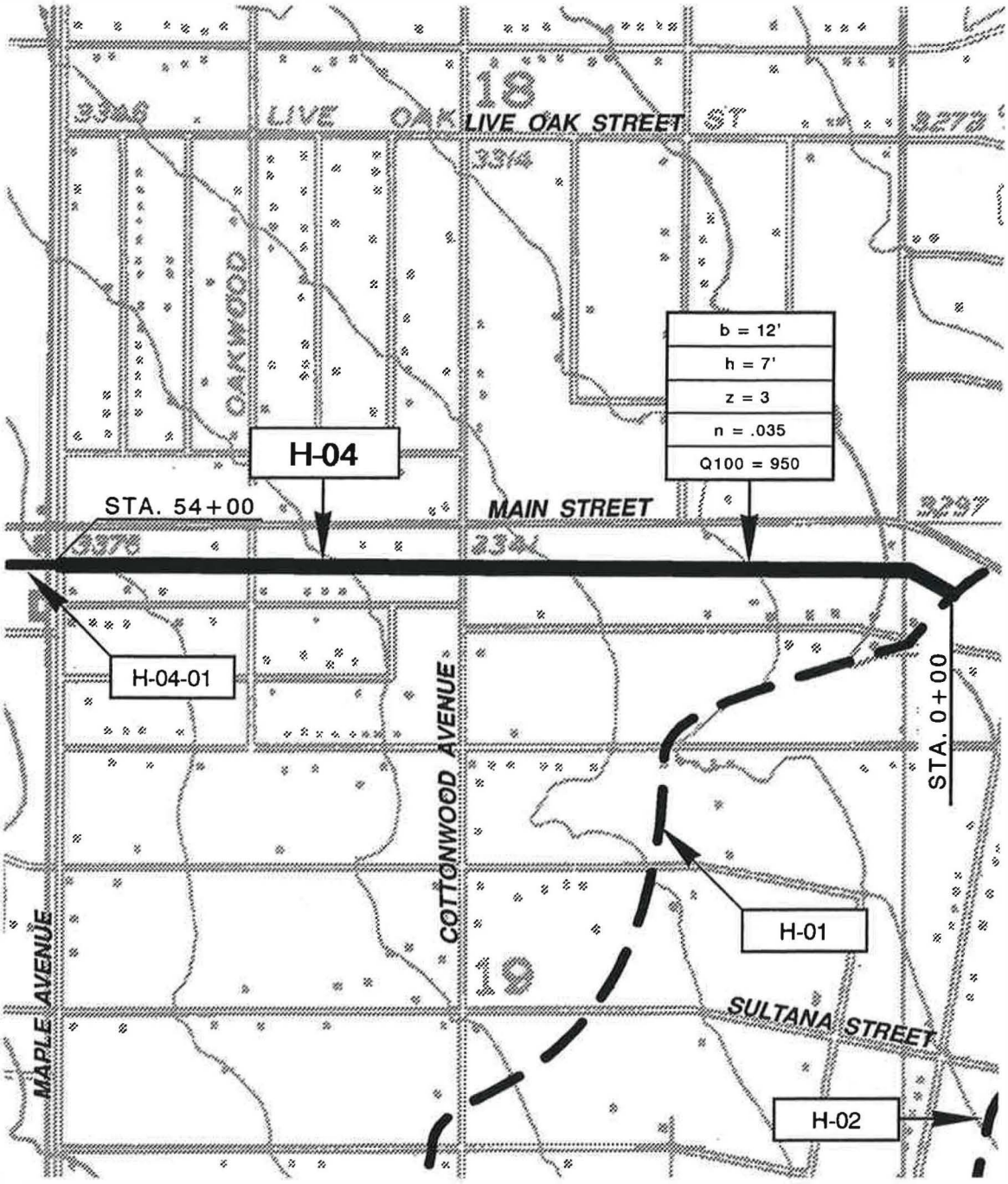
HESPERIA
H-04-01
SHEET 1 OF 1

WILLIAMSON & SCHMID

W/S

SCALE
1" = 1000'

N



LEGEND

PROPOSED FACILITY
FACILITY SHOWN ELSEWHERE
WATERSHED BOUNDARY
FLOODPLAIN
FLOODWAY
DETENTION BASIN

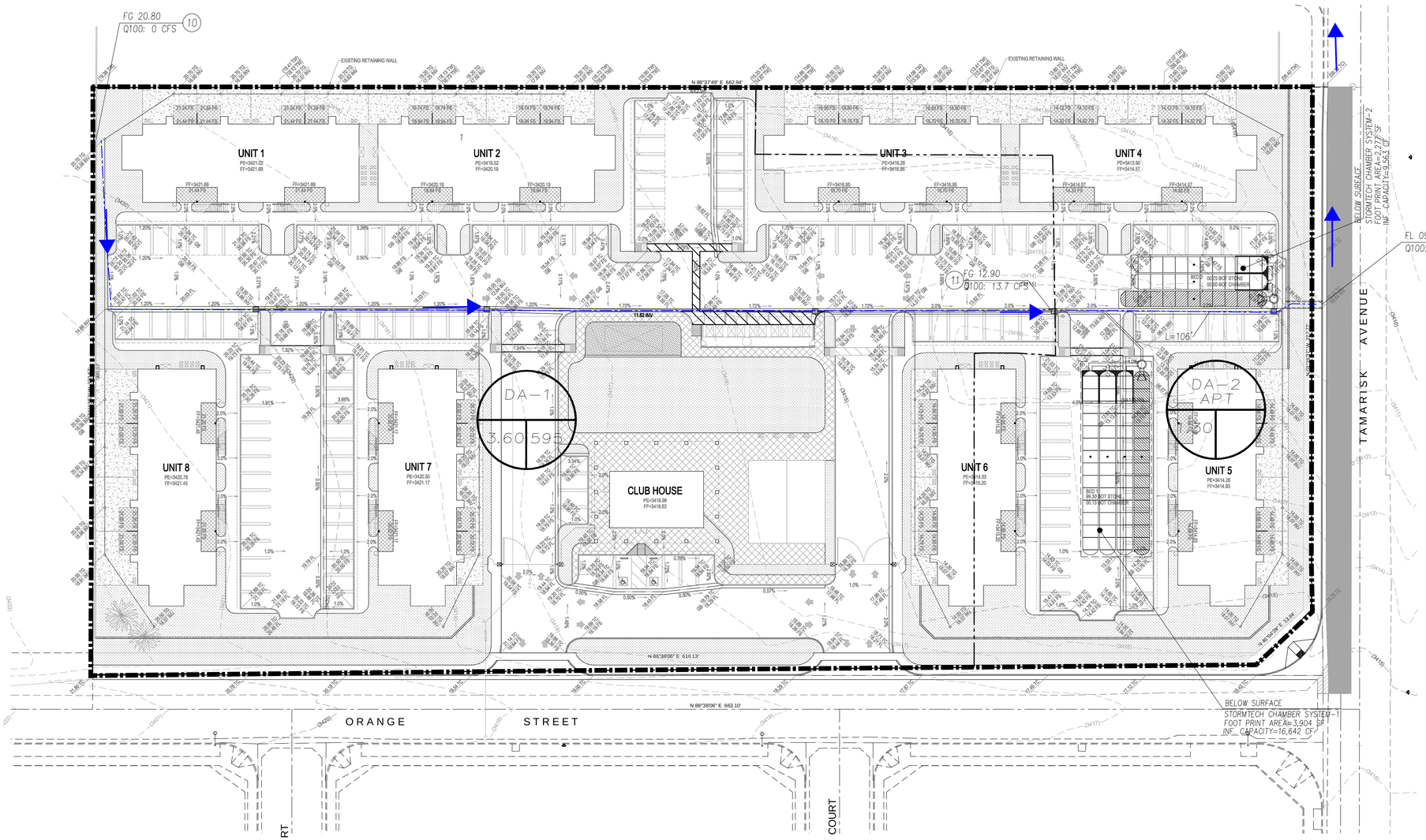
MASTER PLAN OF DRAINAGE

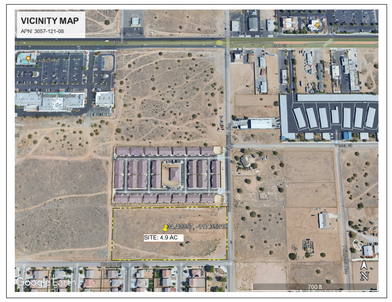
HESPERIA
H-04
SHEET 1 OF 1

WILLIAMSON & SCHMID

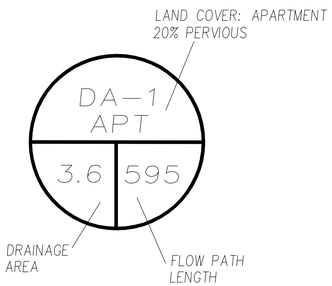
SCALE
1" = 1000'

ONSITE RATIONAL METHOD HYDROLOGY ANALYSIS (100-YR STORM EVENT)





VICINITY MAP
NTS



LATITUDE & LONGITUDE
34.42357°N, −117.35218°W

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

Prepared By:
ALLARD ENGINEERING
Civil Engineering - Land Surveying - Land Planning
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Fontana, California 92335
(909) 356-1815 Fax (909) 356-1795

Prepared For:
MUNEM MAIDA
13302 RANCHERO ROAD
HESPERIA, CA92344

CITY OF HESPERIA CALIFORNIA

DRAINAGE EXHIBIT
(DEVELOPED CONDITION)

TAMARISK AVENUE APT. COMPLEX-2
APN :3057-121-08

PLOT DATE: May 06, 2024 smarin

Filename: I:\Steeno Design Studios\STEENO-TAMARISK APT, HESPERIA\Reports\Drainage\Exhibit\Exhib

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
        (c) Copyright 1983-2016 Advanced Engineering Software (aes)
            Ver. 23.0  Release Date: 07/01/2016  License ID 1400

                          Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* TAMARISK APARTMENT                                                    *
* HYDROLOGY ANALYSIS                                                    *
* 100YR STORM EVENT, DEVELOPED CONDITION                                *
 ************************************************************************

  FILE NAME: TAM.DAT
  TIME/DATE OF STUDY: 15:22 05/06/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  48.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *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) = 1.2400

  *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     10.00 TO NODE     11.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   595.00
  ELEVATION DATA: UPSTREAM(FEET) =     20.80  DOWNSTREAM(FEET) =     12.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.902
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.376
  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.)
  APARTMENTS                 A        3.60      0.74     0.200    52    9.90
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =     13.70
```

```
  TOTAL AREA(ACRES) =      3.60   PEAK FLOW RATE(CFS) =     13.70

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     12.90  DOWNSTREAM(FEET) =      9.64
  CHANNEL LENGTH THRU SUBAREA(FEET) =   106.00   CHANNEL SLOPE =  0.0308
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =  18.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.08

        ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
            CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
            ALLOWABLE DEPTH).
            AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
            ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

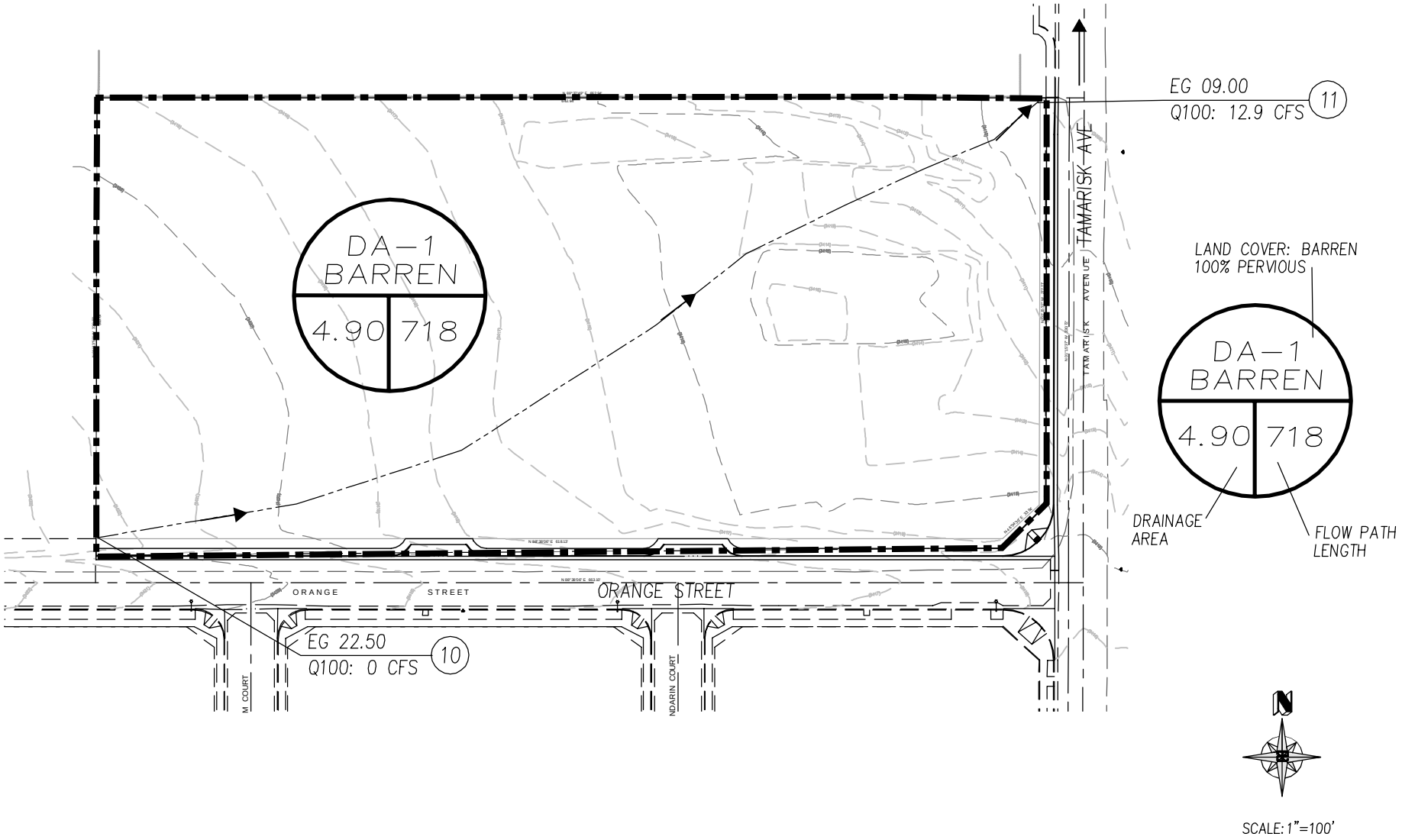
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.364
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  MOBILE HOME PARK           A        1.30      0.74     0.250    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.250
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      16.14
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  43.28
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   0.04
  Tc(MIN.) =    9.94
  SUBAREA AREA(ACRES) =     1.30       SUBAREA RUNOFF(CFS) =    4.89
  EFFECTIVE AREA(ACRES) =      4.90     AREA-AVERAGED Fm(INCH/HR) =   0.16
  AREA-AVERAGED Fp(INCH/HR) =   0.74  AREA-AVERAGED Ap =   0.21
  TOTAL AREA(ACRES) =        4.9         PEAK FLOW RATE(CFS) =      18.55

        ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
            CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
            ALLOWABLE DEPTH).
            AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
            ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.


  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =  49.72

  ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     701.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.9  TC(MIN.) =      9.94
  EFFECTIVE AREA(ACRES) =      4.90  AREA-AVERAGED Fm(INCH/HR)=  0.16
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.213
  PEAK FLOW RATE(CFS)   =      18.55
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```



PLOT DATE: May 06, 2024 ashafiq

Prepared By:

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CITY OF HESPERIA, CALIFORNIA

DRAINAGE EXHIBIT-EXISTING

APN: 03057-121-08

Filename: I:\Steeno Design Studios\STEENO-TAMARISK APT, HESPERIA\Reports\Drainage\Exhibit\Exhib

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                          Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* TAMARISK APARTMENT                                                    *
* HYDROLOGY ANALYSIS                                                    *
* 100YR STORM EVENT, PRE-DEVELOPED CONDITION                            *
 ************************************************************************

  FILE NAME: TAM.DAT
  TIME/DATE OF STUDY: 15:57 05/06/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  48.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *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) = 1.2400

  *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     10.00 TO NODE     11.00 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) =     22.50  DOWNSTREAM(FEET) =      9.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.135
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.110
  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        4.90      0.18     1.000    93   16.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
```

```
  SUBAREA RUNOFF(CFS) =     12.92
  TOTAL AREA(ACRES) =      4.90   PEAK FLOW RATE(CFS) =     12.92
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.9  TC(MIN.) =     16.13
  EFFECTIVE AREA(ACRES) =      4.90  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      12.92
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

ONSITE RETENTION VOLUME CALCULATION FOR HCOC MITIGATION

RETENTION VOL. REQUIRED TO MITIGATE HCOC CONDITION PER THE CITY OF HESPERIA "13.5 CF/100 SF IMPERVIOUS AREA": 25,933 CF

RET/INFILTRATION CONTECH CHAMBER SYSTEM-1 CAPACITY: 16,642 CF
RET/INFILTRATION CONTECH CHAMBER SYSTEM-2 CAPACITY: 9,563 CF

TOTAL RET/INFILTRATION VOLUME PROVIDED: 26,205 CF > 25,933 CF

Target Captured Volume
Watershed DMA 1

1) Calculate the "Watershed Imperviousness Ratio", I which is equal to the percent of impervious area in the BMP Drainage Area divided by 100

Imperviousness(i)= **0.9**

Total Acreage(A) = **4.90** 213444 sf

2) Calculate the composite Runoff Coefficient C_{bmp} for the drainage area

$C_{bmp} = 0.858i^3-0.78i^2+0.774i+0.04$

C_{bmp} = 0.73

3) Determine which Regression Coefficient to use by region the project is located in

Valley	1.481
Mountain	1.909
Desert	1.237

Regression coefficient for this project is: 1.481

4) Determine the area averaged "6 hour Mean Storm Rainfall" , P_6

2 yr 1 Hr Rainfall Depth per NOAA Atlas 14= **0.432** inches

P_6 = 2 yr 1 hr Rainfall x Regression coefficient

P_6 = 0.6398 inches

5) Determine Regression Constant (a) for 48 hour drawdown

a for 24 hour = 1.582
a for 48 hour = 1.963

a = 1.963

6) Calculate the Maximized Detention Volume, P_0

$P_0 = C \times a \times P6$

Po(inches) = 0.9172

7) Calculate the Target Capture Volume, V_0, in acre feet

$V_0 = (P_0 * A)/12$

V_0 = 0.37 acre-feet
V_0 = 16,314 CF

REQD. WQ VOL. : 16,314 CF

8) Retention Volume Calculation:

Use City rule of "13.5-cf of retention per 100-sf of impervious area"

***Retention Volume:** **25,933 CF** [{(4.9*43560)*0.90}*13.5]/100

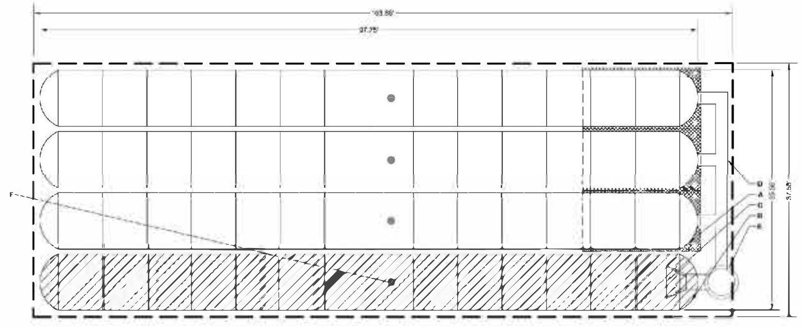
***Required Retention Volume for HCOC mitigation.**

REQD. HCOC MITIGATION VOL.: 25,933 CF

PROPOSED LAYOUT: BED 1		CONCEPTUAL ELEVATIONS	
56	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
8	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
16642	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-7200 CHAMBER:	5.75
		24" ISOLATOR ROW PLUS INVERT:	0.94
		18" x 18" BOTTOM MANIFOLD INVERT:	0.91
3904	SYSTEM AREA (SF)	BOTTOM OF MC-7200 CHAMBER:	0.75
282.9	SYSTEM PERIMETER (ft)	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#: MC7200IEPP18B / TYP OF ALL 18" BOTTOM CONNECTIONS	1.97"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADSN-12	1.97"	
30" ADS MANHOLE	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		16.5 CFS IN
INSPECTION PORT	F	4" SEE DETAIL (TYP 4 PLACES)		



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS 175 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.

SPACE INTENTIONALLY LEFT BLANK

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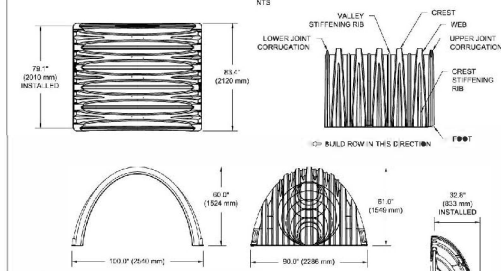
MC-7200 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

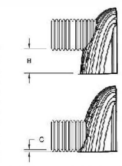
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*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"

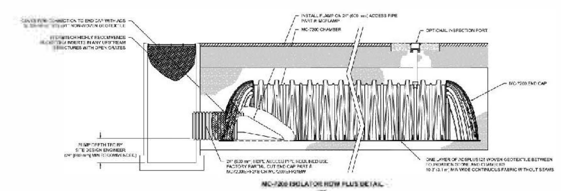
PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC7200IEPP06B		---	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.58" (1029 mm)	---
MC7200IEPP08B		---	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	38.29" (973 mm)	---
MC7200IEPP10B		---	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC7200IEPP12B		---	1.55" (39 mm)
MC7200IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC7200IEPP15B		---	1.70" (43 mm)
MC7200IEPP18T	18" (450 mm)	26.22" (716 mm)	---
MC7200IEPP18TW			
MC7200IEPP18B		---	1.97" (50 mm)
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC7200IEPP24TW			
MC7200IEPP24B		---	2.26" (57 mm)
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED 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-7200 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.

2 MC-7200 TECHNICAL SPECIFICATION



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.

3 MC-7200 ISOLATOR ROW PLUS DETAIL

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 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 OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	FOUNDATION STONE: FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	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".
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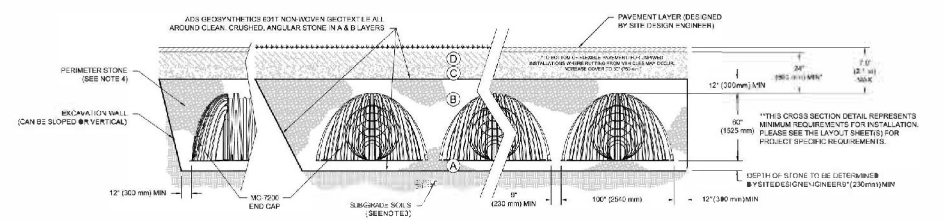
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

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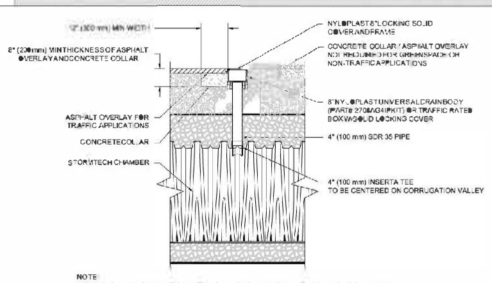
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION 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 SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. 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.

1 MC-7200 CROSS SECTION DETAIL



4" PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)

NTS

4 4" PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)

MC-SERIES END CAP INSERTION DETAIL

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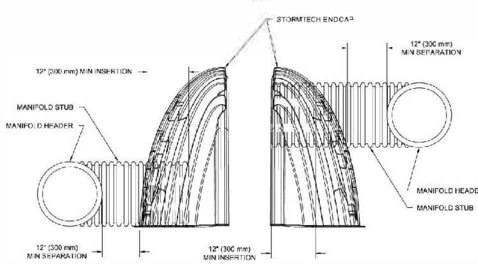


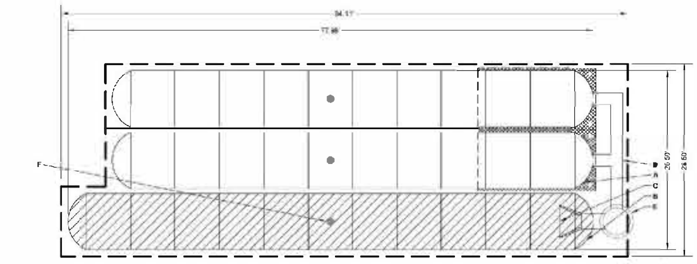
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

5 MC-SERIES END CAP INSERTION DETAIL

PROPOSED LAYOUT: BED 2		CONCEPTUAL ELEVATIONS	
20	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
8	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
	INSTALLED SYSTEM VOLUME (CF)	TOP OF STONE:	6.75
[illegible]	(PERIMETER STONE INCLUDED)	TOP OF MC-7200 CHAMBER:	5.75
	(COVER STONE INCLUDED)	24" ISOLATOR ROW PLUS INVERT:	0.94
	(BASE STONE INCLUDED)	18" x 18" BOTTOM MANIFOLD INVERT:	0.91
2277	SYSTEM AREA (SF)	BOTTOM OF MC-7200 CHAMBER:	0.75
225.2	SYSTEM PERIMETER (ft)	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#: MC7200IEPP18B / TYP OF ALL 18" BOTTOM CONNECTIONS	[illegible]	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	[illegible]	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADS N-12	[illegible]	
30" ADS MANHOLE	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		[illegible] CFS IN
INSPECTION PORT	F	4" SEE DETAIL (TYP 3 PLACES)		



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

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MC-7200 TECHNICAL SPECIFICATION

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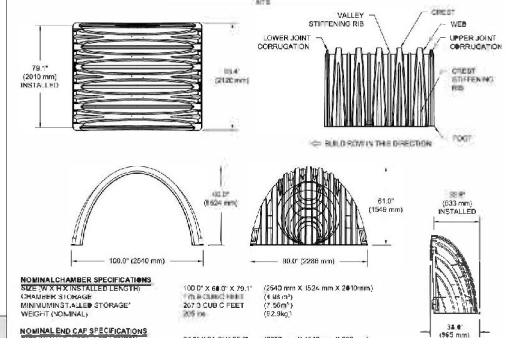


NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	[illegible]	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

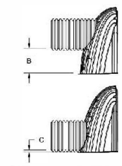
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs	(40.8 kg)

*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"

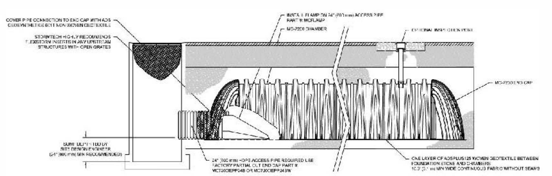
PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	—
MC7200IEPP06B		—	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.50" (1029 mm)	—
MC7200IEPP08B		—	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	[illegible]	—
MC7200IEPP10B		—	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	[illegible]	—
MC7200IEPP12B		—	[illegible]
MC7200IEPP15T	15" (375 mm)	[illegible]	—
MC7200IEPP15B		—	[illegible]
MC7200IEPP18T	18" (450 mm)	[illegible]	—
MC7200IEPP18TW			
MC7200IEPP18B		—	[illegible]
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	—
MC7200IEPP24TW			
MC7200IEPP24B		—	2.26" (57 mm)
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	—	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	—	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	—	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED 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-7200 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.

2 MC-7200 TECHNICAL SPECIFICATION



MC-7200 ISOLATOR ROW PLUS DETAIL

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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.

3 MC-7200 ISOLATOR ROW PLUS DETAIL

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 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.
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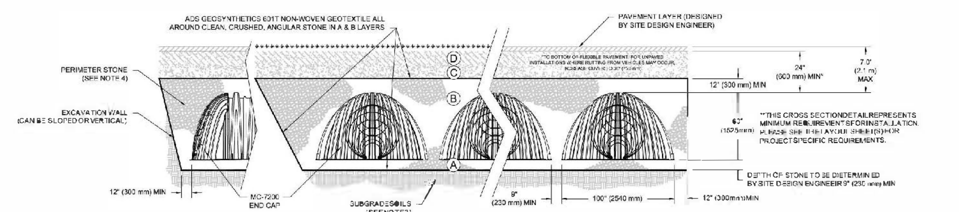

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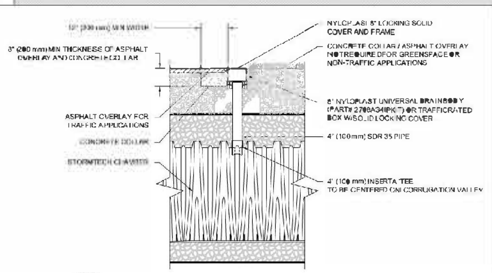


NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

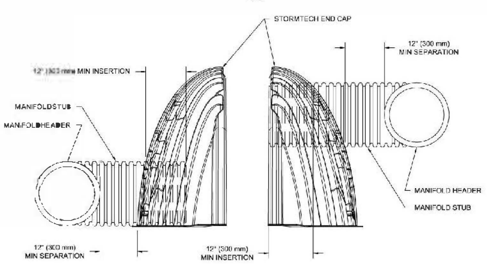
4" PVC INSPECTION PORT DETAIL
(MC SERIES CHAMBER)

NTS

4 4" PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)

MC-SERIES END CAP INSERTION DETAIL

NTS



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5 MC-SERIES END CAP INSERTION DETAIL

1 MC-7200 CROSS SECTION DETAIL