Drainage Reports

Abbreveated Water & Sewer Need Reports

Water Study

Wastewater Study

Stormwater Waiver Application

Preliminary Drainage Report

For

Hayden & Virginia Townhomes

2529 N. Hayden Road
Scottsdale, Arizona

Prepared For:
Del Pueblo Communities
7520 E. Angus Dr.
Scottsdale, AZ 85251

Plan # 33-DR-17
Case #
Q-S #
☑ Accepted
☐ Corrections
DG 11/17/17
Reviewed By Date

Registered Professional Engineer (Civil)
CERTIFICATE NO.
60163
JOHN C.
MCGHEE
10-30-17
Date Signed
ARIZONA, U.S.A.
EXPIRES 06-23-2018

Project No. 17-185

Date: September 2017
Revised October 2017

2045 S. Vineyard Avenue, Suite 101
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1.0 Introduction

1.1 Project Overview

The proposed Hayden and Virginia Townhomes consists of 31 single-family residential units covering 1.82 acres located in Scottsdale, Arizona. The Hayden and Virginia Townhomes development has a gross density of 17.0 du/ac. The site is located on the southeast corner of N. Hayden Rd. and E. Virginia Ave.

Refer to the Vicinity Map in Appendix A for the project location.

1.2 Purpose

The Purpose of this preliminary drainage report is to identify any off-site flows that may affect the site, as well as outline the preliminary grading and drainage design of the site. The drainage design for the project is to be in line with requirements as set forth by the City of Scottsdale, in addition to applicable Maricopa County Drainage Design Standards. A more detailed and final analysis of drainage will be provided during the final engineering stage.

2.0 Existing Conditions

2.1 General Conditions

The site is zoned Multi-Family Residential (R-5); the site's zoning will remain the same. The site is currently developed as a plant nursery and garden center with a small building and other miscellaneous structures on site. The site is bounded by E. Virginia Avenue to the north, an adjacent alley providing separation from the Village Grove subdivision to the east, N. Hayden Road to the west and a commercial building to the south. The site improvements will require the existing building and structures to be demolished and removed during clearing and grubbing operations.

2.2 Drainage Conditions

The Project is exposed to minimal flood hazard and located within FEMA Flood Zone X, as shown on FEMA Flood Insurance Rate Map number 04013C2235L dated October 16, 2013. The FIRM Map has been provided for reference in Figure 2 of Appendix A.

The existing topography of the site is relatively flat with a slight general slope from the northeast to the southwest with an average ground elevation of approximately 1229'. Due to the developed nature surrounding the site, the majority of offsite flows

are conveyed in the concrete gutters of the adjacent streets and collected in the stormdrain catch basins along N. Hayden Road and E. Virginia Street.

Historically offsite flows from the northeast are routed along the eastern edge of the property and within the adjacent alley, bypass the property, and sheet flow to the south of the project. Based on preliminary results of The Lower Indian Bend Wash (LIBW) ADMP, the Scottsdale GIS indicates that the site is exposed to an offsite flow of 12 CFS during a critical storm event. The drainage design for the project is required to accommodate for this offsite flow while mitigating any potential negative impact to adjacent properties.

The existing drainage features and watersheds are presented in Figure 3: Existing Condition Drainage Map within Appendix A.

3.0 Proposed Drainage Plan

3.1 Design Methodology

The preliminary drainage design relies on providing adequate detention storage to satisfy City of Scottsdale drainage guidelines. The required storage volume is found as follows:

$$V = (P/12) \times C \times A$$

where:

V = Required Storage Volume (ft^3)
C = Composite runoff coefficient (From Scottsdale Figure 4.1-4)
P = Rainfall Precipitation Depth (2.82 in.)
A = Drainage Area (ft^2)

In accordance with the City of Scottsdale's pre-vs-post development policy, the required onsite storage is based on the increased runoff resulting from the proposed site improvements. In order to ensure this requirement is satisfied, a pre-vs-post retention analysis has been performed. The pre-vs-post analysis indicates a required storage volume of 7,003 ft^3. To account for the potential offsite flows, retention has been provided for the paved alley that runs along the eastern site boundary.

Additional analysis has been completed to make certain that first flush requirements are fulfilled for the entire re-developed area. The first flush volume requirement was determined to be 3,295 ft^3.

Retention calculations have been provided within Appendix B. Drainage areas can be identified in Figure 3: Existing Condition Drainage Map provided within Appendix A. Though the City of Scottsdale Rainfall precipitation depth of 2.82 in has been utilized in calculations, the NOAA Atlas 14 data has been provided in Appendix C.

3.2 Drainage Design

Surface and grading features are to be implemented in order to rout storm water to an underground storage facility. The proposed onsite streets will convey storm water flows to the west on an inverted crown street/valley gutter, which will be collected into a catch basin at the end of the street. The proposed catch basins are located on the property and will carry the storm water by way of an 18" HDPE pipe into the underground retention structure. The underground retention facility is to consist of 260 linear feet of 6' corrugated metal pipe which provides a total volume of 7,351 ft^3. The underground retention will bleed off to the existing 42" storm drain pipe in N. Hayden Road by way of gravity.

A portion of the frontage and driveway entrances will continue to drain unto the adjacent streets and to the catch basins located on N Hayden Road adjacent to the project. Once developed, the northeastern portion of the site will no longer discharge to the alley but be routed to the underground storage facility. The adjacent alley storm run-off will continue its historic flow pattern and sheet flow south of the project.

The drainage concepts for this project are to maintain the historic drainage patterns of the parcel to the extent possible and to utilize the existing infrastructure.

3.3 Conveyance of Offsite Flows

The site design is required to accommodate for an offsite flow of 12 CFS at the northeast corner of the site. Based on the existing topography, the offsite flow is conveyed south through the adjacent paved alley. A small portion of the site contributes to this flow. With the proposed site improvements, the onsite area which historically contributes flow to the alley will be rerouted through the onsite underground storage facility. Additionally, the onsite storage facility has been sized to retain the volume associated with the adjacent alley; though the adjacent alley storm run-off will continue its historic flow pattern and sheet flow south of the project. Ultimately, the offsite flow will be reduced mitigating negative downstream impacts.

The project will not create additional potential for increased flood damage. The finished floor of the proposed Hayden and Virginia Townhomes buildings have been set a minimum of 18 inches above the site outfall per City of Scottsdale design criteria. Storm water runoff as a result of redevelopment will reduce the existing runoff amount. The project will not impact or diminish the existing storm drain systems or retention systems downstream of the parcel.

3.4 Rational Method

The Rational Method will be used to calculate peak flows at critical locations in the final drainage report for the Project. The Rational Method will be applied as outlined in section 3 of the *Drainage Design Manual for Maricopa County: Hydrology*. Peak flows will be calculated as follows:

$$Q = C \times I \times A_d$$

where:

Q = Peak Discharge (cfs)
C = Runoff Coefficient
I = Rainfall Intensity corresponding to Tc
A_d = Area in acres

Peak flow calculations will be performed based on the final grading design for the site.

3.5 Catch Basin Design

The inlet capacity of an in-sump catch basin is determined by considering the opening of the grate. The curb opening is ignored and thus becomes the clogging factor.

$$Q_i = C_{weir} \times P \times d^{1.5}$$

where:

Q_i = Inlet capacity (cfs)
C_{weir} = Weir coefficient (3.0)
P = Grate perimeter excluding the curb length (ft)

d = Curb depth at the grate (ft)

The capacity of the rectangular weir outfall is determined by as follows:

$$Q_i = C_{weir} \times P \times d^{1.5}$$

where:

Q_i = Weir Capacity (cfs)
C_{weir} = Weir coefficient (2.8)
L = Length of Weir (ft)
d = Depth of Weir (ft)

Inlet capacity calculations are to be performed on the final design in order to assure adequate sizing of the proposed catch basins and scupper during the 100-year 2-hour storm event.

3.6 Notice of Intent (NOI)

Based on the proposed construction, the area of disturbance is anticipated to exceed 1 acre. This results in the requirement to obtain a Notice of Intent (NOI) Certification from ADEQ prior to construction. The NOI will be submitted to ADEQ in order to provide the NOI Certification with an AZCON number to the city during the improvement plan submittal.

The City of Scottsdale, "Warning and Disclaimer of Liability" form has been included in Appendix D.

4.0 Conclusions

This report concluded that:

- The site has been designed to retain the pre-vs-post storm water volumes as outlined by the City of Scottsdale.
- Onsite retention is to be provided by way of a 6' CMP underground storage facility.
- The proposed drainage design results in no adverse impact to surrounding property.
- Upon the final engineering stages, additional analysis is to be performed to evaluate the storm drain system.

- The drainage design is in compliance with applicable City of Scottsdale and Maricopa County drainage design standards.

5.0 References

Drainage Design Manual for Maricopa County, Arizona: Hydrology. Flood Control District of Maricopa County, 2013

Drainage Design Manual for Maricopa County, Arizona: Hydraulics. Flood Control District of Maricopa County, 2013

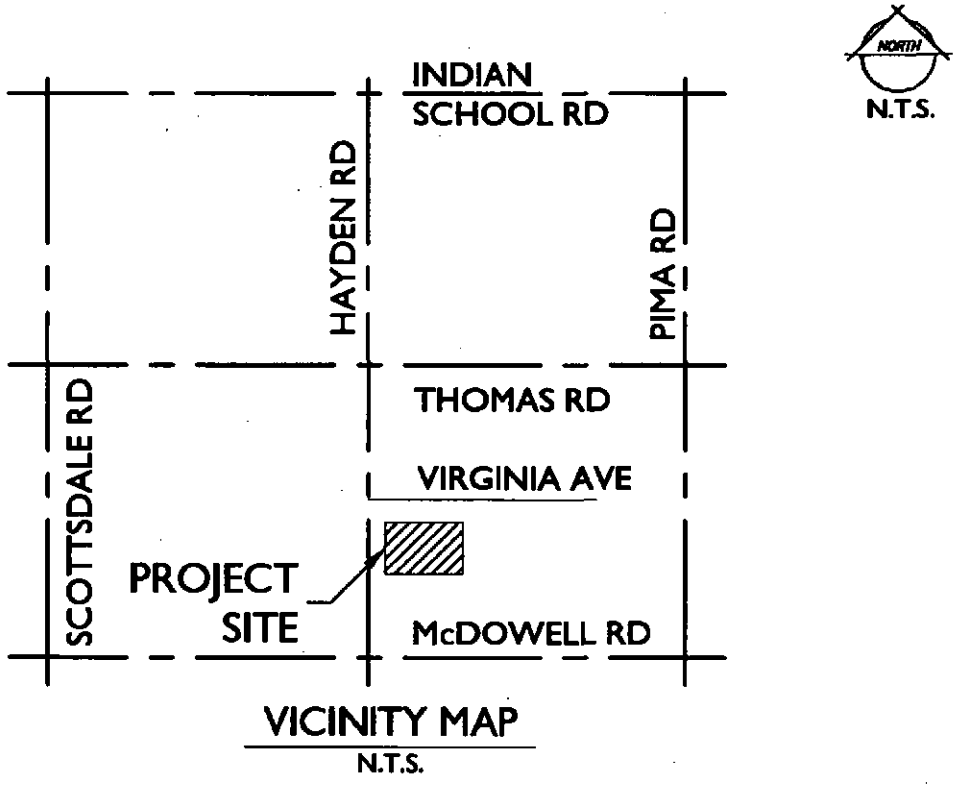
Drainage Policies and Standards for Maricopa County, Arizona. Flood Control District of Maricopa County, 2016

Drainage Standards & Policies Manual: City of Scottsdale, 2010

Appendix A

Figures

Figure 1


NORTH
N.T.S.
INDIAN SCHOOL RD
HAYDEN RD
PIMA RD
THOMAS RD
SCOTTSDALE RD
VIRGINIA AVE
PROJECT SITE
McDOWELL RD
VICINITY MAP
N.T.S.

and Floodway Data and/or Summary of Stillwater Elevations
within the Flood Insurance Study (FIS) report that accompanies
should be aware that BFEs shown on the FIRM represent
elevations. These BFEs are intended for flood insurance rating
should not be used as the sole source of flood elevation
flood elevation data presented in the FIS report should be
with the FIRM for purposes of construction and/or floodplain

Flood Elevations shown on this map apply only landward of 0.0'
Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be
flood elevations are also provided in the Summary of Stillwater
in the Flood Insurance Study report for this jurisdiction.
in the Summary of Stillwater Elevations table should be used for
floodplain management purposes when they are higher than
on this FIRM.

floodways were computed at cross sections and interpolated
sections. The floodways were based on hydraulic considerations
requirements of the National Flood Insurance Program. Floodway
pertinent floodway data are provided in the Flood Insurance Study
jurisdiction.

in Special Flood Hazard Areas may be protected by **flood**
Refer to Section 2.4 "Flood Protection Measures" of the Flood
report for information on flood control structures for this

used in the preparation of this map was Arizona State Plane
(FIPSZONE 0202). The **horizontal datum** was NAD 83 HARN.
Differences in datum, spheroid, projection or State Plane
production of FIRMs for adjacent jurisdictions may result in slight
in map features across jurisdiction boundaries. These
affect the accuracy of this FIRM.

this map are referenced to the North American Vertical Datum
These flood elevations must be compared to structure and
referenced to the same **vertical datum**. Map users wishing to
referenced to the National Geodetic Vertical Datum of 1929
use the following Maricopa County website application:
maricopa.gov/Maps/gismaps/apps/gbacs/application/index.cfm

users to obtain point-specific datum conversion values by
over a VERTCON checkbox on the layers menu on the
The VERTCON grid referenced in this web application was
existing flood elevations from NGVD 29 to NAVD 88.

elevation, description, and/or location information for National
marks shown on this map, please contact the Information
the National Geodetic Survey at (301) 713-3242, or visit its
www.ngs.noaa.gov. To obtain information about Geodetic
Cadastral Survey bench marks produced by the Maricopa
of Transportation, please visit the Flood Control District of
website at:
maricopa.gov/Maps/gismaps/apps/gbacs/application/index.cfm.

shown on this FIRM was derived from multiple sources.
provided in digital format by the Maricopa County Department
Flood Control District. The imagery is dated October 2009 to
Additional National Agricultural Imagery Program (NAIP) imagery
the Arizona State Land Department (ALRIS) and is dated 2007.
system used for the production of the digital FIRM is State Plane
0202 HARN, International Feet.

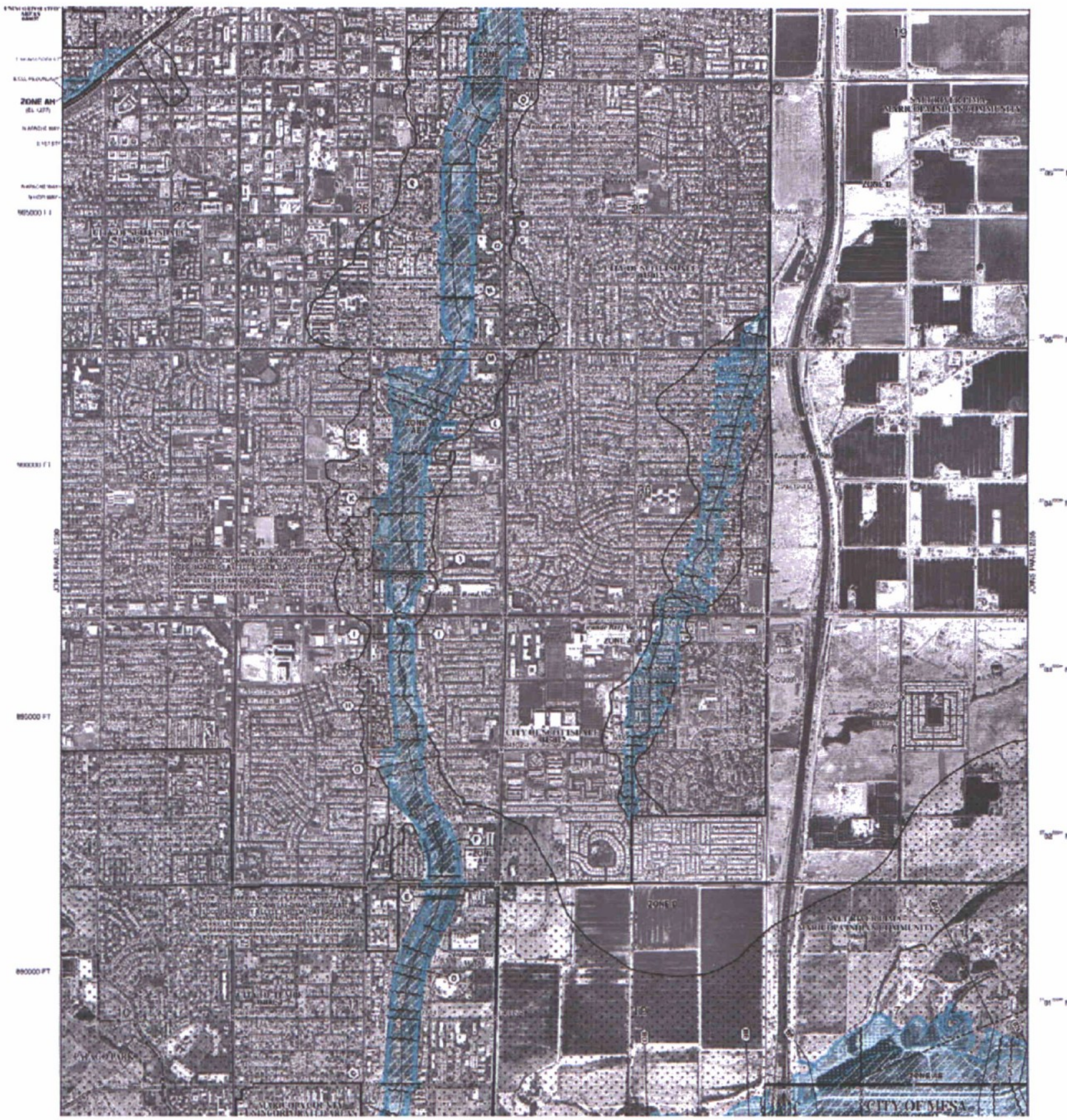
line depicted on this map represents the hydraulic modeling
flood profiles in the FIS report. As a result of improved
the **profile baseline**, in some cases, may deviate significantly
centerline or appear outside the SFHA.

shown on this map are based on the best data available at the
Because changes due to annexations or de-annexations may
this map was published, map users should contact appropriate
to verify current corporate limit locations.

separately printed **Map Index** for an overview map of the
layout of map panels; community map repository addresses;
Communities table containing National Flood Insurance Program
community as well as a listing of the panels on which each
ed.

available products associated with this FIRM, visit the **Map**
(MSC) website at http://msc.fema.gov. Available products may
issued Letters of Map Change, a Flood Insurance Study Report,
of this map. Many of these products can be ordered or obtained
website.

questions about this map, how to order products, or the National
Program in general, please call the **FEMA Map Information**
at **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA
www.fema.gov/.



ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of ... also determined.
ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent ... kept free of encroachment so that the 1% annual chance ... substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas ... with average depths of less than 1 foot or ... 1 square mile; and areas protected by levees ... flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% an...
ZONE D Areas in which flood hazards are undetermined...

COASTAL BARRIER RESOURCES SYST...

OTHERWISE PROTECTED AREAS (OPA...

CBRS areas and OPAs are normally located within or adjacent ...

1% annual chance floodplain bo...
0.2% annual chance floodplain bo...
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood ... Base Flood Elevations, flood ...
Base Flood Elevation line and value ...
Base Flood Elevation value ... elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD ...

Cross section line

MAP REPOSITORIES

MAP SCALE 1" = 1000'

NFIP

PANEL

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURA...

MARICOPA C...

ARIZONA

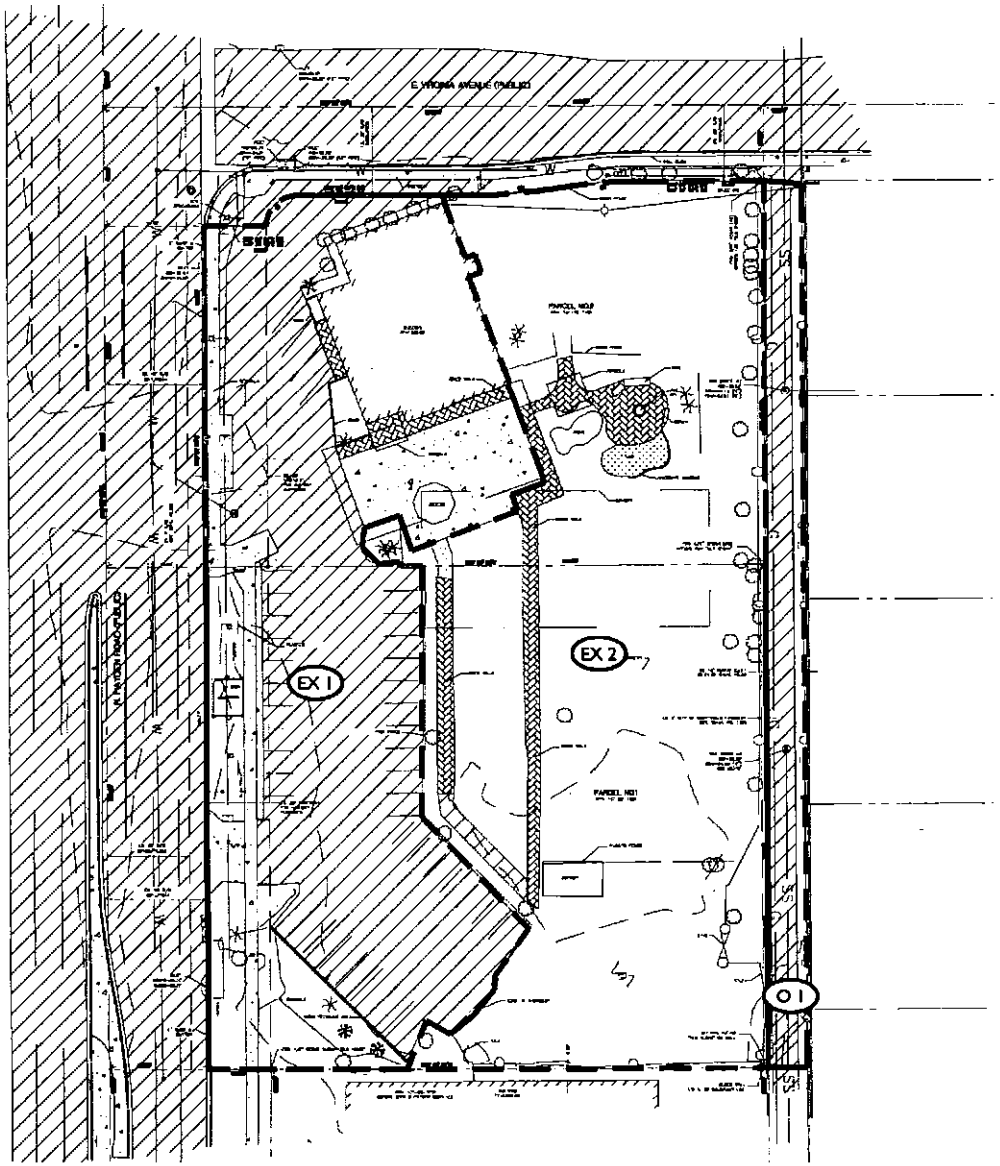
AND INCORPOR...

PANEL 2235 OF 4425

(SEE MAP INDEX FOR ...

CONTAINS:

COMMUNITY
MARICOPA COUNTY
MESA, CITY OF
SCOTTSDALE, CITY OF
TEMPE, CITY OF



LEGEND

DRAINAGE AREA BOUNDARY

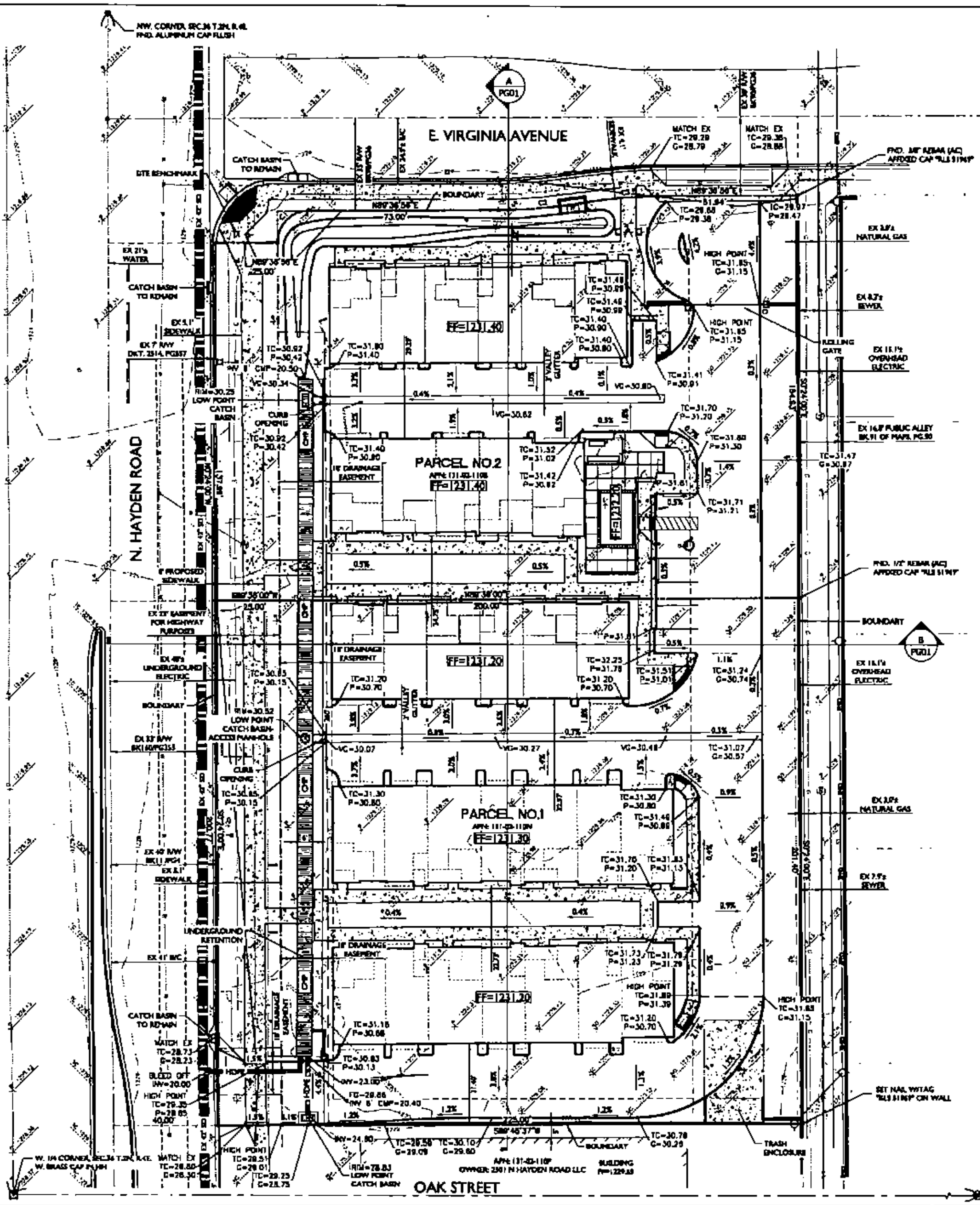
EX 1 DRAINAGE AREA ID

North

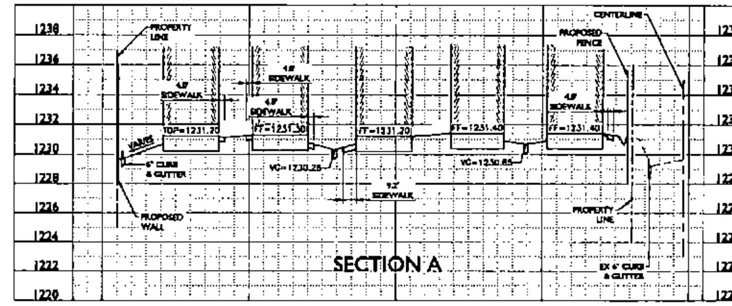
25 0 50

scale feet

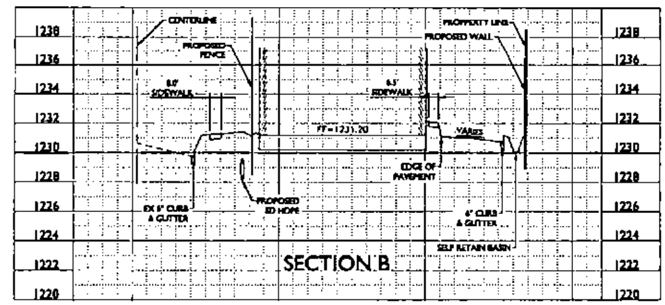
30, 2017 10:11am O:\Projects\2017\17-185\Civil\Preliminary Plan\Design\17-185 - Prelim Retention.dwg



CURVE TABLE				
CURVE	LENGTH	RADIUS	CHORD	DELTA
C1	18.85'	12.00'	16.97'	090°00'00"
C2	31.44'	200.00'	31.43'	009°04'12"
C3	31.44'	200.00'	31.43'	009°04'12"



1" = 40'



1" = 40'

Volume Required and Summary

Basin ID	Sub-Basin ID	Sub Basin Area Description	Contributing Area (ft²)	C =	Volume Required, V_R (ft³)	Volume Provided, V_P (ft³)
PRE	EX 1	Paved	36,000	0.86	8,037	
	EX 2	Unpaved	43,071	0.35	3,543	
		Total	79,071	0.62	11,580	
POST	EX 1 & 2	Developed Site	79,071	0.94	17,467	
	O 1	Offsite	5,000	0.95	1,116	
		Total	79,071	0.94	18,583	
PRE VS. POST					7,003	7,361

FLOOD ZONE DESIGNATION:
THE PROJECT IS LOCATED IN FIRM ZONE X AS
IDENTIFIED ON PANEL NUMBER 04013C2235L
AND DATED 10/16/2013.

SCALE
HORIZONTAL: 1"=20' VERTICAL: 1"=2'

Appendix B

Calculations

Retention Calculations

Project: Harper's Nursury

Storm Event: 100-yr 2-hr (Pre vs. Post)

Prepared by: Kyle Wakefield **Date:** 10/30/2017

$V = C * A * P / 12$ [1]

Where:

V = Runoff Volume

C = Runoff Coefficient

A = Drainage Area

P = 2.82 in

Underground Retention Basin Volume Calculations

Basin ID	*Pipe Diameter (ft)*	*Pipe Length (ft)*	*Volume Provided, V_p (ft^3)*
UG1	6	250	7068.6
			0.0
Total			**7068.6**

Retention Calculations

Project: Harper's Nursury

Storm Event: 100-yr 2-hr (Pre vs. Post)

Prepared by: Kyle Wakefield **Date:** 10/30/2017

Volume Required and Summary

Basin ID	*Sub-Basin ID*	*Sub Basin Area Description*	*Contributing Area (ft^2)*	*C =*	*Volume Required, V_R (ft^3)*	*Volume Provided, V_p (ft^3)*	*Estimated Water Depth (ft)*
PRE	EX 1	Paved	36,000	0.95	8,037		
	EX 2	Unpaved	43,071	0.35	3,543		
		Total	79,071	0.62	11,580		-
POST	EX 1 & 2	Developed Site	79,071	0.94	17,467		
	O 1	Offsite	5,000	0.95	1,116		
		Total	79,071	0.94	18,583		
PRE VS. POST					7,003	7,069	-

Notes:
(1) Sub-Basin IDs are identified on the Existing Condition Drainage Map
(2) C values are based on City of Scottsdale Table 4-1.4

Retention Calculations

Project: Harper's Nursury

Storm Event: 100-yr 2-hr (First Flush)

Prepared by: Kyle Wakefield **Date:** 10/30/2017

V = C * A * P / 12 [1]
Where:
V = Runoff Volume
C = Runoff Coefficient (C=1)
A = Drainage Area
P = 0.50 in

Underground Retention Basin Volume Calculations

Basin ID	*Pipe Diameter (ft)*	*Pipe Length (ft)*	*Volume Provided, V_p (ft^3)*
UG1	6	250	7068.6
Total			**7068.6**

Retention Calculations

Project: Harper's Nursury

Storm Event: 100-yr 2-hr (First Flush)

Prepared by: Kyle Wakefield **Date:** 10/30/2017

Volume Required and Summary

Basin ID	Sub-Basin ID	Sub Basin Area Description	Contributing Area (ft^2)	C =	Volume Required, V_R (ft^3)	Volume Provided, V_p (ft^3)	Estimated Water Depth (ft)
First Flush	O 1	Offsite	5,000	1.00	208		
	EX 1 & 2	Developed Site	79,071	1.00	3,295		
		Total	79,071	1.00	3,295	7,069	-

Notes:
(1) Sub-Basin IDs are identified on the Existing Condition Drainage Map

Appendix C

NOAA Atlas 14

Location name: Scottsdale, Arizona, USA*
Latitude: 33.4762°, Longitude: -111.9079°
Elevation: 1222.88 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]

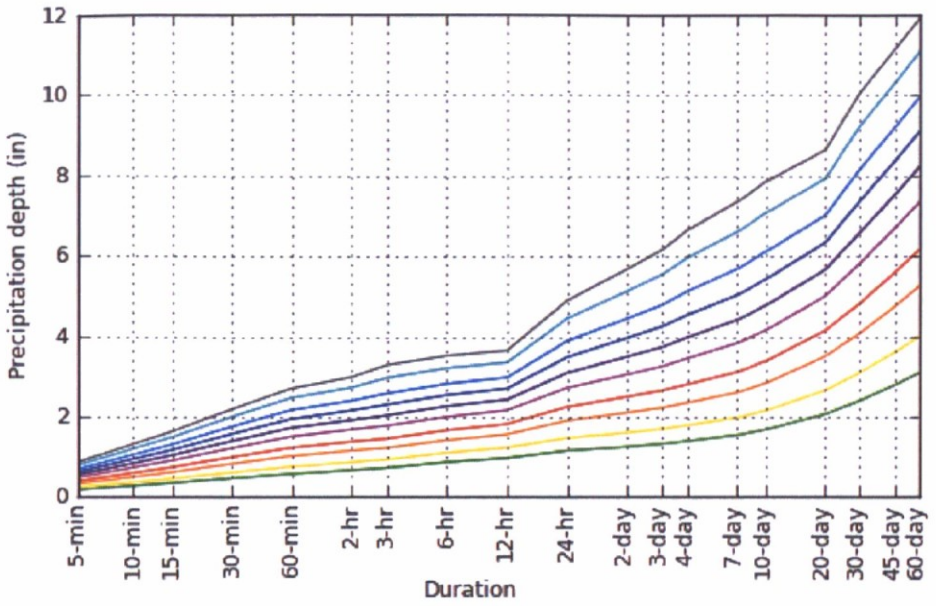
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.183** (0.153-0.222)	**0.239** (0.201-0.290)	**0.324** (0.272-0.393)	**0.390** (0.325-0.471)	**0.479** (0.393-0.576)	**0.549** (0.444-0.656)	**0.619** (0.491-0.738)	**0.691** (0.539-0.823)	**0.788** (0.598-0.939)	**0.861** (0.641-1.03)
10-min	**0.278** (0.233-0.338)	**0.363** (0.306-0.442)	**0.494** (0.414-0.598)	**0.594** (0.495-0.717)	**0.730** (0.598-0.876)	**0.835** (0.675-0.998)	**0.942** (0.747-1.12)	**1.05** (0.820-1.25)	**1.20** (0.910-1.43)	**1.31** (0.976-1.57)
15-min	**0.344** (0.289-0.419)	**0.450** (0.380-0.548)	**0.612** (0.513-0.742)	**0.736** (0.613-0.888)	**0.905** (0.741-1.09)	**1.04** (0.837-1.24)	**1.17** (0.926-1.39)	**1.30** (1.02-1.55)	**1.49** (1.13-1.77)	**1.63** (1.21-1.94)
30-min	**0.464** (0.389-0.564)	**0.606** (0.511-0.738)	**0.824** (0.691-0.999)	**0.992** (0.826-1.20)	**1.22** (0.998-1.46)	**1.40** (1.13-1.67)	**1.57** (1.25-1.87)	**1.76** (1.37-2.09)	**2.00** (1.52-2.38)	**2.19** (1.63-2.61)
60-min	**0.574** (0.481-0.699)	**0.750** (0.633-0.913)	**1.02** (0.855-1.24)	**1.23** (1.02-1.48)	**1.51** (1.24-1.81)	**1.73** (1.40-2.06)	**1.95** (1.54-2.32)	**2.17** (1.70-2.59)	**2.48** (1.88-2.95)	**2.71** (2.02-3.23)
2-hr	**0.665** (0.567-0.793)	**0.861** (0.735-1.03)	**1.15** (0.980-1.37)	**1.38** (1.16-1.63)	**1.68** (1.40-1.98)	**1.92** (1.57-2.25)	**2.16** (1.74-2.54)	**2.40** (1.90-2.82)	**2.73** (2.11-3.21)	**2.99** (2.26-3.54)
3-hr	**0.723** (0.614-0.868)	**0.927** (0.791-1.12)	**1.22** (1.03-1.46)	**1.45** (1.22-1.73)	**1.78** (1.47-2.11)	**2.03** (1.66-2.41)	**2.30** (1.85-2.72)	**2.58** (2.04-3.05)	**2.97** (2.27-3.52)	**3.29** (2.45-3.90)
6-hr	**0.869** (0.754-1.02)	**1.10** (0.959-1.30)	**1.41** (1.22-1.66)	**1.66** (1.43-1.94)	**2.00** (1.69-2.32)	**2.27** (1.89-2.62)	**2.54** (2.09-2.94)	**2.83** (2.28-3.27)	**3.22** (2.52-3.73)	**3.52** (2.70-4.10)
12-hr	**0.972** (0.851-1.13)	**1.23** (1.08-1.42)	**1.56** (1.36-1.80)	**1.82** (1.57-2.09)	**2.16** (1.86-2.49)	**2.43** (2.06-2.79)	**2.71** (2.26-3.10)	**2.98** (2.46-3.43)	**3.36** (2.70-3.88)	**3.65** (2.88-4.25)
24-hr	**1.16** (1.04-1.29)	**1.47** (1.32-1.64)	**1.90** (1.71-2.13)	**2.24** (2.00-2.51)	**2.72** (2.41-3.03)	**3.09** (2.73-3.44)	**3.49** (3.05-3.88)	**3.89** (3.38-4.33)	**4.45** (3.82-4.96)	**4.89** (4.16-5.47)
2-day	**1.25** (1.12-1.40)	**1.60** (1.44-1.79)	**2.10** (1.88-2.35)	**2.50** (2.23-2.79)	**3.05** (2.71-3.41)	**3.50** (3.08-3.90)	**3.96** (3.47-4.43)	**4.45** (3.87-4.98)	**5.13** (4.41-5.75)	**5.67** (4.83-6.38)
3-day	**1.32** (1.19-1.48)	**1.69** (1.52-1.89)	**2.22** (1.99-2.48)	**2.65** (2.36-2.96)	**3.25** (2.89-3.63)	**3.74** (3.29-4.17)	**4.25** (3.72-4.74)	**4.79** (4.16-5.35)	**5.55** (4.76-6.20)	**6.16** (5.23-6.91)
4-day	**1.39** (1.25-1.56)	**1.78** (1.60-1.99)	**2.35** (2.10-2.62)	**2.80** (2.50-3.13)	**3.45** (3.06-3.85)	**3.98** (3.51-4.43)	**4.54** (3.97-5.06)	**5.13** (4.45-5.72)	**5.97** (5.11-6.66)	**6.65** (5.63-7.44)
7-day	**1.54** (1.38-1.72)	**1.97** (1.77-2.21)	**2.60** (2.32-2.90)	**3.10** (2.77-3.47)	**3.82** (3.39-4.27)	**4.40** (3.88-4.90)	**5.02** (4.39-5.60)	**5.67** (4.92-6.33)	**6.59** (5.64-7.36)	**7.34** (6.22-8.21)
10-day	**1.68** (1.50-1.87)	**2.14** (1.93-2.40)	**2.83** (2.53-3.15)	**3.38** (3.02-3.76)	**4.15** (3.68-4.61)	**4.76** (4.20-5.29)	**5.42** (4.75-6.02)	**6.11** (5.31-6.79)	**7.07** (6.07-7.87)	**7.85** (6.67-8.75)
20-day	**2.06** (1.85-2.29)	**2.65** (2.38-2.95)	**3.49** (3.14-3.88)	**4.13** (3.70-4.59)	**4.99** (4.45-5.54)	**5.66** (5.02-6.28)	**6.33** (5.60-7.03)	**7.01** (6.17-7.80)	**7.93** (6.91-8.84)	**8.64** (7.47-9.65)
30-day	**2.40** (2.16-2.67)	**3.09** (2.78-3.44)	**4.07** (3.65-4.52)	**4.82** (4.31-5.33)	**5.82** (5.18-6.44)	**6.59** (5.85-7.28)	**7.37** (6.51-8.15)	**8.17** (7.18-9.04)	**9.24** (8.07-10.3)	**10.1** (8.71-11.2)
45-day	**2.79** (2.51-3.10)	**3.59** (3.24-3.99)	**4.73** (4.26-5.25)	**5.57** (5.00-6.18)	**6.68** (5.98-7.40)	**7.51** (6.70-8.33)	**8.36** (7.42-9.27)	**9.20** (8.13-10.2)	**10.3** (9.04-11.5)	**11.1** (9.71-12.4)
60-day	**3.09** (2.79-3.42)	**3.99** (3.60-4.41)	**5.24** (4.73-5.80)	**6.15** (5.53-6.80)	**7.34** (6.59-8.11)	**8.22** (7.35-9.09)	**9.10** (8.10-10.1)	**9.95** (8.83-11.0)	**11.1** (9.77-12.3)	**11.9** (10.4-13.3)

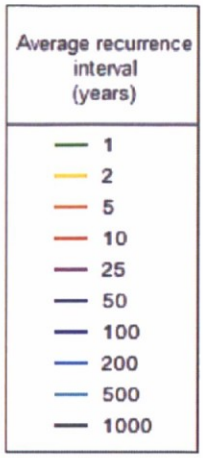
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

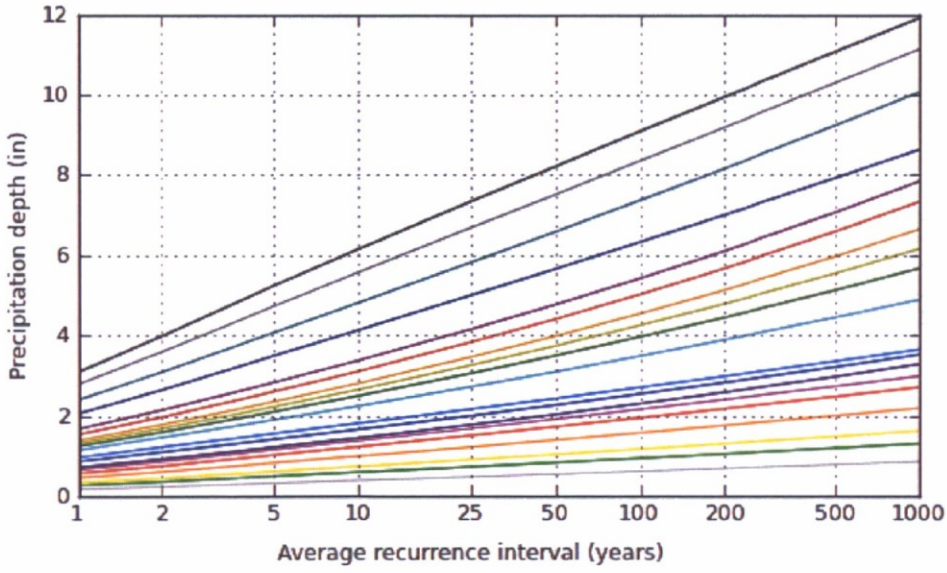
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

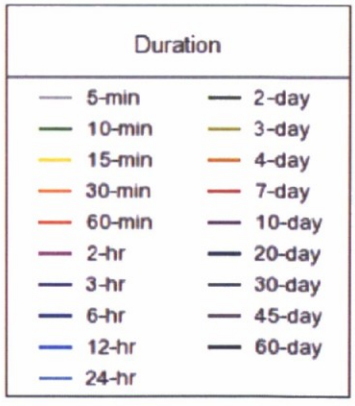
Please refer to NOAA Atlas 14 document for more information.

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.4762°, Longitude: -111.9079°









NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Wed Sep 27 20:16:25 2017

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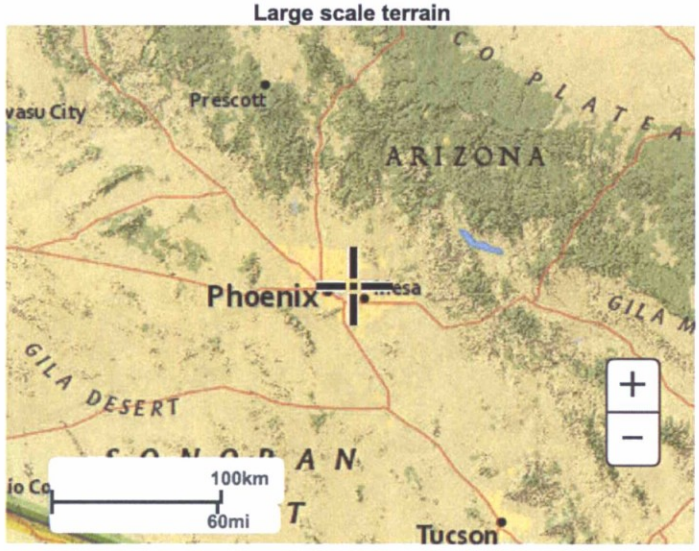
Maps & aerials

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

Appendix D

Warning and Disclaimer of Liability Form

2529 N. Hayden Townhomes

2529 N. Hayden Road

Scottsdale Arizona 85257

Final Water Basis of Design Report

December 28, 2017

EPS Job #17-185

City Case No: 33-DR-2017

Expires:09/30/2020

Submitted by:

Del Pueblo Communities

7520 E. Angus Dr.

Scottsdale, AZ 85251

Phone #: 602-318-0034

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4. **PROPOSED CONDITIONS** 2

Existing Water Meters 3

Fire suppression and Fire Hydrant Locations 3

5. **COMPUTATIONS** 3
6. **SUMMARY** 4
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Appendices

Appendix 'A' – Vicinity Map & Site Plan

Appendix 'B' –Water Node Exhibit

Appendix 'C' – C.O.S. Water Pressure Zone Map / Water Service Area Map / Flow Tests

1. Introduction

The proposed 2529 N. Hayden Townhomes consists of 31 single-family residential units covering 1.82 acres located in Scottsdale, Arizona. The Hayden and Virginia Townhomes development has a gross density of 17.0 du/ac. The site is located on the southeast corner of N. Hayden Rd. and E. Virginia Ave. the project is Maricopa county assessor's office number (APN) 131-02-110B & 131-02-110N. The site is within section 36, Township 2 North, Range 4 East of the Gila and Salt River base and meridian, City of Scottsdale, Maricopa County, Arizona. (Refer to the Vicinity Map in Appendix A for the project location.

2. Design Documentation

The infrastructure water lines and unit daily demands requirements for this project have been determined using the City of Scottsdale Design Standards & Policies Manual (DS&PM).

3. Existing Conditions

The site is zoned Multi-Family Residential (R-5). The site's current zoning will remain the same. The Hayden and Virginia Townhomes development is located within the City of Scottsdale Zone 1 water pressure zone. (See Appendix C - City of Scottsdale Pressure Zone Map).

The site is currently developed as a plant nursery and garden center with small building and other miscellaneous structures on site. The site is bounded by E. Virginia Avenue to the north, Village Grove subdivision to the east, N. Hayden Road to the west and a commercial building to the south.

The existing improvements including the small building will be demolished and removed during clearing and grubbing operations. The average ground elevation of the site is approximately 1229'. The existing infrastructure has provided adequate domestic water and fire protection for the previous development and the surrounding developments. It is assumed that the water system is adequate to continue domestic water and fire protection for the proposed 2529 N. Hayden Townhomes.

4. Proposed Conditions

A 2" water main will serve potable water to the 31 proposed townhomes. The development will have a master meter and each unit will have a sub-meter for potable water. The site will have one landscape meter and one pool meter. The landscape and pool water meters will be equipped with backflow prevention. The site will have two water main connections. One connection will be onto an existing 6" ACP lines located along E. Virginia Avenue and the second connection onto an existing 12" CIP line in N. Hayden Road. The water lines within the site will be looped as required per the City of Scottsdale DS&PM. Water lines extending from the main drive in to the dead-end driveways will be capped, with curb stop and flushing pipe per MAG Standard Detail 390 type "B". Each condominium building will be served from the 1" water service. The developer will meet with the City of Scottsdale to determine if this is an acceptable solution. The water system layout including water mains, meters and fire hydrants locations is showed in Appendix 'B' –Water Node Exhibit.

Existing Water Meters

Any existing water meters serving the current development will be utilized as a landscape or pool water meter as applicable. Any remaining existing meters will be abandoned and a fee credit will be requested.

Fire suppression and Fire Hydrant Locations

The townhomes will utilize the 13D fire sprinkler system. A proposed 6" fire line is looped within the development with individual fire line services to each unit. One existing fire hydrant is located near the property and will provide fire protection for the Hayden and Virginia Townhomes. One new fire hydrant will be installed within the development in a centralized location.

5. Computations

According to the City of Scottsdale DS&PM, Residential Demand per dwelling units based on dwelling units per acres (Hayden and Virginia Townhomes 17.0 DU/ac) assume 227.6 gpd per unit. The City of Scottsdale requires water lines to be designed to account for Average Day (ADD), Max Day (MDD) and Peak hour (PH) demands. Please see the table below for water demand calculations.

** Per City of Scottsdale DS&PM 6-1.404: The peaking factors are 2 times the average day for maximum day, and 3 1/2 times the average day for peak hour*

Development	Dwelling Units (du)	Average Day Demand (ADD) 227.6 gpd X 31 du (gpd)	Max Day Demand ADD X 2 (gpd)	Peak Hour Demand ADD X 3.5 (gpd)
2529 N. Hayden Townhomes	31	7,055.6	14,111.2	24,694.6

A fire flow analysis was also performed utilizing Bentley WaterCAD V8i and assuming 1,500 gpm per City of Scottsdale standards. Please see the table below for fire flow calculations

Hydrant Node	Fire Demand (gpm)	Hydrant Elevation (ft)	Residual Pressure (psi)
H-1	1,500	1,230.00	63

6. Summary

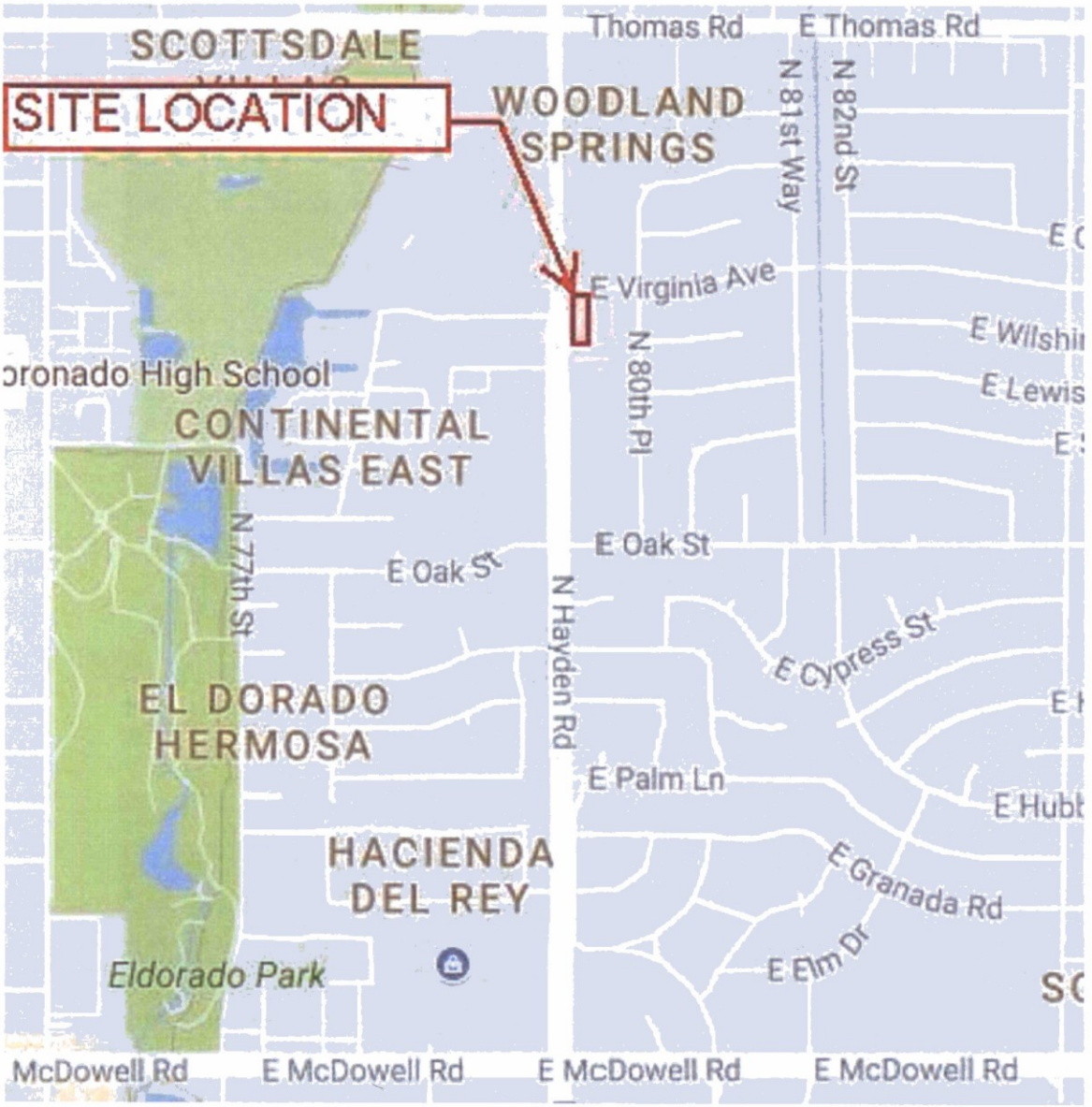
The 2529 N. Hayden Townhomes water design described within this Water Report is similar to the water demands of the existing developments in the area (Macalister Scottsdale Apartments, and Condominiums west of N. Hayden Road). The fire flow model has shown sufficient pressure to provide the required flows onsite.

- Two water line Connections: E. Virginia Avenue and N. Hayden Road – Domestic water
- Two water line Connections: E. Virginia Avenue and N. Hayden Road – fire line
- 2" water main for domestic water with master meter/sub-meters to each unit.
- 6" Fire line with individual services to each unit
- 1 pool water meter with backflow preventer (utilize exist. water meter if possible)
- 1 Landscape water meter (utilize existing water meter if possible)

7. References

- City of Scottsdale Design Standards & Policies Manual (DS&PM).
- City of Scottsdale Geographic Information Systems Quarter Section Maps 14-47
- C.O.S. Water Pressure Zone Map / Water Service Area Map

Appendix A - Vicinity Map

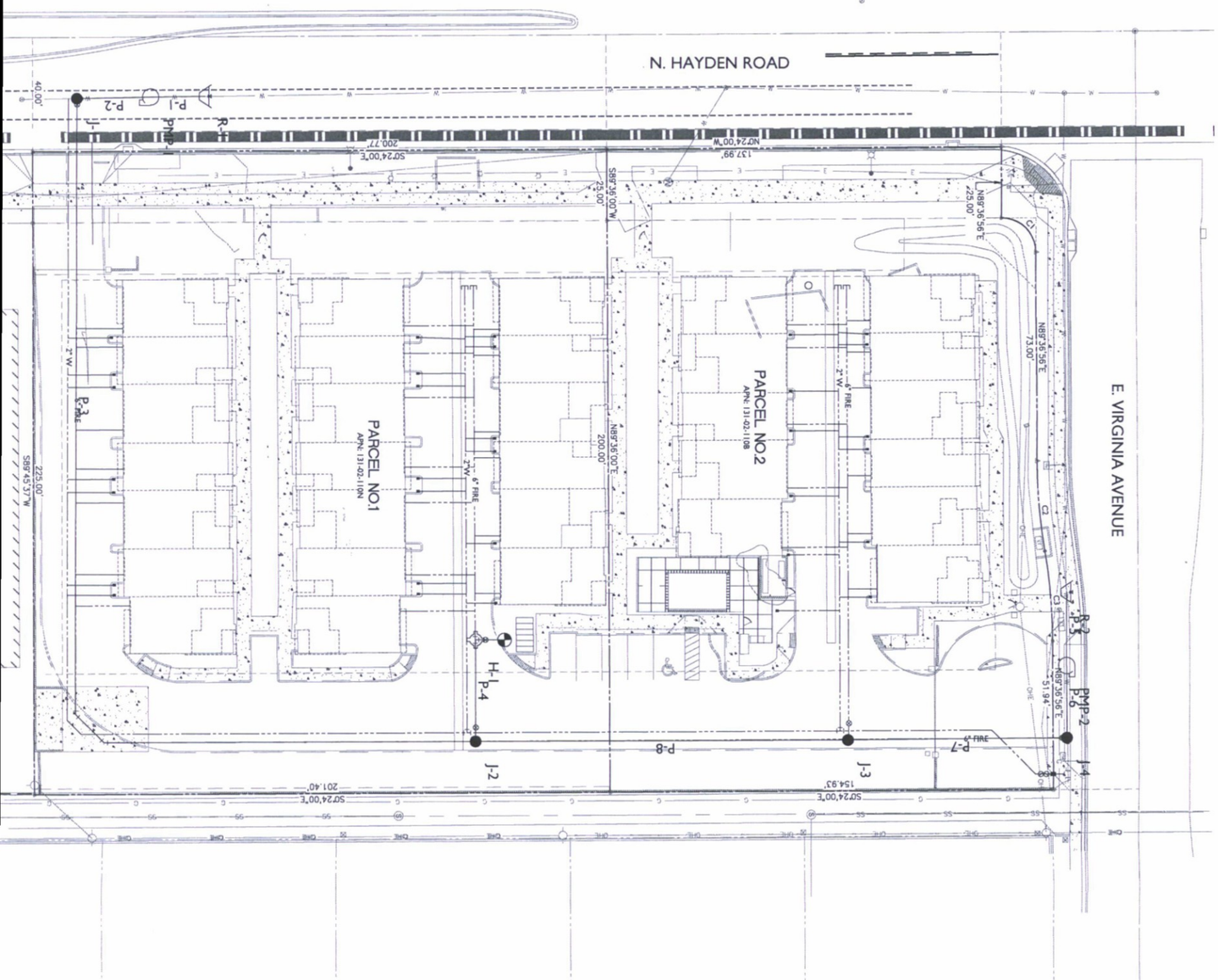


Appendix B - Water Node Exhibit

(See attached)

17-185 HARPER'S NURSERY

Dec. 27, 2017 2:36pm Q:\Projects\2017\17-185\Civil_Construction Documents\Design\Water\Water Model\17-185 - Water Model.dwg



Sheet No.

Job No. 17-185

Designer: EPS
Drawn by: JAF

Revisions:

Project:
2529 N. HAYDEN TOWNHOMES
2529 N. HAYDEN ROAD
SCOTTSDALE, ARIZONA

WATER EXHIBIT

EPS GROUP
2045 S. Vineyard Ave, Suite 101
Mesa, AZ 85210
T:480.503.2250 | F:480.503.2258
w w w . e p s g r o u p i n c . c o m

Appendix C- C.O.S. Water Pressure Zone Map / Water Service Area Map / Flow Tests

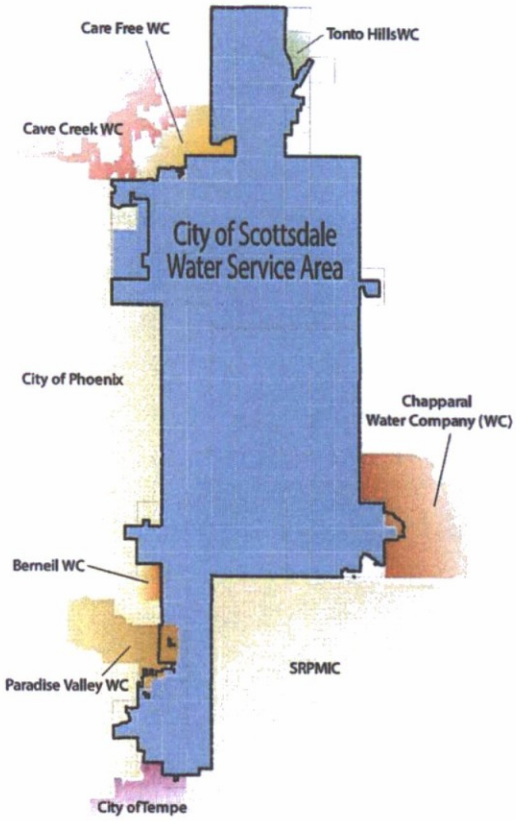
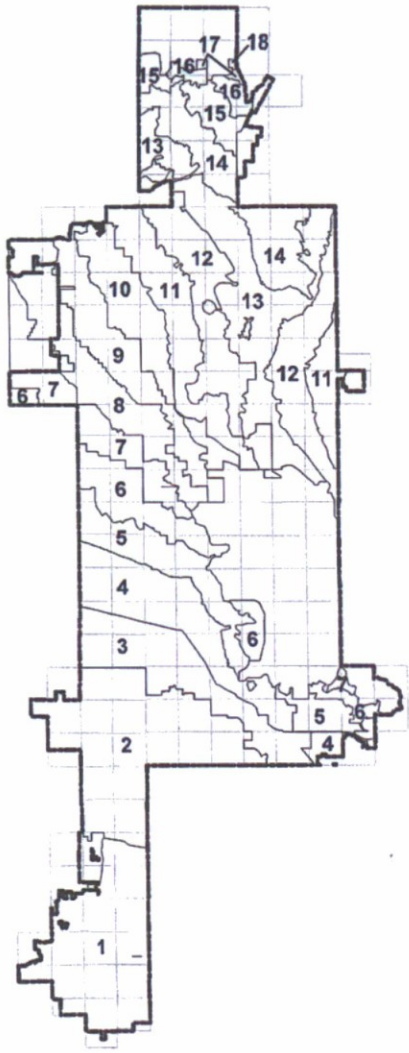


FIGURE 6.1-1 WATER SERVICE AREAS



Zone	Ground Elevation Range (Ft.)
1	1180-1280
1A	1250-1330
2A	1280-1330
2	1330-1440
3	1440-1550
4	1510-1650
4E	1550-1650
5	1650-1790
5E	1650-1750
6	1790-1920
6E	1750-1934
7	1920-2050
7E	1934-2065
8	2050-2180
8E	2065-2200
9	2180-2310
10	2310-2440
11,11E	2440-2570
12,12E	2570-2700
13	2700-2830
14	2830-2960
15	2960-3090

FIGURE 6.1-3 PRESSURE ZONE MAP

-low Test Summary

Project Name:	EJFT 17260-1
Project Address:	2529 N Hayden Rd, Scottsdale, AZ 85257
Date of Flow Test:	2017-12-20
Time of Flow Test:	7:40 AM
Data Reliable Until:	2018-06-20
Conducted By:	Austin G., Eder C. & Logan G. (EJ Flow Tests) 602.999.7637
Witnessed By:	Phil Cipolla (City of Scottsdale) 602.828.0847
City Forces Contacted:	City of Scottsdale (602.828.0847)
Permit Number:	C54335
Note	Scottsdale requires a max static pressure of 72 psi for safety factor

Raw Flow Test Data

Static Pressure:	90.0 PSI
Residual Pressure:	82.0 PSI
Flowing GPM:	2,284
GPM @ 20 PSI:	7,367

Data with a 18 PSI Safety Factor

Static Pressure:	72.0 PSI
Residual Pressure:	64.0 PSI
Flowing GPM:	2,284
GPM @ 20 PSI:	6,275

Hydrant F_1

Pitot Pressure (1):	41	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	4	inches

Additional Coefficient 0.83 on orifice #1

Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
320 ft (measured linearly)

Static-Residual Elevation
1230 ft (above sea level)

Flow Hydrant (F_1) Elevation
1231 ft (above sea level)

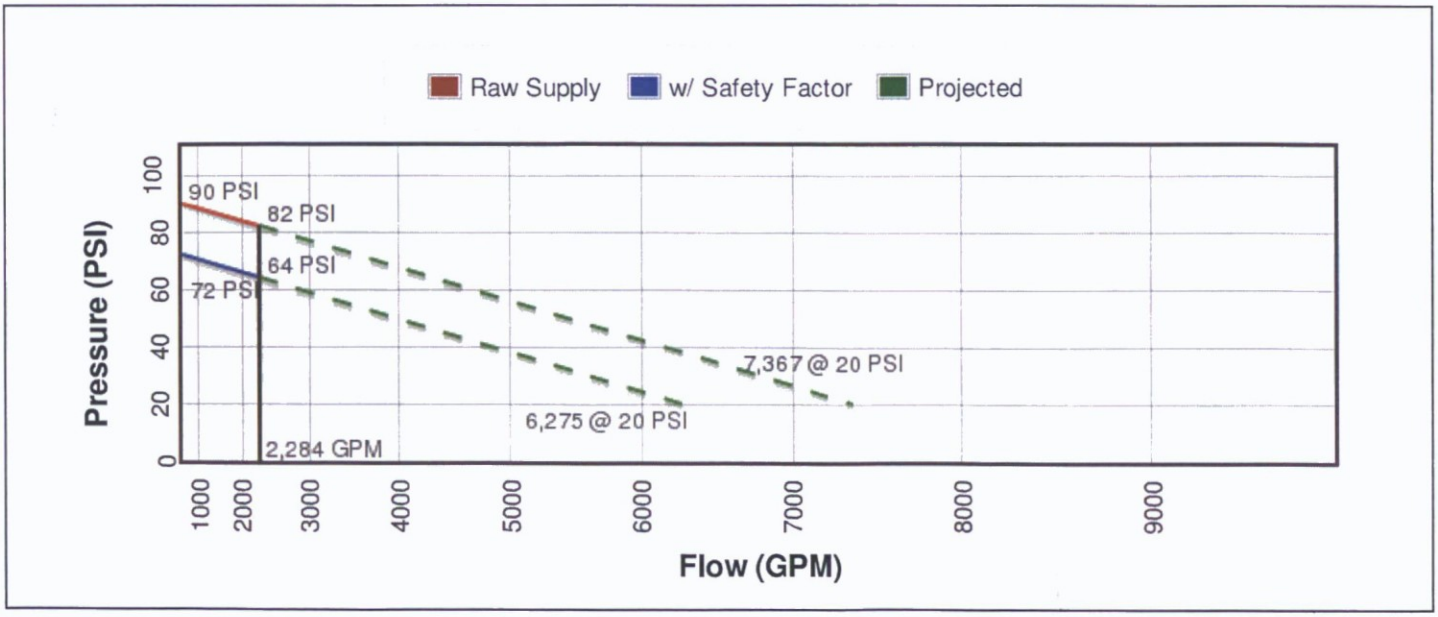
Elevation & distance values are approximate

Static-Residual Hydrant

Flow Hydrant (only hydrant F1 shown for clarity)

Approximate Project Site

Water Supply Curve $N^{1.85}$ Graph



Flow Test Summary

Project Name:	EJFT 17260-2
Project Address:	2529 N Hayden Rd, Scottsdale, AZ 85257
Date of Flow Test:	2017-12-20
Time of Flow Test:	7:50 AM
Data Reliable Until:	2018-06-20
Conducted By:	Austin G., Eder C. & Logan G. (EJ Flow Tests) 602.999.7637
Witnessed By:	Phil Cipolla (City of Scottsdale) 602.828.0847
City Forces Contacted:	City of Scottsdale (602.828.0847)
Permit Number:	C54335

Note Scottsdale requires a max static pressure of 72 psi for safety factor

Raw Flow Test Data

Static Pressure:	90.0 PSI
Residual Pressure:	85.0 PSI
Flowing GPM:	2,069
GPM @ 20 PSI:	8,605

Data with a 18 PSI Safety Factor

Static Pressure:	72.0 PSI
Residual Pressure:	67.0 PSI
Flowing GPM:	2,069
GPM @ 20 PSI:	7,329

Hydrant F_1

Pitot Pressure (1):	38	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	2.5	inches
Pitot Pressure (2):	38	PSI
Coefficient of Discharge (2):	0.9	
Hydrant Orifice Diameter (2):	2.5	inches

Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
133 ft (measured linearly)

Static-Residual Elevation
1229 ft (above sea level)

Flow Hydrant (F_1) Elevation
1228 ft (above sea level)

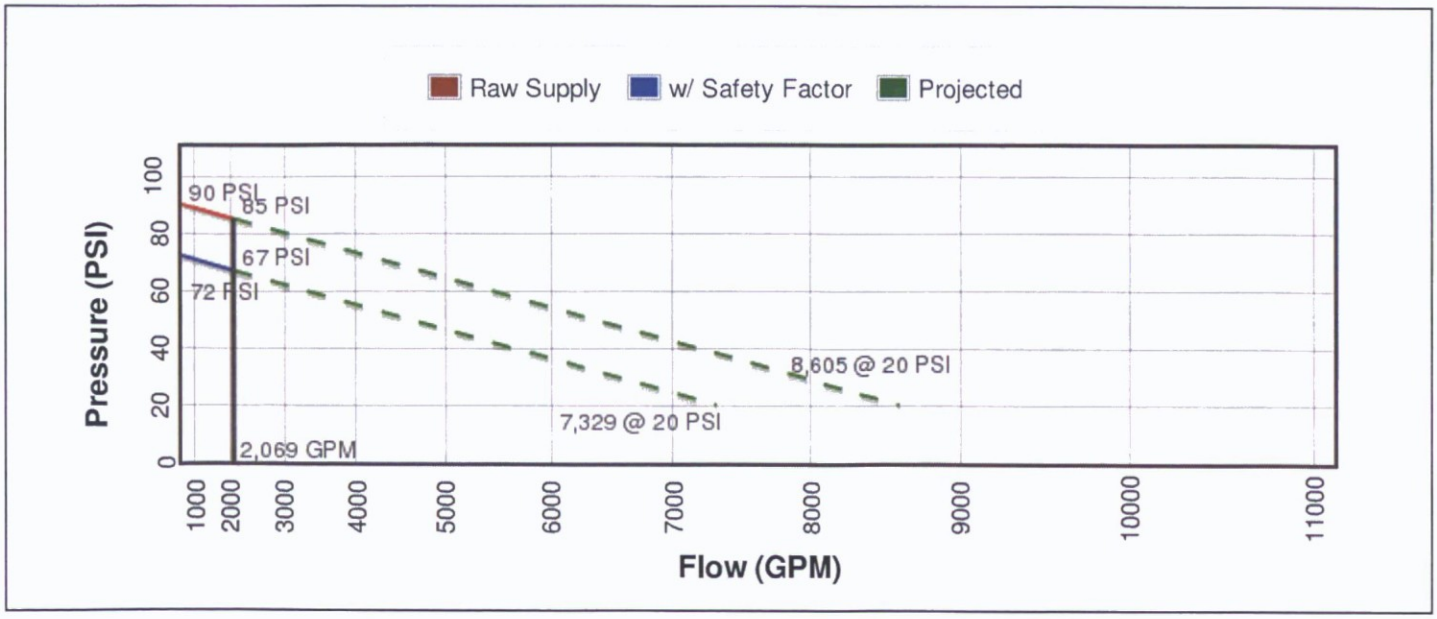
Elevation & distance values are approximate

Static-Residual Hydrant

Flow Hydrant (only hydrant F1 shown for clarity)

Approximate Project Site

Water Supply Curve $N^{1.85}$ Graph



2529 N. Hayden Townhomes

2529 N. Hayden Road

Scottsdale, Arizona 85257

Final Wastewater Basis of Design Report

December 28, 2017

EPS Job #17-185

City Case No: 33-DR-2017

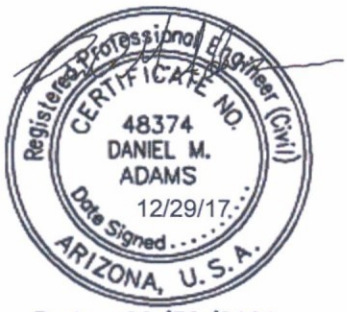
Submitted by:

Del Pueblo Communities

7520 E. Angus Dr.

Scottsdale, AZ 85251

Phone #: 602-318-0034



Expires:09/30/2020

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Mesa, AZ 85210
o: 480.503.2250
f: 480.503.2258

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Appendices

Appendix A – Vicinity Map

Appendix B –Sewer Exhibit

Appendix C – Sewer Capacity Calculations

1. Introduction

The proposed 2529 N. Hayden Townhomes consists of 31 single-family residential units covering 1.82 acres located in Scottsdale, Arizona. The Hayden and Virginia Townhomes development has a gross density of 17.0 du/ac. The site is located on the southeast corner of N. Hayden Rd. and E. Virginia Ave. the project is Maricopa county assessor's office number (APN) 131-02-110B & 131-02-110N. The site is within section 36, Township 2 North, Range 4 East of the Gila and Salt River base and meridian, City of Scottsdale, Maricopa County, Arizona. (Refer to the Vicinity Map in Appendix A for the project location.

2. Existing Conditions

The site is zoned Multi-Family Residential (R-5). The site's current zoning will remain the same. The site is currently developed as a plant nursery and garden center with small building and other miscellaneous structures on site. The site is bounded by E. Virginia Avenue to the north, Village Grove subdivision to the east, N. Hayden Road to the west and a commercial building to the south.

The existing improvements including the small building will be demolished and removed during clearing and grubbing operations. The average ground elevation of the site is approximately 1229'. The existing infrastructure has provided adequate domestic water and fire protection for the previous development and the surrounding developments. It is assumed that the water system is adequate to continue domestic water and fire protection for the proposed 2529 N. Hayden Townhomes.

3. Proposed Conditions

Master Infrastructure

The Hayden and Virginia Townhomes development is located within the City of Scottsdale Wastewater Service Area. All sewer lines within the site will be 8" PVC pipes located within an Access and Utility Easement. Individual sewer laterals at a typical depth of 5-feet below finished floor will be provided to each unit. The new 8" PVC sewer main will connect to the existing 8" sewer line located in the alley east of the property. The proposed sewer mains will connect to an existing manhole. Flows from the development ultimately outfall to a 15" VCP sewer main located on N. Granite Reef Road and are conveyed to a City of Scottsdale reclamation facility. See Appendix B –Sewer Exhibit.

4. Design Considerations/Computations

The infrastructure sewer lines and unit daily demands requirements for this project have been determined using the City of Scottsdale Design Standards & Policies Manual (DS&PM).
All sewer lines will be designed using Manning's equation assuming pipe flowing full using a manning's "n" value of 0.013. Pipe sizes will be designed such that the peak flow will not exceed a depth of flow to pipe diameter ratio of 0.65 (d/D).

Minimum Slopes

Per the City of Scottsdale DS&PM a minimum full flow velocity of 2.5 feet per second will used to determine the minimum slope for each pipe segment. The maximum velocity will be limited to 10 fps at estimated peak flow.

Sewer flows summary

Per the City of Scottsdale DS&PM townhomes/Condominiums residential density assume 2.5 persons per dwelling unit, using 100 gallons per capita per day (gpcpd) and a peaking factor of 4. The average day sewer flow for the 31 units is 7,750 gpd with a peaking flow of 31,000 gpd. (See table below)

Peaking Factor

The City of Scottsdale requires a sewer line to be designed to account for a peak flow scenario. A peaking factor is applied to the average day flows. A peaking factor of 4 was used for this parcel per the Engineer Design Standards and Policy Manual. Please see the table below for sewer flow calculations.

Development	Dwelling Units (DU)	*Average Day (gpdfpc) 250 gal. x (DU)	Peaking Factors (Average Day x 4)
2529 N. Hayden Townhomes	31	7,750	31,000

* 100 gallons per capita per day (gpcpd) and a peaking factor of 4. Residential densities are to assume 2.5 persons per dwelling unit, apartment or town home. (2.5 x 100 = 250 gal. per DU)

5. Summary

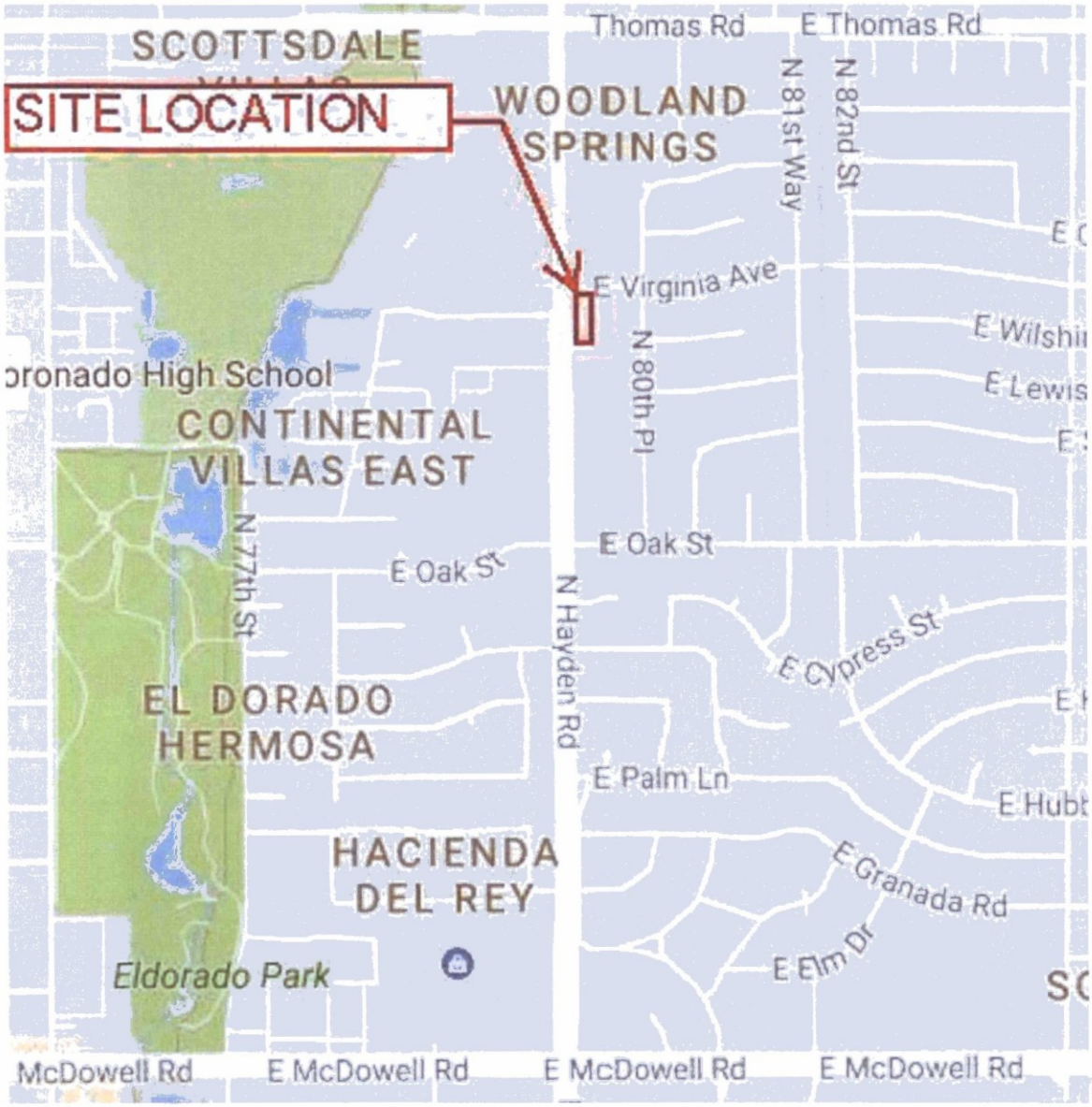
The 2529 N. Hayden Townhomes sewer design described within this Sewer Basis of Design Report was designed to collect and covey the wastewater flow under Peak flow conditions. The wastewater from the development will ultimately be conveyed and treated at a City of Scottsdale Reclamation Facility. The City's design standards and policies have been met for wastewater design for the proposed buildings. Approximate Project start is anticipated to be June 2018 with completion by January 2019. No request for credit or variances are being requested.

- Approx. 727 LF of 8" PVC sewer line, located within an Access and Utility Easement.
- sewer connection to an existing manhole/existing 8" sewer main in the alley east of the project.
- Individual 4" Sewer laterals

6. References

- City of Scottsdale Design Standards & Policies Manual (DS&PM).
- City of Scottsdale Geographic Information Systems Quarter Section Maps 14-47

Appendix A – Vicinity Map

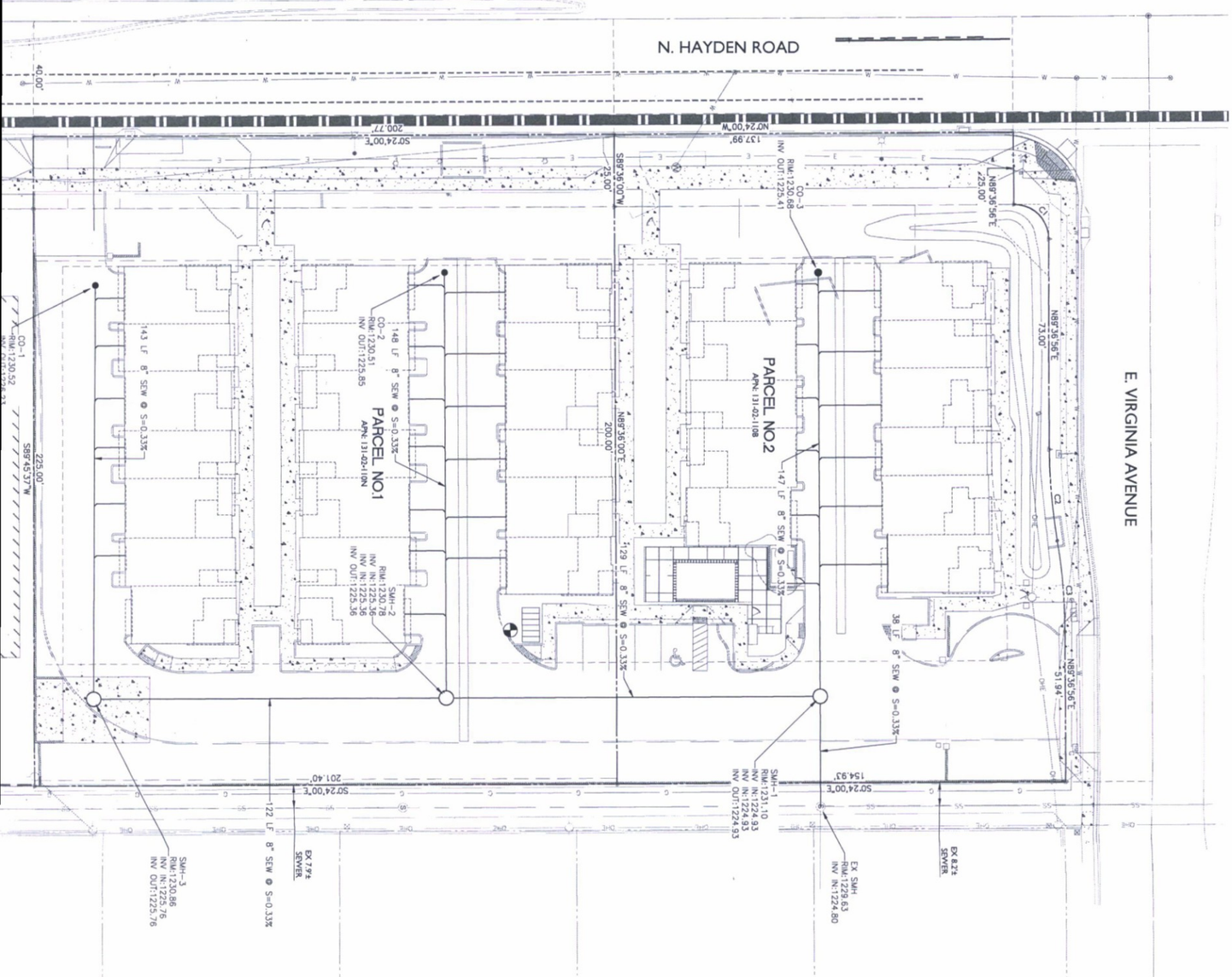


Appendix B –Sewer Exhibit

(See attached)

17-185 HARPER'S NURSERY

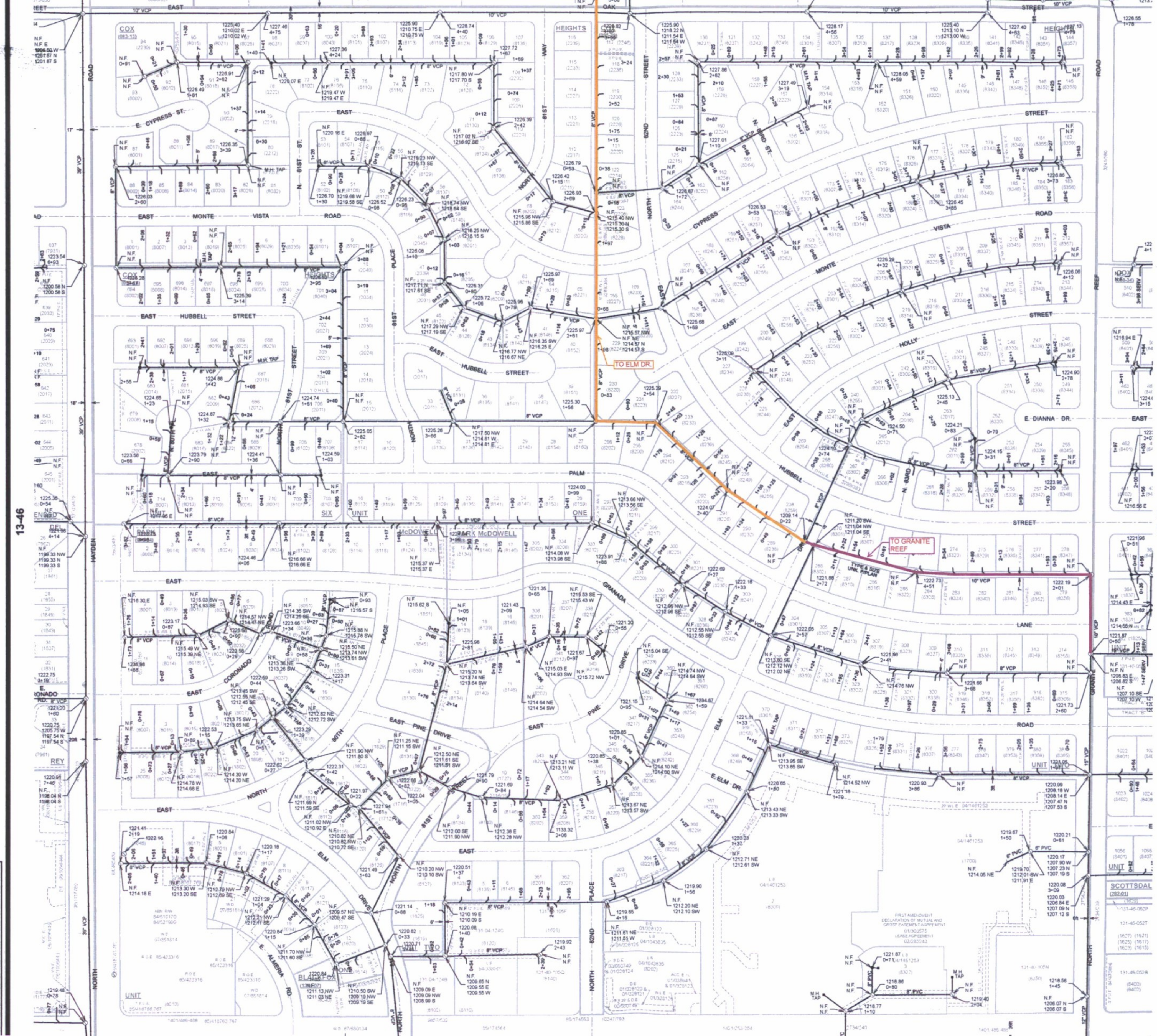
Dec 27, 2017 12:58pm Q:\Projects\2017\17-185\Civil_Construction Documents\Design\Sewer\17-185 - Sewer Exhibit.dwg



Sheet No.	Job No.	Designer:	Drawn by:	Revisions:	Project:	EPS GROUP
	17-185	EPS	JAF		2529 N. HAYDEN TOWNHOMES 2529 N. HAYDEN ROAD SCOTTSDALE, ARIZONA	2045 S. Vineyard Ave, Suite 101 Mesa, AZ 85210 T:480.503.2250 | F:480.503.2258 www.epsgroupinc.com

SEWER EXHIBIT

• THE SECTION LINE BEARING AND DISTANCES ARE BASED ON THE CITY OF SCOTTSDALE GPS SURVEY OF SEPTEMBER, 1991. BEARINGS ARE NAD 83 GRID AND DISTANCES ARE FLATTENED TO GROUND. WHERE NO CORNER WAS FOUND THE DIMENSIONS ARE GIVEN TO CALCULATED SECTION CORNERS AND ARE NOTED AS 'CALCULATED' ON THE MAP.
LEGEND:
Cleanout
Lift Station
Manhole
Non-GPS Point
Plug
Sewer Service Point
Sewer Tap Point
Sewer Valve
Treatment Plant
Sewer Main - Gravity
Sewer Main - Force
Sewer Main - Private
VICINITY MAP
THOMAS ROAD
HAYDEN ROAD
GRANITE REEF ROAD
OAK STREET
NORTH
SCALE: 1" = 100'
The map scale of 1" = 100' is based on a full size print of 30" x 36"
SEWER
QUARTER SECTION MAP
14-47
NW 1/4 SEC. 36 T2N R4E
14-46
14-48
SITE
TO 81ST ST
TO OAK ST
THOMAS ROAD
EAST EDGEMONT AVENUE
EAST WINDSOR AVENUE
EAST CAMBRIDGE AVENUE
VIRGINIA AVENUE
EAST WILSHIRE DRIVE
EAST LEWIS AVENUE
EAST SHERIDAN STREET
EAST VERNON AVENUE
NORTH HAYDEN ROAD
NORTH GRANITE REEF ROAD
N. 80TH PLACE
N. 81ST STREET
N. 82ND STREET
N. 83RD PLACE
NOTICE
THE CITY OF SCOTTSDALE



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LEGEND:

- Cleanout
- Lift Station
- Manhole
- Non-GPS Point
- Plug
- Sewer Service Point
- Sewer Tap Point
- Sewer Valve
- Treatment Plant
- Sewer Main - Gravity
- Sewer Main - Force
- Sewer Main - Private

VICINITY MAP

NORTH

SCALE: 1" = 100'

0 50 100 200

The map scale of 1" = 100' is based on a full size print of 30" x 36"

SEWER

QUARTER SECTION MAP

13-47

SW 1/4 SEC. 36 T2N R4E

N O T I C E

...VIDED FOR GENERAL INFORMATION PURPOSES ONLY. THE CITY OF ... T WARRANT ITS ACCURACY, COMPLETENESS OR SUITABILITY FOR ANY ... IT SHOULD NOT BE RELIED UPON WITHOUT FIELD VERIFICATION.

THE CITY OF SCOTTSDALE

Sewer Capacity Calculations

(See attached)

Average Daily Sewer Flows and Pipe Capacity Using Manning's Equation

Project: Hayden and Virginia Townhomes

Prepared by: Daniel M. Adams **Date:** 12/27/2017

Calculations Assume 100 GPD/capita
Calculations Assume 2.5 Persons/D.U. (1)

Sewer Pipe Information					Additional Flow Information				Peak Demand Information						Full Flow Check		Non-Pressurized Flow Calculations					
Sewer Reach	Length (ft)	Pipe Diameter (in)	Slope (ft/ft)	Manning's Roughness	Description	Additional Contributing Lots	Other Additional Contributing Flow (GPD)	Additional Upstream Flow (GPD)	Cumulative Daily Flow (GPD)	Equivelant Population	Peaking Factor	Peak Demand (GPD)	Peak Demand (MGD)	Peak Demand (cfs)	Full Flow Capacity (cfs)	Pressurized Flow?	Theta of flow (rad)	Depth of Flow (ft)	Percent Full (d/D)	Area of Flow (ft2)	Wetted Perimeter of flow (ft)	Velocity of Flow (fps)
Site	432	8	0.0033	0.013	Site Sewer Flow	31			7,750	78	4.00	31,000	0.031	0.048	0.70	NO	1.72	0.12	17%	0.0403	0.572	1.19
To 81st Street	951	8	0.0033	0.013	From Site to 81st St	14			11,250	113	4.00	45,000	0.045	0.070	0.70	NO	1.90	0.14	21%	0.0530	0.633	1.31
To Oak Street	1277	8	0.0033	0.013	81st St to Oak St	151			49,000	490	4.00	196,000	0.196	0.303	0.70	NO	2.99	0.31	46%	0.1575	0.996	1.93
To Elm Dr	1739	8	0.0033	0.013	Oak St to Elm Dr	130			81,500	815	4.00	326,000	0.326	0.504	0.70	NO	3.67	0.42	63%	0.2321	1.224	2.17
To Granite Reef	946	10	0.0044	0.013	Elm Dr to Granite Reef 15"	210			134,000	1,340	4.00	536,000	0.536	0.829	1.46	NO	3.30	0.45	54%	0.3007	1.376	2.76

Notes:

(1) Flow requirements per City of Scottsdale DS&PM