ALLARD ENGINEERING
civil engineering land surveying land planning

TRACT 17841

APN 0434-063-02

At the corner of Navajo and Sandia Road, Apple Valley, CA

Drainage Report

November 10, 2020

Prepared By:
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Prepared under the supervision of:

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36052
CIVIL
STATE OF CALIFORNIA

Raymond J Allard, P.E. RCE 36052 Exp. 06-30-22

Discussion

Introduction

APN 0434-063-02 is a tract (Tract# 17841) proposed to be developed as a multifamily dwelling (Apartment) site in Apple Valley, California. The site is located at the northwest corner of Navajo Road and Sandia Road and lies within a sparsely but developing area. The site is located within the tributary of the proposed Master Plan Storm Drain System (S-01) prepared by the San Bernardino County Flood Control District in 1996. Upon build out of the master plan, there will be trapezoidal natural channel (80' base width, 10' depth, 3:1 side slope) running across the site which will drain to Navajo Road. The master plan facility (S-01) sized for an average Q100 of 6,702cfs across the site. The Town will ultimately improve the channel downstream

Purpose

The purpose of this Drainage Report is to assess the existing and future flows that affect the site and provide necessary flood protection. The criteria utilized for hydrologic analysis is the San Bernardino County Hydrology Manual. San Bernardino Master Drainage Plan and AES software was used to calculate the maximum water surface elevation for the estimated peak runoff from the offsite tributary area that runs through the proposed site. Also we have calculated the water surface depth in the same master storm plan Line S-01in developed condition of the proposed tract.

Criteria

Findings

The existing topography of this site slopes from southwest towards the northwest at approximately 0.4% slope. The site has the evidence of flows within the existing drainage swale crossing the site from southwest towards the northeast. This existing drainage swale carries the storm runoff as indicated in the Master Plan of Drainage.

In the proposed condition the site will be developed as multifamily dwelling (Apartment complex) and in ultimate condition the site will drain to the proposed earthen trapezoidal channel (at the footprint of the existing flowline) which will be built per the ultimate facility according to the Apple Valley Master Plan of Drainage as designated as Line S-01 [Base width (b): 80-ft, Channel Depth (h): 10-ft, Side Slope(z): 3:1 with a slope of 0.004] on Comprehensive Storm Drain Plan (See attached reference documents). This proposed channel (Line S-01) will convey runoff from upstream offsite areas and onsite area in a northeasterly direction at a slope of 0.4 and drain to Navajo Road per the Master Drainage Plan.

Per the Comprehensive Storm Drain Plan, the ultimate facility (Line S-01) will carry a total runoff of 6,702 cfs from offsite tributary areas and onsite area from a 100-year storm event and will drain to the northeast towards Navajo Road. For proposed site development we ran the Rational Method Hydrology calculation and estimated that a flow of 55.5 cfs will be generated. We add this runoff from onsite with ultimate flow (6,702-cfs) and ran the hydraulic calculation to estimate the water depth and top width of the proposed channel (See attached RM hydrology calc and the hydraulic calculations in Reference Material Section). Line S-01 of the Comprehensive Storm Drain has the capacity to handle the runoff and will only increase the flow depth by about 0.5 inch. Flow depth calculated for Line S-01 with undeveloped site condition is 7.41-ft where as it is 7.45-ft. Therefore, the proposed ultimate facility (Line S-01) will be able to transfer upstream offsite tributary area and the onsite runoff in safe manner.

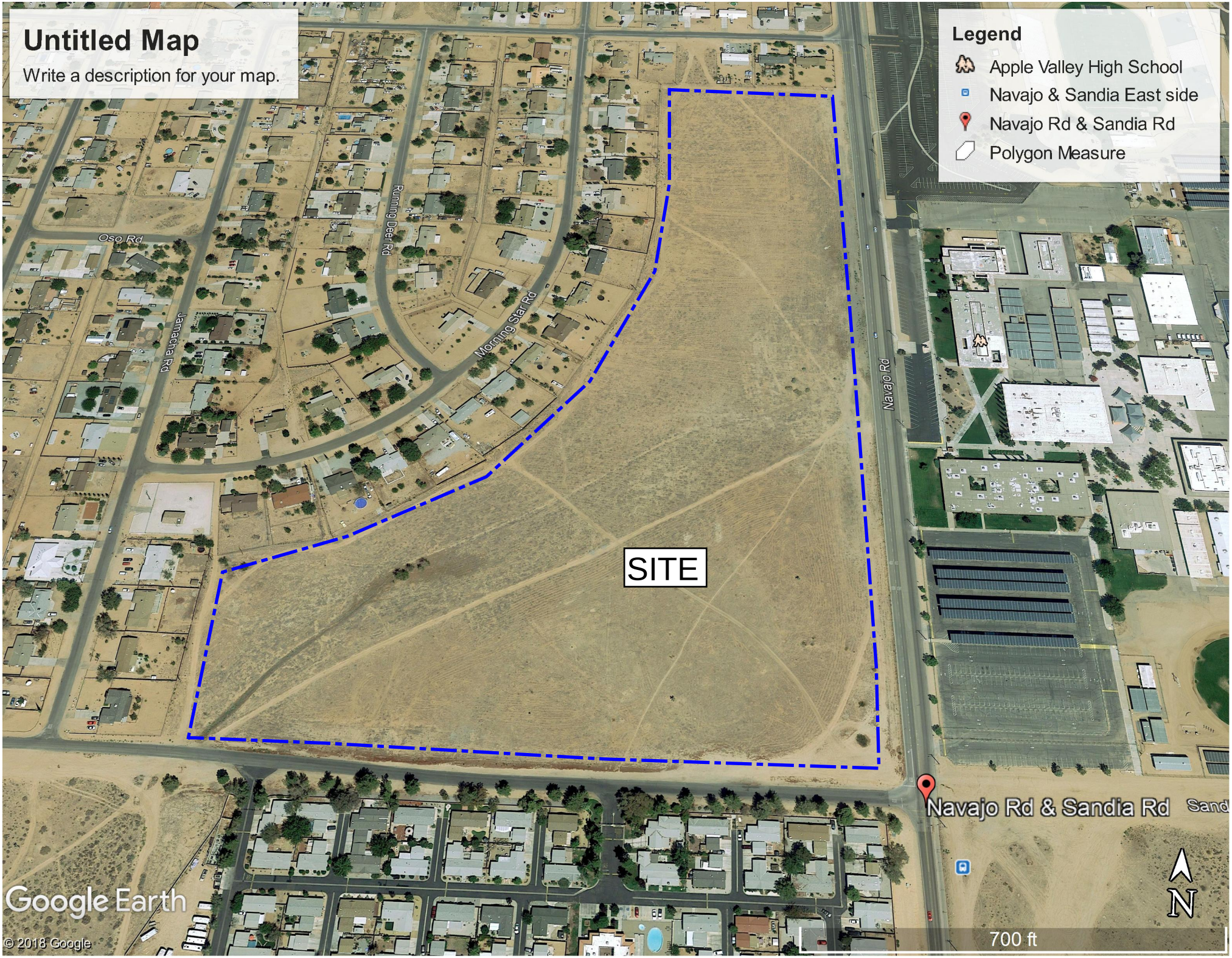
It is proposed a segment of the channel (Around 50-ft segment) approximately 20-ft upstream from Navajo Road to be built 2-ft deeper than the proposed depth (10-ft) to incorporate Water Quality Volume retention/infiltration purposes. The proposed channel will daylight at around 20-ft upstream from ROW of Navajo Road. Please refer to the Drainage Exhibit attached here on with the report.

Since there is no downstream outlet at this time due to the High School not being required to construct the channel, the system ends at Navajo Road. If an event occurs that would cause ponding to a depth that would over flow the channel, the water would enter Navajo Road like it does today. This is highly unlikely due to the watershed not being nearly fully developed. The Town assures that there will be no increased runoff with their detention basin policy. The channel is fenced like all flood control facilities and gates can be locked during a storm event.

A small pilot channel will be constructed in the channel to contain low flow and nuisance flows, This will allow for some passive recreational use to occur in the main channel.

Calculations and exhibits are attached to support these findings.

REFERENCE MATERIALS

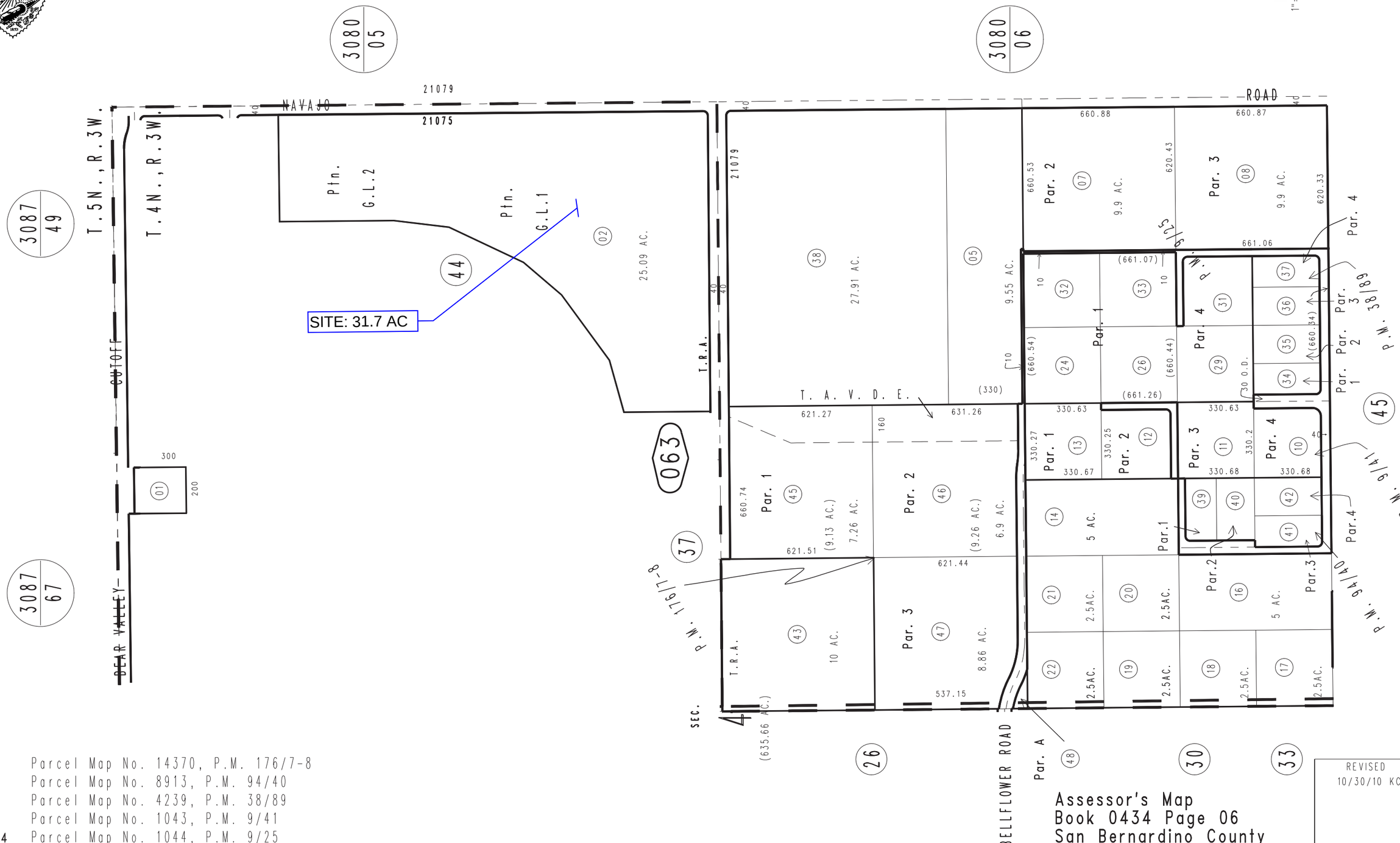

Untitled Map
Write a description for your map.
Legend
Apple Valley High School
Navajo & Sandia East side
Navajo Rd & Sandia Rd
Polygon Measure
Oso Rd
Jamacha Rd
Running Deer Rd
Morning Star Rd
Navajo Rd
SITE
Navajo Rd & Sandia Rd
Google Earth
© 2018 Google
700 ft
N

THIS MAP IS FOR THE PURPOSE OF AD VALOREM TAXATION ONLY.

Fractional Sec.4, T.4N., R.3W., S.B.B.&M.

Town of Apple Valley 0434- 06
Tax Rate Area
21075 21079

1" = 800'

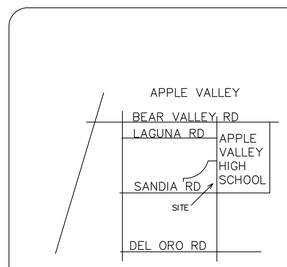


Parcel Map No. 14370, P.M. 176/7-8
Parcel Map No. 8913, P.M. 94/40
Parcel Map No. 4239, P.M. 38/89
Parcel Map No. 1043, P.M. 9/41
Parcel Map No. 1044, P.M. 9/25

April 2004

REVISED
10/30/10 KC

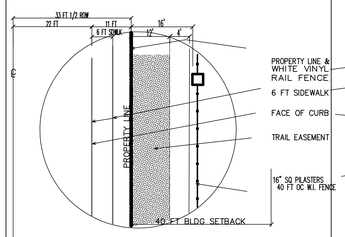
Assessor's Map
Book 0434 Page 06
San Bernardino County

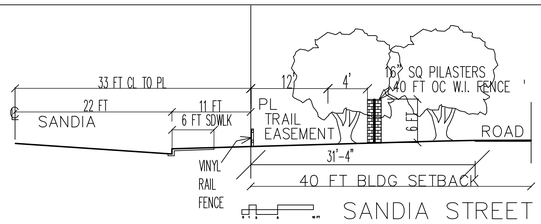


VICINITY MAP

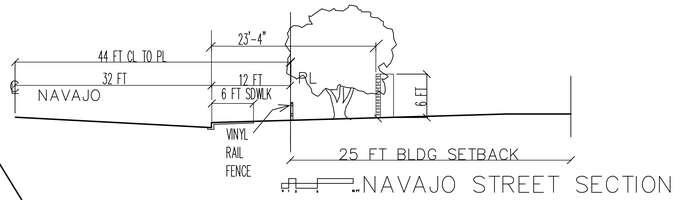
ENTRANCE

PARKER DR.





SANDIA STREET SECTION



NAVAJO STREET SECTION

EXISTING SINGLE FAMILY RES. SINGLE STORY STUCCO WALLS COMPOSITION ROOFING

TYPICAL AIR CONDITIONING

ADJACENT HOMES

TYP. PRIVATE OPEN SPACE

PEDESTRIAN GATE

COLORED DECOR PAVING

GATE EXIT ONLY

GUEST PARKING

ASPHALT PAVING TYP.

DRAINAGE CHANNEL

PARK BENCH

TYPICAL 6 FT HT WROUGHT IRON FENCE

RECREATION AREA 184,192 SF FT

BBQ

PARK BENCH

AMENITY GAZEBOS

AMENITY OPEN SPACE TRAIL

AMENITY

POOL

REC BLDG & OFFICE

FOUNTAIN

PLANTER

ASPHALT PAVING TYPICAL

FIRE ROAD –ASPHALT PAVING TYPICAL

DETENTION AREA 24,602 SF OPEN SPACE

TYPICAL VINYL OR WOOD FENCE

PROPERTY LINE & SLUMP BLOC, SPLIT FACE OR STUCCO OVER CMU

REQUIRED 25 FT. REAR YARD

TYP. PRIVATE OPEN SPACE

MOBILE HOME PARK

SANDIA RD

SANDIA CT.

ENTRANCE

EXIT ONLY

COLORED DECOR PAVING

ROAD

6 FT WIDE SIDEWALK

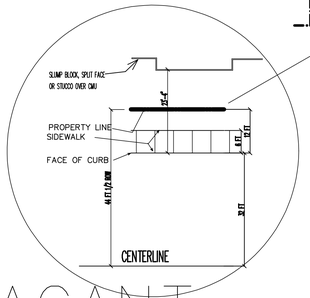
PROP LINE

FRONT SETBACK

16" SQ PILASTERS 40 FT OC W.I. FENCE

12 FT TRAIL EASEMENT

AMENITIES PROVIDED
- POOL
- SPA
- TRAIL OPEN SPACE
- GAZEBO
- BBQ
- EXTERIOR SITTING AREA COVERED
- INTERIOR SITTING AREA REC CENTER
- BANQUET HALL
- CONFERENCE ROOM
- GYM
- TOT LOT



TYP. PRIVATE OPEN SPACE

PROPERTY LINE

SIDEWALK

FACE OF CURB

EDGE OF PAVING

SLUMP BLOCK, SPLIT FACE OR STUCCO OVER CMU

MONUMENT SIGN

COLORED DECOR PAVING ENTRANCE

NAVAJO ROAD

PROPERTY LINE

SIDEWALK

CURB AND GUTTER

EDGE OF PAVING

COLORED DECOR PAVING ENTRANCE

PROPERTY LINE & SLUMP BLOC, SPLIT FACE OR STUCCO OVER CMU

NAVAJO RD

VACANT

HIGH SCHOOL

ENTRANCE

ENTRANCE

FENCE DETAILS

PLAN LEGEND

ELEVATION

ELEVATION
WROUGHT IRON FENCE AT CHANNEL

16" SQ PILASTERS
40 FT OC W.I. FENCE
40 FT
AT SANDIA RD.

FT HT. VINYL FENCE

FT HT. VINYL FENCE

PLAN VIEW JOGGED 3 FT

BLOCK CAP
SLUMP BLOC, SPLIT FACE OR STUCCO OVER CMU
ELEVATION
TYPICAL PERIMETER BLOCK WALL DETAIL

PROPERTY LINE & SLUMP BLOC, SPLIT FACE OR STUCCO OVER CMU

WHITE VINYL RAIL FENCE AT TRAIL EASEMENT

PATH OF TRAVEL

SCALE 1 INCH = 80 FT

PETE VOLBEDA Architecture Planning
164 N. 2ND AVE., SUITE 100 UPLAND CA 91786
TEL 909 373 1150 FAX 909 373 1152

10/22/2020

REV	DATE

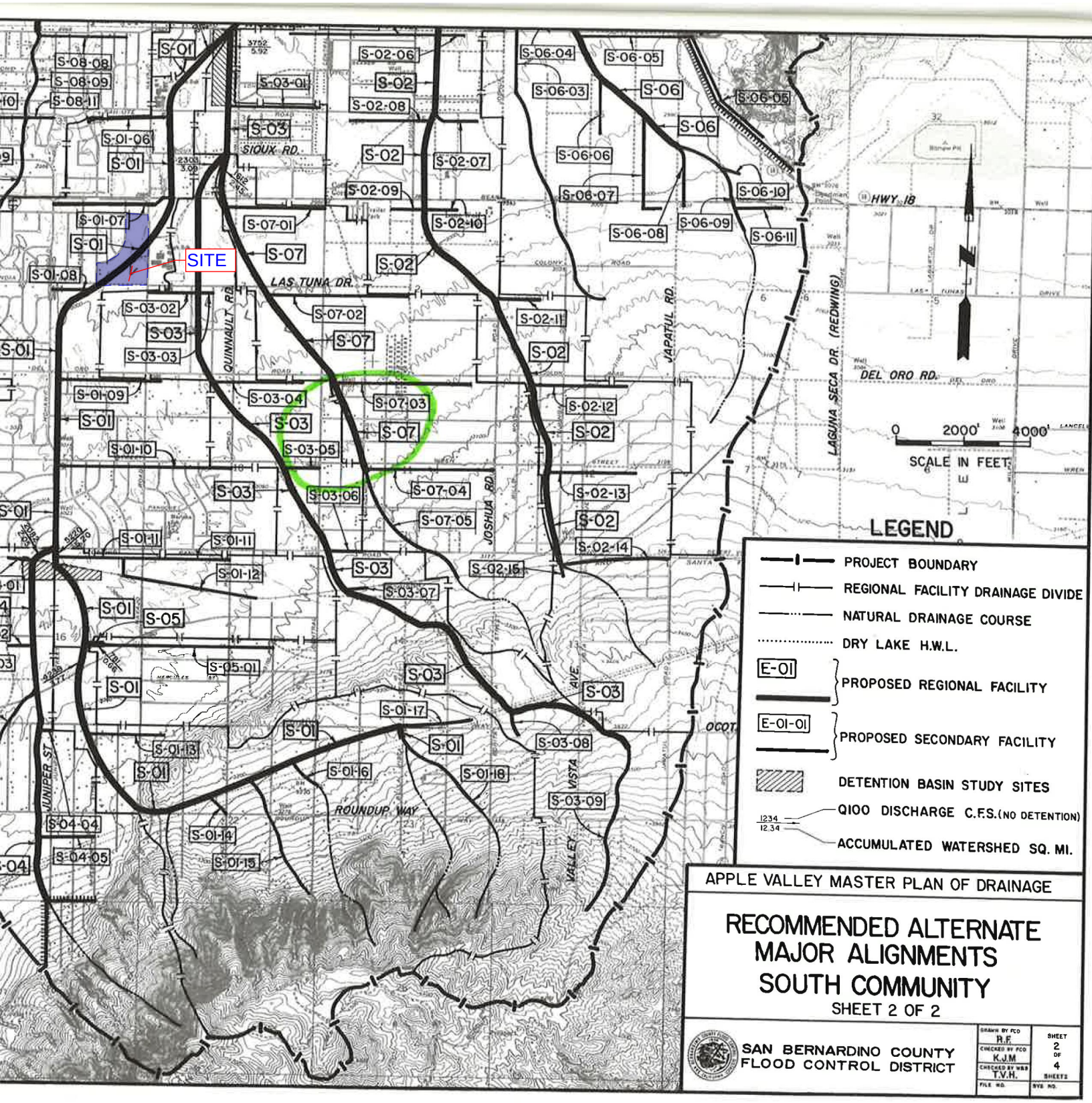
DESIGN
DRAWN BY:
CHECKED
OWNER APPROVAL
DATE
PLAN CHECK
APPROVED
BID SET

PATH/NAME: C:\CADD\MWGS\KATZ STEEPLE CHASE DIAMOND BADGE\3

SITE PLAN

APARTMENT FOR BM INVESTMENTS
NAVAJO, APPLE VALEY

SHEET 2 OF



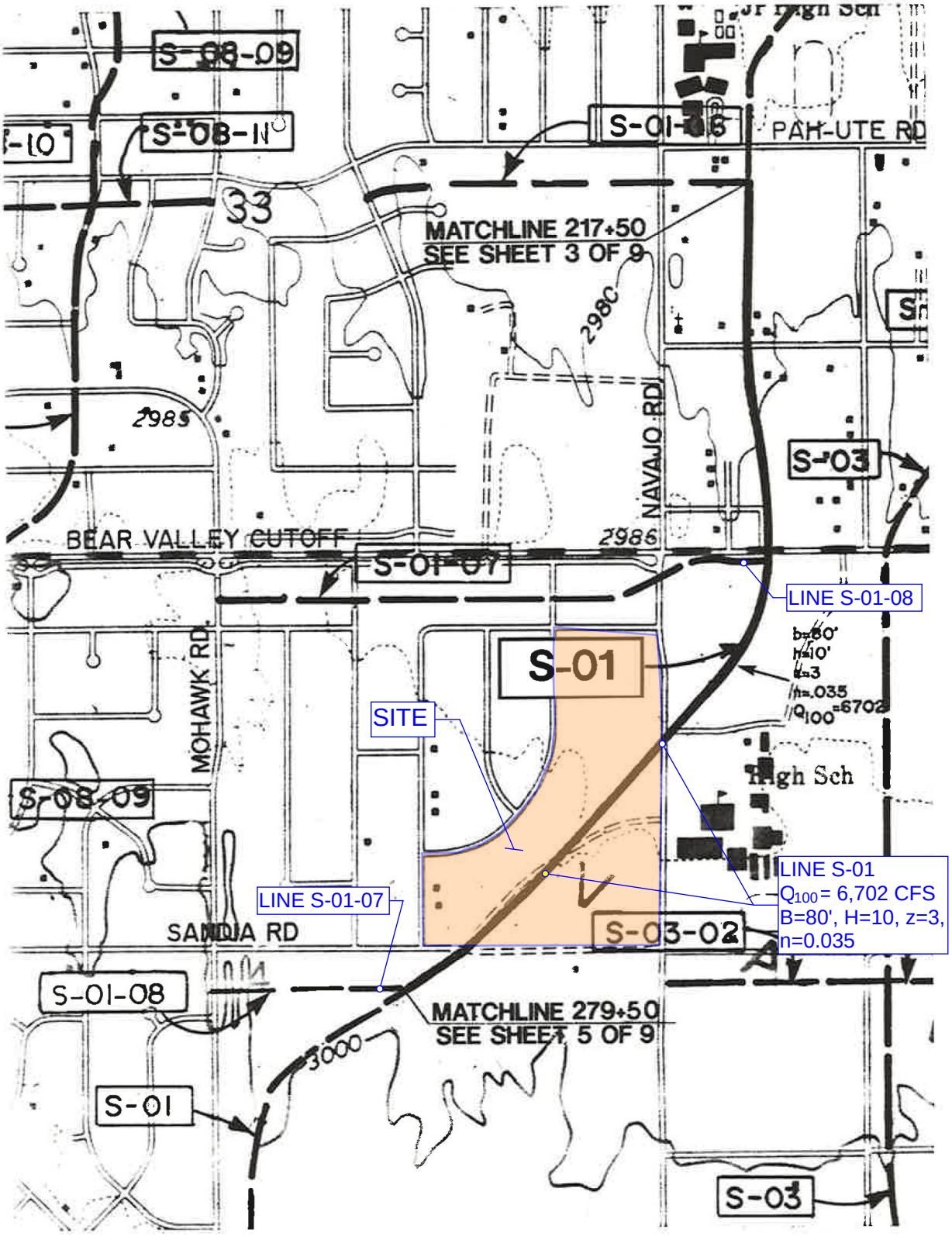
APPLE VALLEY MASTER PLAN OF DRAINAGE

RECOMMENDED ALTERNATE MAJOR ALIGNMENTS SOUTH COMMUNITY

SHEET 2 OF 2

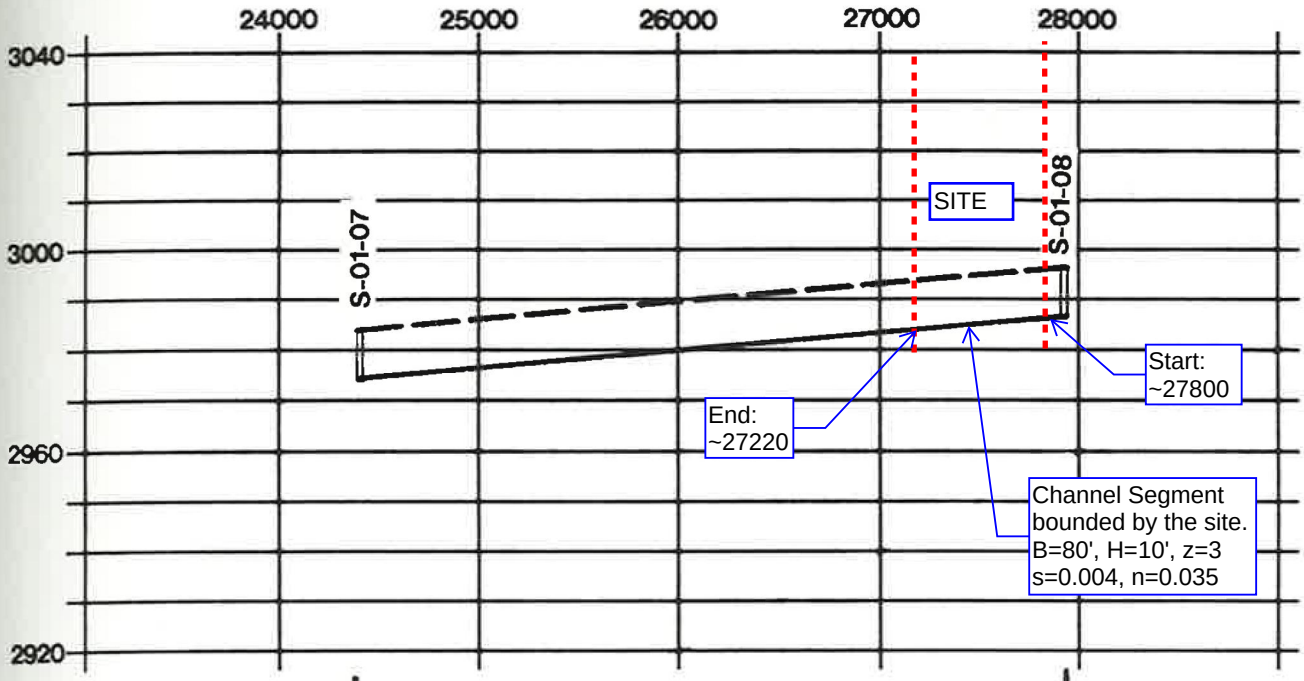
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

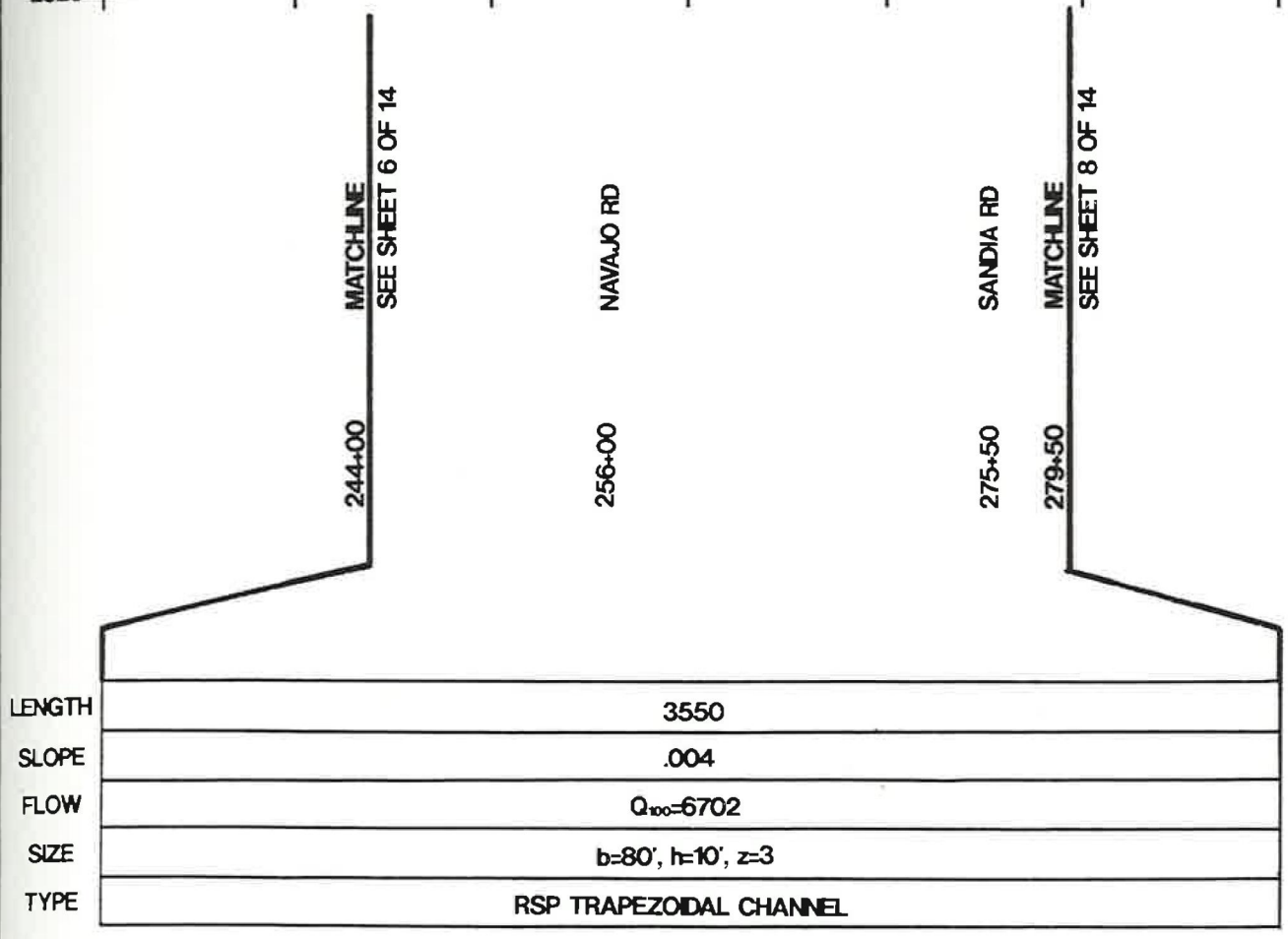
DRAWN BY FCD	SHEET
R.F.	2
CHECKED BY FCD	OF
K.J.M.	4
CHECKED BY W&S	SHEETS
T.V.H.	
FILE NO.	SYS NO.



LEGEND			
	WATERSHED BOUNDARY	.....	DRY LAKE H.W.L.
	PROPOSED FACILITY	⊓⊓⊓⊓⊓	LEVEE
	FACILITY SHOWN ELSEWHERE	—··—	N.D.C.

APPLE VALLEY MASTER PLAN OF DRAINAGE	COMPREHENSIVE STORM DRAIN PLAN LINE S-01 SHEET 4 OF 9	SCALE 1"=1000' WILLIAMSON & SCHMID





LENGTH	3550
SLOPE	.004
FLOW	Q_{100}=6702
SIZE	b=80', h=10', z=3
TYPE	RSP TRAPEZOIDAL CHANNEL

LEGEND

- LEVEE
- NATURAL GROUND
- PROPOSED FLOWLINE

APPLE VALLEY MASTER PLAN OF DRAINAGE	COMPREHENSIVE STORM DRAIN PLAN LINE S-01 SHEET 7 OF 14	SCALE H: 1"=1000' V: 1"=40' WILLIAMSON SCHMID

ONSITE HYDROLOGY CALCULATION
Rational Method Hydrology

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******************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
        (c) Copyright 1983-2006 Advanced Engineering Software (aes)
            Ver. 13.0  Release Date: 06/01/2006  License ID 1400

                          Analysis prepared by:

                            Allard Engineering
                           16866 Seville Avenue
                            Fontana Ca. 92335
                    Tel. 909-356-18185, Fax. 909-356-1795

 ************************* DESCRIPTION OF STUDY *************************
* NAVAJO TRACT, APPLE VALLY                                             *
* ONSITE-DEVELOPED CONDITION                                            *
* 100-YR STORM EVENT                                                    *
 ************************************************************************

  FILE NAME: NAVAJO.DAT
  TIME/DATE OF STUDY: 16:00 10/16/2019
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  60.00
  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)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.0200

  *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     20.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1540.00
  ELEVATION DATA: UPSTREAM(FEET) =   3003.00  DOWNSTREAM(FEET) =   2996.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.949
```

```
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.104
  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       31.70      0.80     0.200    52   17.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =     55.49
  TOTAL AREA(ACRES) =     31.70   PEAK FLOW RATE(CFS) =     55.49
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     31.70  TC(MIN.) =     17.95
  EFFECTIVE AREA(ACRES) =     31.70  AREA-AVERAGED Fm(INCH/HR)=  0.16
  AREA-AVERAGED Fp(INCH/HR) =  0.80  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =     55.49
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

NOAA Atlas 14, Volume 6, Version 2
Location name: Apple Valley, California, USA*
Latitude: 34.4655°, Longitude: -117.192°
Elevation: 2993.55 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	0.078 (0.064–0.095)	0.110 (0.091–0.135)	0.155 (0.128–0.190)	0.194 (0.158–0.240)	0.250 (0.197–0.319)	0.295 (0.228–0.386)	0.344 (0.260–0.461)	0.397 (0.292–0.547)	0.473 (0.333–0.678)	0.535 (0.364–0.793)
10-min	0.112 (0.092–0.137)	0.158 (0.130–0.193)	0.222 (0.183–0.273)	0.278 (0.227–0.344)	0.358 (0.283–0.458)	0.423 (0.327–0.553)	0.494 (0.372–0.661)	0.569 (0.418–0.783)	0.678 (0.477–0.972)	0.766 (0.522–1.14)
15-min	0.135 (0.112–0.165)	0.191 (0.157–0.234)	0.269 (0.221–0.330)	0.336 (0.274–0.416)	0.433 (0.342–0.554)	0.512 (0.396–0.669)	0.597 (0.450–0.799)	0.688 (0.505–0.947)	0.820 (0.577–1.18)	0.927 (0.631–1.38)
30-min	0.185 (0.153–0.227)	0.261 (0.216–0.320)	0.368 (0.303–0.452)	0.460 (0.375–0.569)	0.593 (0.468–0.758)	0.701 (0.542–0.916)	0.817 (0.617–1.09)	0.943 (0.692–1.30)	1.12 (0.791–1.61)	1.27 (0.864–1.88)
60-min	0.232 (0.192–0.284)	0.328 (0.270–0.401)	0.461 (0.379–0.566)	0.576 (0.470–0.713)	0.743 (0.586–0.950)	0.879 (0.679–1.15)	1.02 (0.773–1.37)	1.18 (0.867–1.63)	1.41 (0.991–2.02)	1.59 (1.08–2.36)
2-hr	0.332 (0.274–0.406)	0.449 (0.370–0.550)	0.610 (0.502–0.749)	0.749 (0.611–0.927)	0.947 (0.748–1.21)	1.11 (0.857–1.45)	1.28 (0.965–1.71)	1.46 (1.07–2.01)	1.72 (1.21–2.47)	1.93 (1.31–2.87)
3-hr	0.407 (0.336–0.497)	0.541 (0.446–0.662)	0.726 (0.597–0.891)	0.884 (0.721–1.09)	1.11 (0.876–1.42)	1.29 (0.999–1.69)	1.48 (1.12–1.99)	1.69 (1.24–2.33)	1.98 (1.39–2.84)	2.21 (1.51–3.28)
6-hr	0.561 (0.464–0.686)	0.737 (0.608–0.902)	0.976 (0.803–1.20)	1.18 (0.962–1.46)	1.47 (1.16–1.88)	1.70 (1.31–2.22)	1.94 (1.46–2.59)	2.19 (1.61–3.02)	2.55 (1.80–3.66)	2.83 (1.93–4.21)
12-hr	0.730 (0.603–0.893)	0.963 (0.794–1.18)	1.28 (1.05–1.57)	1.54 (1.26–1.91)	1.91 (1.51–2.45)	2.20 (1.70–2.88)	2.51 (1.89–3.35)	2.82 (2.07–3.89)	3.26 (2.30–4.68)	3.61 (2.46–5.36)
24-hr	0.966 (0.856–1.11)	1.29 (1.15–1.49)	1.73 (1.53–2.00)	2.09 (1.83–2.44)	2.59 (2.20–3.12)	2.99 (2.48–3.67)	3.39 (2.74–4.27)	3.81 (3.00–4.93)	4.39 (3.32–5.92)	4.84 (3.54–6.76)
2-day	1.16 (1.03–1.34)	1.58 (1.40–1.82)	2.14 (1.89–2.48)	2.60 (2.28–3.03)	3.23 (2.74–3.89)	3.72 (3.09–4.57)	4.22 (3.42–5.31)	4.73 (3.73–6.13)	5.44 (4.11–7.34)	5.98 (4.37–8.36)
3-day	1.26 (1.12–1.46)	1.75 (1.55–2.01)	2.38 (2.10–2.75)	2.90 (2.54–3.38)	3.61 (3.06–4.34)	4.15 (3.45–5.11)	4.71 (3.82–5.93)	5.29 (4.17–6.85)	6.07 (4.59–8.20)	6.69 (4.89–9.34)
4-day	1.34 (1.19–1.54)	1.86 (1.64–2.14)	2.54 (2.25–2.94)	3.10 (2.72–3.61)	3.86 (3.27–4.65)	4.45 (3.69–5.47)	5.05 (4.09–6.36)	5.67 (4.47–7.34)	6.51 (4.93–8.79)	7.17 (5.24–10.0)
7-day	1.45 (1.29–1.67)	2.01 (1.78–2.31)	2.75 (2.43–3.17)	3.36 (2.94–3.91)	4.20 (3.56–5.06)	4.85 (4.03–5.96)	5.52 (4.47–6.95)	6.21 (4.89–8.04)	7.16 (5.42–9.67)	7.90 (5.77–11.0)
10-day	1.54 (1.36–1.77)	2.11 (1.87–2.43)	2.89 (2.56–3.34)	3.54 (3.10–4.13)	4.45 (3.77–5.35)	5.15 (4.27–6.33)	5.87 (4.76–7.40)	6.63 (5.22–8.58)	7.67 (5.80–10.4)	8.49 (6.20–11.9)
20-day	1.74 (1.54–2.00)	2.41 (2.13–2.77)	3.32 (2.93–3.84)	4.09 (3.59–4.77)	5.18 (4.39–6.24)	6.04 (5.01–7.42)	6.93 (5.61–8.73)	7.86 (6.20–10.2)	9.15 (6.92–12.3)	10.2 (7.43–14.2)
30-day	1.96 (1.74–2.25)	2.72 (2.40–3.13)	3.77 (3.33–4.35)	4.66 (4.08–5.43)	5.93 (5.02–7.13)	6.93 (5.75–8.52)	7.98 (6.46–10.0)	9.07 (7.15–11.7)	10.6 (8.01–14.3)	11.8 (8.61–16.5)
45-day	2.33 (2.07–2.68)	3.23 (2.86–3.72)	4.49 (3.96–5.19)	5.56 (4.87–6.48)	7.10 (6.02–8.55)	8.34 (6.92–10.3)	9.63 (7.80–12.1)	11.0 (8.65–14.2)	12.9 (9.73–17.4)	14.3 (10.5–20.0)
60-day	2.54 (2.25–2.92)	3.50 (3.10–4.04)	4.87 (4.30–5.62)	6.04 (5.29–7.04)	7.73 (6.55–9.30)	9.09 (7.55–11.2)	10.5 (8.53–13.3)	12.0 (9.48–15.6)	14.1 (10.7–19.1)	15.8 (11.5–22.0)

[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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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

HYDRAULIC CALCULATIOM

CHANNEL SIZING CALC - ONSITE EXISTING CONDITION

```
**************************************************************************
                HYDRAULIC ELEMENTS - I  PROGRAM PACKAGE
        (C) Copyright 1982-2006 Advanced Engineering Software (aes)
            Ver. 13.0  Release Date: 06/01/2006  License ID 1400

                          Analysis prepared by:

                            Allard Engineering
                           16866 Seville Avenue
                            Fontana Ca. 92335
                    Tel. 909-356-18185, Fax. 909-356-1795

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 15:04 10/16/2019
==========================================================================
 Problem Descriptions:
  LINE S-01  DEPTH OF FLOW CALC
  FOR 100-YR STORM
  EXISTING CONDITION
**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    CHANNEL Z1(HORIZONTAL/VERTICAL) =    3.00
            Z2(HORIZONTAL/VERTICAL) =    3.00
    BASEWIDTH(FEET) =    80.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.004000
    UNIFORM FLOW(CFS) =     6702.00
    MANNINGS FRICTION FACTOR = 0.0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =   7.41 <----
    FLOW TOP-WIDTH(FEET) =       124.48 <----
    FLOW AREA(SQUARE FEET) =         758.01
    HYDRAULIC DEPTH(FEET) =     6.09
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     8.84
    UNIFORM FROUDE NUMBER =    0.631
    PRESSURE + MOMENTUM(POUNDS) =       277454.59
    AVERAGED VELOCITY HEAD(FEET) =      1.214
    SPECIFIC ENERGY(FEET) =      8.628
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =       113.55
    CRITICAL FLOW AREA(SQUARE FEET) =         541.18
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     4.77
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =    12.38
    CRITICAL DEPTH(FEET) =     5.59
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =       249805.83
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      2.381
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      7.974
==========================================================================
```

CHANNEL SIZING CALC - ONSITE DEVELOPED CONDITION

```
**************************************************************************
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                          Analysis prepared by:

                            Allard Engineering
                           16866 Seville Avenue
                            Fontana Ca. 92335
                    Tel. 909-356-18185, Fax. 909-356-1795

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 16:09 10/16/2019
==========================================================================
 Problem Descriptions:
  LINE S-01  DEPTH OF FLOW CALC
  FOR 100-YR STORM
  WITH ONSITE DEVELOPED CONDITION
**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    CHANNEL Z1(HORIZONTAL/VERTICAL) =    3.00
            Z2(HORIZONTAL/VERTICAL) =    3.00
    BASEWIDTH(FEET) =    80.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.004000
    UNIFORM FLOW(CFS) =     6757.50
    MANNINGS FRICTION FACTOR = 0.0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =   7.45
    FLOW TOP-WIDTH(FEET) =       124.69
    FLOW AREA(SQUARE FEET) =         762.28
    HYDRAULIC DEPTH(FEET) =     6.11
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     8.86
    UNIFORM FROUDE NUMBER =    0.632
    PRESSURE + MOMENTUM(POUNDS) =       280337.78
    AVERAGED VELOCITY HEAD(FEET) =      1.220
    SPECIFIC ENERGY(FEET) =      8.668
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =       113.72
    CRITICAL FLOW AREA(SQUARE FEET) =         544.43
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     4.79
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =    12.41
    CRITICAL DEPTH(FEET) =     5.62
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =       252473.33
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      2.392
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      8.013
==========================================================================
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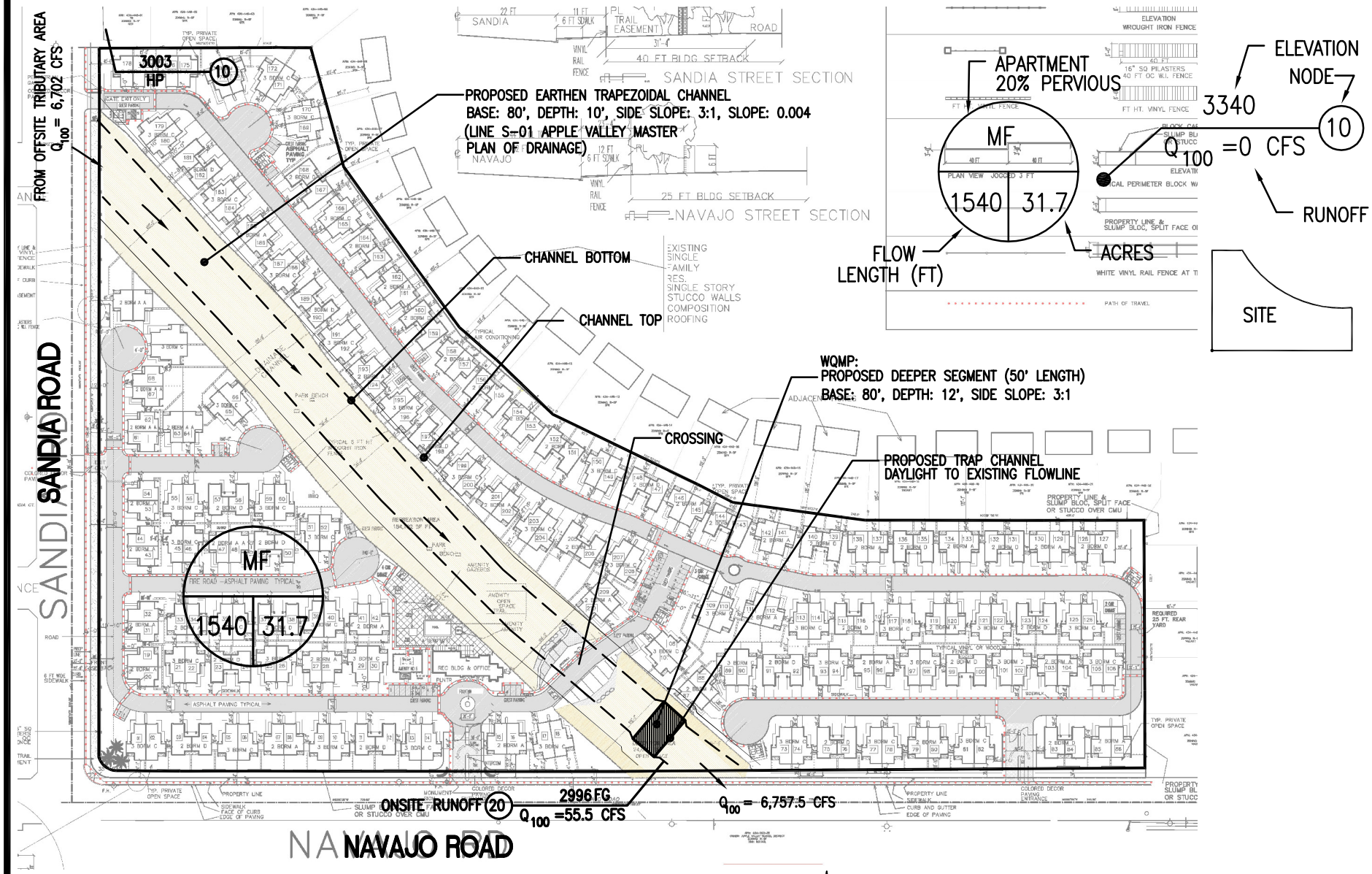
ONSITE DRAINAGE EXHIBIT



Prepared By:

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(909) 356-1815 Fax (909) 356-1795

SCALE: 1"=250'

APN: 0434-063-02
TOWN OF APPLE VALLEY
DRAINAGE EXHIBIT

PLOT DATE: November 10, 2020 ballard

Filename: I:\Barbara Monroy\Apple Valley\PROJECT ADMIN\REPORTS\DRAINAGE\DRAINAGE UPDATE\Drainage Site Exhibit.dwg