

Drainage Reports  
Abbreviated Water & Sewer Need Reports  
Water Study  
Wastewater Study  
Stormwater Waiver Application

# PIMA SELF STORAGE

LOCATED AT THE NORTHWEST CORNER OF THE INTERSECTION OF PIMA ROAD  
AND THOMAS ROAD

## WATER BASIS DESIGN REPORT

MARCH 13, 2016  
REVISED: MAY 24, 2016  
Project No.: 15138

PREPARED FOR:

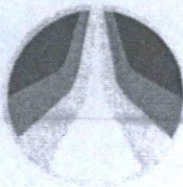
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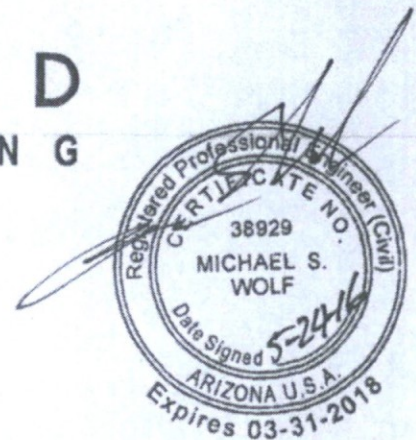
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57-DR-2015  
05/25/16

1-ZN-2019  
01/16/2019

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## 1.0 INTRODUCTION AND SCOPE OF WORK

This report presents the results of a *Water Basis of Design Report* conducted by Hubbard Engineering at the request of Wentworth Property Company, LLC ("client"), for Pima Self Storage ("site"). The purpose of this report is to provide a water demand evaluation for the site. This report addresses off-site and on-site conditions as well as storm water runoff detention.

### 1.1 Site Location

The site is located in Section 25 of Township 2N, Range 4E of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The location of the site is shown on the site *Vicinity Map*, **FIGURE 1**, on the next page. The project is bounded by City park to the west, Thomas Road to the south, Pima Rd to the east and residential subdivisions to the north.

### 1.2 Project Type

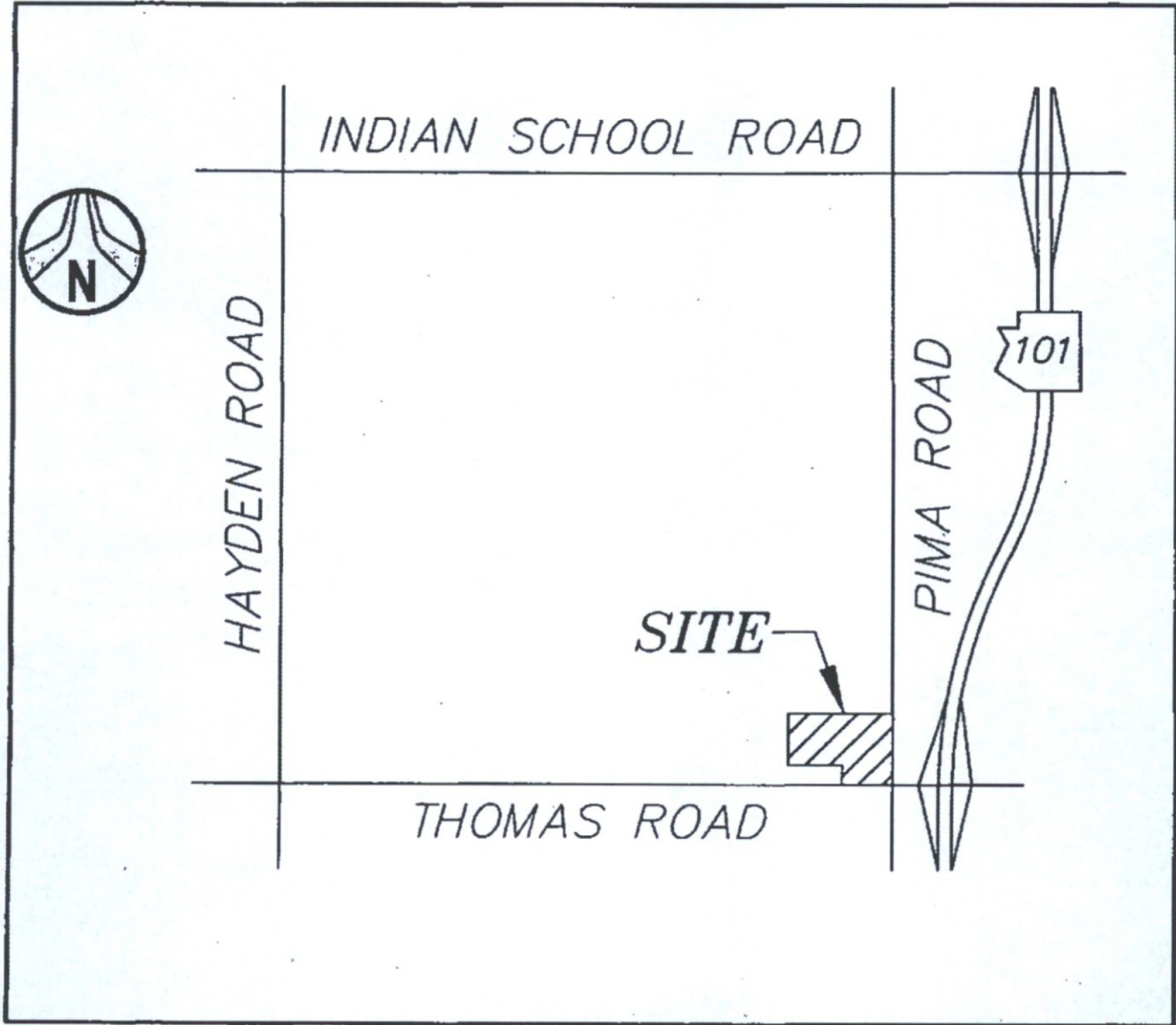
The site is rectangular in shape and encompasses approximately 10.78 gross acres. The site is currently developed with 1 existing building and parking lot. The proposed development for the site is a 2-phased project. Phase 1 will encompass the renovation of the existing Microsemi building for storage as well as adding additional storage units around the existing building. A part of Phase 1 is deeding to the City of Scottsdale the west half of the site, approximately 4.87 acres, to become a part of a regional retention basin. Phase 2 will be future retail pads along Thomas Rd. These pads will only be rough graded for Phase 1.

### 1.3 Regulatory Jurisdiction


The criteria used in the water design and analysis of the site was established using the guidelines and modeling software as described in the following:

- *Design Standards & Policies Manual Chapter 6 Water, City of Scottsdale, Dated January, 2010. (Reference 1).*
- *Water Model Software, EPANET 2, Provided by the EPA, 05/27 Version (Reference 2).*

**PIMA SELF\_STORAGE  
VICINITY MAP**



SECTION 25  
T2N, R4E., G.&S.R.B. & M.  
MARICOPA COUNTY, ARIZONA

Proj. No. 15138	Date 03/13/16	 <p><b>HUBBARD ENGINEERING</b> www.hubbardengineering.com 1840 S. Stapley Dr., Ste. 137 - Mesa, AZ 85204 Ph: 480.892.3313</p>
Sht: 1 of 1		
Proj. Mangr. SDH	Proj. Eng. MSW	

## 2.0 DESCRIPTION OF EXIST. WATER COND. & CHARACTERISTICS

### 2.1 Existing Onsite Water

The existing site was originally designed for a semi-conductor facility. There is approximately 132,500 sf of existing building on 10.8 acres of property. Based on Figure 6.1-2 of the DS&PM, there is an average daily flow of 11,902 gallons per day or 7.70 gallons per minute with a peak hour of 27 gallons per minute. There is an existing single 8" service line that services the site from Thomas Rd. The existing 8" service line splits to an existing water meter with the remainder of the 8" line running along the west and east side of the site to service existing fire hydrants.

### 2.2 Existing Off-Site Water

The on-site waterlines are served by an existing 12" ACP in Thomas Rd. See **FIGURE 2** for the area water quarter section map.

*Now Deleted!*  
8" CIP PER OUR 1/4 SEC MAPS (Archived)

### 2.3 Fire Flow Analysis

A fire flow test was performed 03/17/16 by Metro Fire Equipment, Inc. The test was performed at the southwest intersection of Pima Rd. and Thomas Rd. See **APPENDIX B** for the fire flow test results and locations. The static pressure was 92 psi with a residual pressure of 88 psi. The resulting flow at 20 psi is 5,927 gpm. The results were used to create the pump curve for the EPANET 2 water model.

### 3.0 PROPOSED WATER SYSTEM

#### 3.1 On-Site Water

The proposed site will consist of the existing building with additional exterior storage units for Phase 1. Phase 2 will include 2 future pads for retail/restaurant . The existing 8" service will be abandoned and 2 new 8" services will be installed to a public looped water system. This looped system will service the new fire hydrants, new water meter (for the existing building) and fire sprinkler services. A separate 1" landscape service will be provided and a separate water meter will be provided for the 2 future retail pads. See **EXHIBIT 1** for water design.

#### 3.2 Water Calculations and Hydraulics

To size the model the water system, the following design criteria were used:

- 1,027 g/acre/d total, based on 4.8 acres results in 4,930 g/d average
- 9,860 g/d maximum day flow (2\*average daily flow)
- 17,255 g/u/d peak hour flow (3.5\*average day flow)
- Pressure Zone 1
- Maximum Residual Pressure = 120 psi
- Minimum Residual Pressure = 50 psi
- Minimum Fire Flow Pressure = 30 psi
- Hazen-Williams roughness constant = 130
- 2,000 gpm fire flow, 50% reduction for NFPA 13 (based on Building Type IA, 132,500 sf, 4,000 gpm)

The proposed site will comprise of an existing 132,500 sf building with additional exterior storage facilities. The facility will only have bathrooms so the average daily flow is based on industrial demands which results to 4,930 gallons per day. The exterior storage facilities will not require potable water and the 2 future retail pads will each have their own future service from Thomas Rd. The maximum day flow results to a flow of 12 gpm which can easily be attained by a 1" disc meter. The proposed water use is less than the existing water use projections.

**Appendix A** shows the modeling results. The model is based on the fire flow results. A pump curve was developed based on the static pressure of 92 psi and residual pressure of 88, see pump curve in **Appendix B**.

The required fire flow with the 50% reduction is 2,000 gpm. The model was ran for worst case scenario if all the hydrants were in operation for a 4,000 gpm flow. This result showed all hydrants maintaining the flow with pressures above 46 psi. There is adequate pressure and supply to service the site.

#### **4.0 SUMMARY AND CONCLUSIONS**

- 1. The proposed development for this site consists of an existing 132,500 sf facility and additional storage units around the site.**
- 2. The water demand calculations have been based upon a 1,027 gallons per acre which results in an average daily flow of 3.4 gpm. The facility will only have bathrooms for clientele.**
- 3. The current water infrastructure is adequate to accommodate for fire protection.**
- 4. The site has an estimated date of construction within the third quarter of 2016.**

## 5.0 REFERENCES CITED AND REVIEWED

1. *Design Standards & Policies Manual Chapter 6 Water, City of Scottsdale, Dated January, 2010.* (Reference 1).

## 6.0 LIMITATIONS

This report is focused on providing practical design information, evaluation, and calculations for the water distribution system. The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices. Additionally, the criteria for this evaluation are designed to conform to currently applicable ordinances, regulations and policies affected by the appropriate jurisdictional regulatory authorities for the site.

In performing the services contained herein, Hubbard has received or will receive information prepared or compiled by other professionals. Hubbard, as engineering professionals, may rely on the information unless actual knowledge concerning the validity of the information is known or is obvious to the professional.

**APPENDIX A**  
**ALTA Scottsdale**

*Water Calculations and Hydraulics*

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\*\*\*\*\*  
 \* E P A N E T \*  
 \* Hydraulic and Water Quality \*  
 \* Analysis for Pipe Networks \*  
 \* Version 2.0 \*  
 \*\*\*\*\*

Input File:

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
2	J-3	J-2	350	12
3	J-1	J-2	1	48
4	J-1	J-3	1	48
5	J-3	J-4	227	8
6	J-4	J-5	36	8
7	J-5	J-6	6	8
9	FH-2	J-8	159	8
10	J-8	J-9	46	8
11	J-9	FH-3	94	8
12	FH-3	J-11	37	8
13	J-11	J-12	316	8
14	J-12	FH-4	64	8
15	FH-4	J-14	339	8
16	J-14	FH-1	38	8
18	FH-1	J-2	214	8
19	FH-1	J-16	291	8
20	J-16	J-6	29	8
21	J-6	FH-2	59	8
PUMP-1	RES-1	J-1	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /Mgal	Avg. Kw	Peak Kw	Cost /day
PUMP-1	100.00	75.00	550.04	132.01	132.01	0.00
Demand Charge:						0.00
Total Cost:						0.00

Page 2

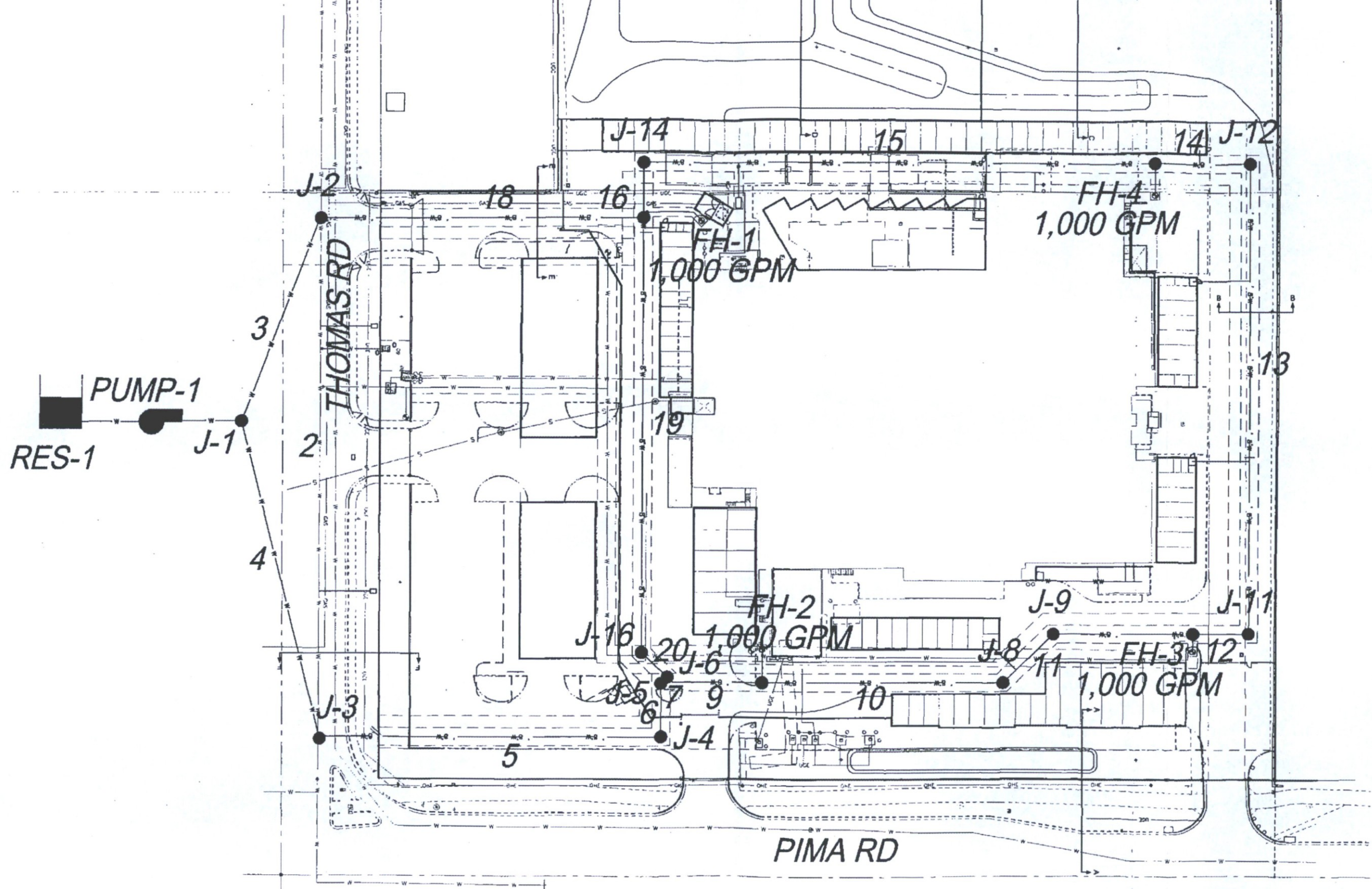
Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
J-1	0.00	131.31	56.90	0.00
J-2	0.00	131.31	56.90	0.00
J-3	0.00	131.31	56.90	0.00
J-4	0.00	118.00	51.13	0.00
J-5	0.00	115.89	50.22	0.00
J-6	0.00	115.54	50.06	0.00
FH-2	1000.00	111.97	48.51	0.00
J-8	0.00	109.53	47.46	0.00

J-9	0.00	108.82	47.15	0.00
FH-3	1000.00	107.38	46.53	0.00
J-11	0.00	107.39	46.53	0.00
J-12	0.00	107.46	46.56	0.00
FH-4	1000.00	107.47	46.57	0.00
J-14	0.00	114.73	49.71	0.00
FH-1	1000.00	115.55	50.07	0.00
J-16	0.00	115.54	50.06	0.00
RES-1	-4000.00	0.00	0.00	0.00 Reservoir

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	3.54	0.01	0.00	Open
3	2119.45	0.38	0.03	Open
4	1880.55	0.33	0.02	Open
5	1877.01	11.98	58.63	Open
6	1877.01	11.98	58.63	Open
7	1877.01	11.98	58.63	Open
9	909.89	5.81	15.34	Open
10	909.89	5.81	15.34	Open
11	909.89	5.81	15.34	Open
12	-90.11	0.58	0.21	Open
13	-90.11	0.58	0.21	Open
14	-90.11	0.58	0.21	Open
15	-1090.11	6.96	21.43	Open
16	-1090.11	6.96	21.43	Open
18	-2122.99	13.55	73.65	Open
19	32.88	0.21	0.03	Open
20	32.88	0.21	0.03	Open
21	1909.89	12.19	60.54	Open
PUMP-1	4000.00	0.00	-131.31	Open Pump



S:\Design\Projects\15138\15138-0002-COMB.Dwg Job: 21, 2019 - 11/17/2019

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Suite 1000  
Mesa, AZ 85210  
PH: 480.962.3310

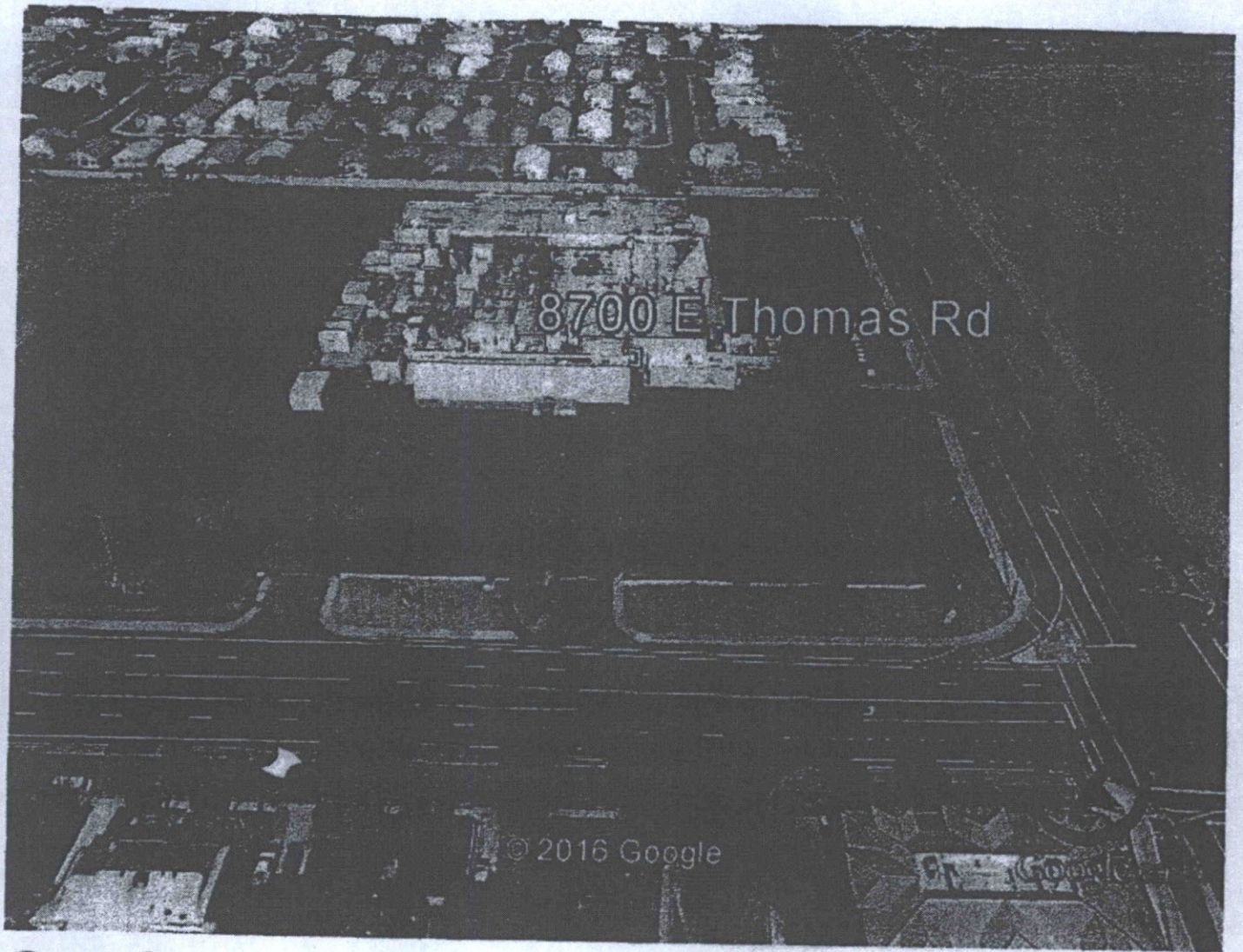
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ENGINEERING  
www.hubbardengineering.com



WATER MODEL EXHIBIT  
PIMA SELF STORAGE

Date	03/21/16	Project Eng.	BH
Project No.	15138	Project Mgr.	SDH





Google earth

feet  
meters

200

70



⊗ Hydrant

**APPENDIX B**  
**ALTA Scottsdale**

*Fire Flow Test Results & Pump Curve*

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# METRO FIRE EQUIPMENT, INC.

63 S. Hamilton Place, Gilbert, AZ 85233 • 3851 N. Oracle Road, Tucson, AZ 85705  
Main (480) 464-0509 • Fax (480) 962-5372 • Tucson (520) 888-0694 • www.metrofireaz.com  
AZ ROC# C-16:111021 • CR-67:103313 • CR-5: 213027 • CR-60:295875 • R-16:166777

## Hydrant Flow Test Report

LOCATION: 8700 E. Thomas Rd. DATE: 3/17/2016  
 TEST BY: Metro Fire Equipment TIME: 8:30am  
 WATER SUPPLIED BY: Scottsdale Water  
 PURPOSE OF TEST: Water Curve Data

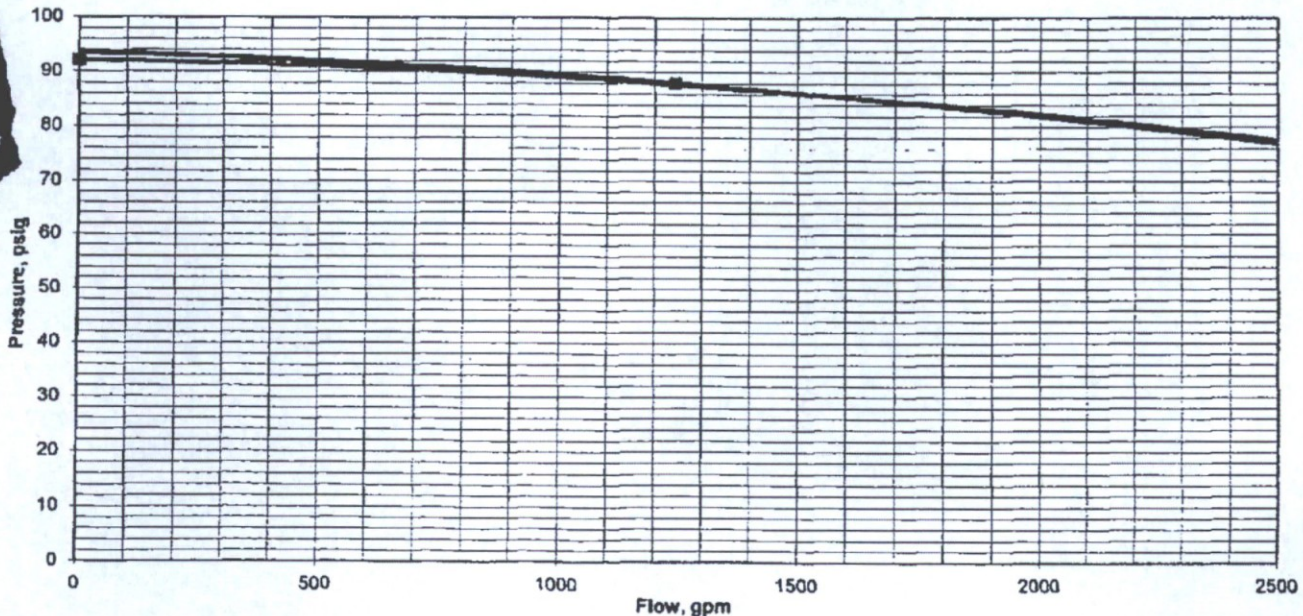
FLOW HYDRANT(S)	DATA		
	A1	A2	
SIZE OPENING:	<u>2.5</u>	<u>2.5</u>	
COEFFICIENT:	<u>0.9</u>		
PITOT READING:	<u>55</u>	<u>0</u>	
GPM:	<u>1244</u>	<u>0</u>	
TOTAL FLOW DURING TEST:	<u>1244</u>	GPM	

STATIC READING: 92 PSI RESIDUAL: 88 PSI

ADJ. STATIC: 92 PSI RESIDUAL: 88 PSI

ADJ. FLOW: AT 20 PSI RESIDUAL 5927 GPM AT 0 PSI 6765 GPM

Results of this flow test identify water system characteristics for the date, time, and locations of this test only. Pressure and flows within the water system vary of time, it is expected and should be considered when preparing designs based upon fire flow test data. Numerous factors affect the water system, such as water level fluctuations in reservoirs, operating pressure ranges at booster pump stations, elevations at point of use, daily demand fluctuations, seasonal demands, emergency demands, water treatment plant availability, increased demands due to growth, operation/maintenance schedules, etc.



# PIMA SELF STORAGE – PHASE I

LOCATED AT THE NORTHWEST CORNER OF THE INTERSECTION OF PIMA ROAD  
AND THOMAS ROAD

## FINAL DRAINAGE REPORT

FEBRUARY 13, 2017  
Project No.: 15138

PREPARED FOR:

WENTWORTH PROPERTY COMPANY, LLC  
2701 EAST CAMELBACK RD., SUITE 185  
PHOENIX, AZ 85016  
(602) 628-1885

PREPARED BY:

HUBBARD ENGINEERING  
1201 S. ALMA SCHOOL RD., SUITE 12000  
MESA, ARIZONA 85210  
(480) 892-3313  
MICHAEL S. WOLF, PE



**H U B B A R D**  
E N G I N E E R I N G



**1-ZN-2019**  
**01/16/2019**

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Figure 2	Aerial Topographic Maps
Figure 3	Flood Insurance Rate Map

### APPENDICES

Appendix A	Reference Data
Appendix B	Rational Method Peak Flow Calculations
Appendix C	Onsite Hydraulic Calculations
Appendix D	Retention and Dissipation Calculations
Appendix E	Storm Drain Calculations

### EXHIBITS

Exhibit 1	Proposed Site Drainage Map
Exhibit 2	Proposed Grading and Drainage
Exhibit 3	Hec-Ras Cross Sections



## 1. INTRODUCTION AND SCOPE OF WORK

This report presents the results of a *Final Drainage Study* conducted by Hubbard Engineering at the request of Wentworth Property Company, LLC (“client”), for Pima Storage (“site”). The purpose of this report is to provide a hydrologic and hydraulic evaluation for the site. This report addresses off-site and on-site conditions as well as storm water runoff detention.

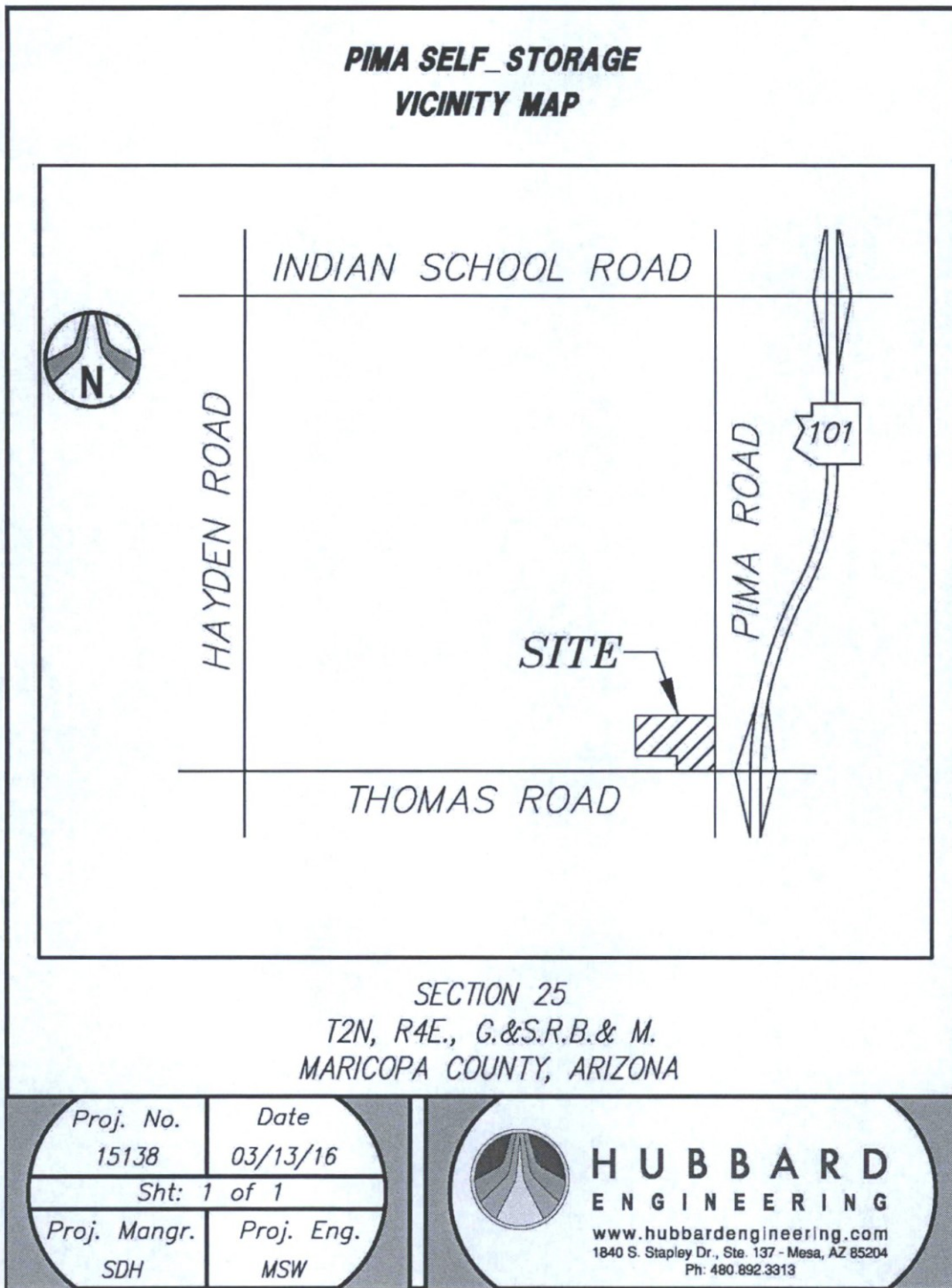
### 1.1 Site Description

The site is located in Section 25 of Township 2N, Range 4E of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The location of the site is shown on the site *Vicinity Map*, **FIGURE 1**, on the next page. The project is bounded by City Park to the west, Thomas Road to the south, Pima Rd to the east and residential subdivisions to the north.

### 1.2 Project Type

The site is rectangular in shape and encompasses approximately 10.78 gross acres. The site is currently developed with 1 existing building and parking lot. The proposed development for the site is a 2-phased project. Phase 1 will encompass renovation of the existing Microsemi building for storage, constructing a site wall, re-grading the driveways along Pima Road and also, re-grading a portion of landscaped area just outside of the right of way to west side of Pima Road. The landscaped area lies between the two existing driveways on Pima Rd. A basin/swale will be graded in the landscaped area. The basin/swale will consist of 6:1 side slopes adjacent to the right of way, 6:1 side slopes along the north and south sides of the driveways and a proposed block wall as shown in **Exhibit 2**. The basin/swale will provide additional capacity that is needed to keep the water surface elevation within the required tolerances. See **Exhibit 2** for the Grading and Drainage Plan. Phase 1 will encompass the addition of storage units and site improvements within Lot 1 which is the development outside the new flood plain limits. Lot 2 is the southern portion of the site that has 2 future planned retail pads. This area will be rough graded to accommodate the new flood plain. Lot 2 also includes a portion along Pima Rd that will contain the new flood plain allowing for Lot 1 to be out of the flood plain.

Figure 1 – Vicinity Map



### 1.3 Regulatory Issues

The criteria used in the drainage design and analysis of the site was established using the guidelines as described in the following:

- *Design Standards & Policies Manual Chapter 4 Grading and Drainage, City of Scottsdale, Dated January, 2010.* (Reference 1).
- *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (Reference 2).
- *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics* (Reference 3)

## 2. DESCRIPTION OF EXIST. DRAINAGE COND. & CHARACTERISTICS

### 2.1 Onsite Drainage

The site currently lies within the Flood Plain Zone AE with established water surface elevations. The flood zone begins at the northeast portion of the site from Pima Rd. and then fans out across the site. The flood waters pass through the site and discharges into Thomas Rd through two existing driveways.

The site has historically discharged the storm water into Thomas Rd. with no retention at a flow rate of 74.15 cfs. The site drains from the northwest to south following the same flow pattern as the flood plain.


See *Aerial Topographic Map (FIGURE 2)*.

Figure 2

# PIMA SELF-STORAGE AERIAL MAP



Proj. No. <b>15138</b>	Date <b>03/30/16</b>
Sht: 1 of 1	
Proj. Mangr. <b>SDH</b>	Proj. Eng. <b>SDH</b>



## HUBBARD

### ENGINEERING

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1840 S. Stapley Dr., Ste. 137 - Mesa, AZ 85204  
Ph: 480.892.3313

## 2.2 Existing Off-Site Conditions Characteristics

As discussed in the previous section, the site does lie within the Flood Plain Zone AE. The off-site flows come from the northeast of the site from Thomas Rd. and fan out through the site to eventually discharge into Thomas Rd.

The site lies within the Granite Reef Wash. The Granite Reef Wash has been analyzed previously as recorded in the Granite Reef Wash Floodplain Delineation Study prepared by Entellus for the Flood Control District of Maricopa County dated May 1997 (Reference 4). The Granite Reef Wash Floodplain Delineation Study started at River Mile 0.320 and ended at River Mile 2.218. See **Appendix A**. River Mile 2.218 is at Thomas Rd just south of the project site. Therefore, our project site is outside the limit of study for the Granite Reef Wash Floodplain Delineation Study. However, the Granite Reef Wash Floodplain Delineation Study shows an approximate flow of 644 cfs coming onto the site from the northeast corner from Pima Rd. Hubbard Engineering (HE) has submitted a CLOMR to FEMA to remove the floodplain off of the property that will have the existing and proposed storage buildings on the property. The results of the CLOMR can be found in the CLOMR approved by the City of Scottsdale for this report.

## 2.3 Flood Zone Information

Based on Flood Insurance Rate Map No. 04013C2235L, dated October 16, 2013, the property is located in Zone AE, which is described as:

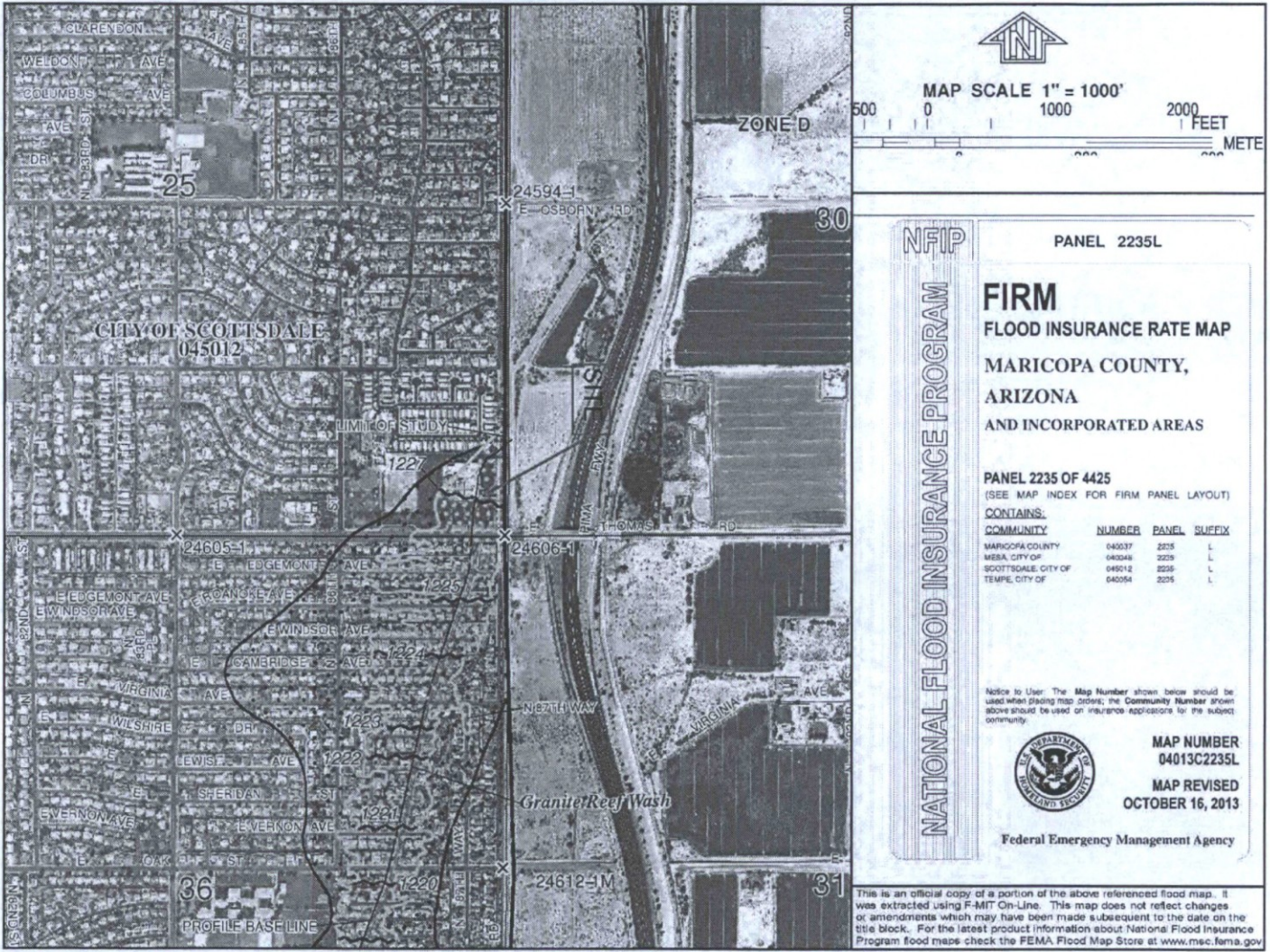
“Base Flood Elevations Determined.”

The existing building has an existing exterior elevation of 1228.10 with the base flood elevation of a 1227.00. Refer to FEMA Firmette in **FIGURE 3**.

## 2.4 Adjacent Properties

The adjacent property to the north is single family and separated with a 12' site wall. An existing City park is to the west with Pima Rd. to the east and Thomas Rd. to the south.

Figure 3 – FIRM



### 3. PROPOSED DRAINAGE PLAN

#### 3.1 On-Site Hydrology

The final site configuration and grading design indicates that the Rational Method of hydrology as described in the *Drainage Design Manual for Maricopa County, Volume I* (Reference 2) will be applicable in developing design storm discharges for the site. Since the site has been historically discharging into Thomas Rd., being a part of the flood plain, the City allows the same drainage pattern so long the pre vs. post hydrology is not exceeded. The proposed site will be captured by grate inlets and be allowed to discharge via storm drain into the existing storm drain that is in Thomas Rd. See **Exhibit 1** for proposed drainage areas and **Appendix C** for inlet calculations. Based on the improvements Phase 1, of the site will discharge to the existing storm drain that is in Thomas Rd. Along the west side of property line for improvements being done in Phase 1 a swale will need to be graded on the City of Scottsdale's property to direct runoff from the City of Scottsdale's property away from the northern site, Phase 1. The remainder of the site, Phase 2, will discharge into Thomas Rd via sheet flow at a rate of 8.31 cfs. The new discharge flow rate is significantly lower than the pre discharge rate mentioned early. A typical C-value of 0.95 is used for the on-site impervious areas and a C-value of 0.45 is used for desert landscape areas in accordance with the City of Scottsdale's *Design Standards and Policies Manual* (Reference 1).

The proposed site is graded so that the off-site flow from Pima Rd will not inundate the northern site, Phase 1. See **Exhibit 2** for the grading and drainage plans for the proposed site. The northern driveway along Pima Rd has a proposed grade of 1229.00 at the property line and a high water elevation of 1228.85 was determined from the post-development HEC-RAS model ran by Hubbard Engineering. See **Table 1** below for results of the approved post-development vs pre-development water surface elevations and **Section 3.2** for additional information on the HEC-RAS models and methodology used for the models. A proposed wall will be constructed as shown in **Exhibit 2** between the northern driveway and the southern driveway along Pima Rd. The proposed top of wall at the north driveway will have an elevation of 1229. The wall will continue on at an elevation of 1229 until the wall reaches the north side of the southern driveway. The adjacent high water elevation along the entire wall has been determined to be lower than 1229. See **Exhibit 3** for River Mile cross sections mentioned in **Table 1**. The southern driveway along Pima Rd will allow inundation of the high water elevation but not on the property of Phase 1. The grades adjacent to the property of Phase 1 located near the southern driveway have been raised so that the high water elevation will not inundate the northern site, Phase 1. The grades near the driveway have a proposed elevation of 1228.25 at the property line. The adjacent high water elevation was also determined to be lower. Just south of the southern driveway the high water elevation will inundate the southern site, Phase 2 as shown on **Exhibit 2**. The proposed wall along the north side of the Phase 2 site will keep the water from inundating the northern site along with having the entrances along the south side by having elevations as shown on **Exhibit 2**. The high water elevation along the south side of the site was determined to be 1227.96 from the post-development HEC-RAS model run by Hubbard Engineering. The emergency outfall for the DA-A is located at the southwest corner of the site at an elevation of 1227.15. See approved

CLOMR for additional information also, see **Exhibit 1**. As shown in **Exhibit 2** the floodplain is kept off of the proposed northern site, Phase 1.

Table 1: Post-Development vs. Pre-Development Results

Post Project Model Comparison to Pre Project Model

Cross Section ID	FIS WSE	Duplicate Model WSE	Corrected Effective WSE	Pre Project WSE	Post Project WSE	Difference
Original Model	[NAVD 88]	[NAVD 88]	[NAVD 88]	[NAVD 88]	[NAVD 88]	
	[1]	[2]	[3]	[4]	[5]	[5] - [4]
2.355	28.58	28.59	28.86	28.89	28.85	-0.04
<b>2.342</b>			28.71	28.78	28.55	-0.23
<b>2.335</b>			28.66	28.68	28.53	-0.15
2.295	27.30	27.31	28.02	28.14	28.23	0.09
<b>2.275</b>			27.83	27.95	28.02	0.07
<b>2.269</b>			27.51	27.87	27.96	0.09
<b>2.256</b>			27.41	27.85	27.90	0.05
<b>2.243</b>			27.12	27.54	27.52	-0.02
2.218	26.14	26.25	26.26	26.17	26.17	0.00
2.208	25.88	25.92	25.92	25.82	25.82	0.00

WSE=Water Surface Elevation

Vertical Datum NAVD 88

2.355 Existing Cross Sections

**2.342** Proposed Cross Sections

### 3.2 CLOMR Methodology and Study Results

The study of the re-grading and proposed construction of a wall to re-delineate the floodplain was done using HEC-RAS, Version 4.1.0 from the Army Corps of Engineers. The original HEC-2 data was obtained from the FCD of Maricopa County records [Effective Model] and converted to HEC-RAS [Duplicate Effective Model]. The existing water surface elevations from the original HEC-2 data were then compared to the HEC-RAS [Duplicate Effective Model] water surface elevations and were within 0.5-feet of the reported water surface elevations. These results can be seen in the **Table 1** located in the Request For CLOMR report done by Hubbard Engineering and is approved by the City of Scottsdale. The [Duplicate Effective Model] was then used to create the [Corrected Effective Model]. When creating the [Corrected Effective Model] it was determined that the original topography used in the FDS done by Entellus was the Maricopa County topography. The topography was flown with contours at 1 foot intervals. As part of this project, Hubbard Engineering went out and surveyed the site and surrounding area with ground survey that had a vertical tolerance of 3/4-inch. The new topography was incorporated into the

[Corrected Effective Model] along with additional cross sections and extensions of the existing cross section between river stations 2.218 to 2.355 to ensure adequate coverage of flows on the geometry.

Up to this point all the models were run using the flows determined in the current FDS study which can be found in **Appendix A** and is also located in the Request For CLOMR report approved by the City of Scottsdale and done by Hubbard Engineering. The flows that were determined in the current FDS study did not account for the existing storm drain system in Pima Road. It was determined that the existing storm drain system originated a significant distance upstream from the project site. The distance was significant enough to incorporate the flows that the existing storm drain system in Pima Road was taking on before the offsite flow approached the project site. With the assistance and coordination of the City of Scottsdale's engineering consultant, a flow rate of 50.5 cfs was determined for the Granite Reef Watershed Project as described in more detail in **Section 5.3** which is located in the approved Request For CLOMR report done by Hubbard Engineering. The storm drain capacity of 50.5 cfs was determined to be a conservative flow rate to be removed by the existing storm drain system. See **Appendix B** of the approved Request For CLOMR report done by Hubbard Engineering for local storm drain flows. This flow was then subtracted from the original flow of 644 cfs at river station 2.355 and 1,240 cfs at river station 2.218 and was then used in modeling the HEC-RAS [Pre-Project Existing Conditions Model] and the [Post-Project Proposed Conditions Model]. The study results from the [Pre-Project Existing Conditions Model] and the [Post-Project Proposed Conditions Model] were compared and analyzed. The [Post-Project Proposed Conditions Model] showed a rise in the base flood elevations of less than 1-foot. See **Tables 1 through 4** located in the approved Request For CLOMR report done by Hubbard Engineering for the water surface elevation results from the corresponding HEC-RAS models. See **Appendices C through G** which are located in the approved Request For CLOMR report done by Hubbard Engineering for all data associated with the HEC-RAS models, or **Appendix A** which is also located in the approved Request For CLOMR report done by Hubbard Engineering for the original reference data. Refer to the approved Request For CLOMR report done by Hubbard Engineering for additional information on the HEC-RAS models.

### 3.3 Proposed Drainage System

The proposed site is split into 2-major drainage areas. See **Exhibit 1**. Drainage area DA-A, Phase 1 conveys the storm water via surface flow to grate inlets which will be connected with storm pipe. The proposed storm drain system used the Rational Method to determine peak flows for each drainage area. Refer to **Appendix B and C** for calculations. The site will drain from the north to the south through a storm drain system, which will tie into an existing catch basin located at the southeast driveway along Thomas Rd. The storm drain pipe will capture the 100-yr, 2-hr storm event per the City of Scottsdale's *Design Standards and Policies Manual* (Reference 1) requirements. See **Appendix E** storm drain calculations. A small portion of DA-A will be stored in RB-1. RB-1 will also act as a swale and add additional capacity that is needed to keep the water surface elevation within the required tolerances mentioned in the approved Request For CLOMR report done by Hubbard Engineering. The storm water will convey via sheet flow to the proposed retention basin.

The second major drainage area is DA-B, Phase 2. See **Exhibit 1**. The storm water is conveyed via surface flow to Thomas Rd. as it has been historically discharging. The southern site labeled as "Phase 2" will discharge through the south driveways along at a flow rate of 8.31 cfs as previously mentioned.

### **3.4 Storm Water Storage**

As previously mentioned a small portion of DA-A will be stored in RB-1. The storm water will convey via sheet flow to the proposed retention basin RB-1. The proposed basin will have 6:1 side slopes as shown in the **Exhibit 2** and have a depth of 0.85 feet. The required volume that the retention basin must hold per City of Scottsdale's *Design Standards and Policies Manual* (Reference 1) is 821 cubic feet. The proposed retention basin will provide 3,231 cubic feet of water. The basin will not require any drywells see drain time calculations in **Appendix D**. In the case that the retention basin reaches an elevation higher than 1225.85 the water will drain into a catch basin and drain through the storm drain system shown in **Exhibit 1**. The retention required and retention provided calculations can be found in **Appendix D**.

For storm events that exceed the 100-year, 2-hour event, or for back-to-back events that inundate the retention facilities, the storm water will cascade toward the low outfall of the site, Phase 1. The ultimate outfall is located at the southwest corner of the site at an elevation of 1227.15 ft. See **Exhibit 1**. The ultimate outfall for Phase 2 is the south driveways at an elevation of 1225.90.

### **3.5 Finish Floor Elevations**

The site is split into Lot 1 and Lot 2. The approved CLOMR for the project takes the flood plain out of Lot 1 so there are no requirements for the proposed finish floors that pertain to the new flood plain. The 2 proposed retail pads in Lot 2 will be in the new flood plain. The CLOMR modeling has incorporated the proposed building footprints within the flood plain determination. Based on the model, the adjacent water surface elevation will be 1,227.96. The proposed finish floor elevations of the 2 retail pads will need to be a minimum of 1,229.00 in order to meet the 1' above water surface elevation requirement.

## **4. SPECIAL CONDITIONS**

### **4.1 Section 404 & 401**

The site is not delineated as a 404 & 401 jurisdiction.

### **4.2 AZPDES**

More than one acre of land will be disturbed and will require an AZPDES permit.

### **4.3 ESL**

The site does not qualify as an Environmentally Sensitive Land on the City of Scottsdale Environmentally Sensitive Land Inventories.

## **5. DATA ANALYSIS METHODS**

### **5.1 Peak Flows and Stormwater Storage**

Storage for the 100-year, 2-hour and peak flow for the 100-year storm was determined by rational method per COS Requirements. See the associated Appendices for the references and parameters that were used to calculate the storm water flows and required retention.

## 6. SUMMARY AND CONCLUSION

- The project is bound by Thomas Rd to the south, Pima Rd. to the east, City park to the west and a single family residence to the north.
- The proposed development for this site consists of self-storage.
- The site has moved out of the Flood Plain Zone AE.
- The City is in process of designing a new public storm drain in Pima Rd. to mitigate the existing flood plain. This mitigation will have the potential to taking the site, Phase 2 out of the flood plain.
- The majority of the site will convey the 100-yr storm event into storm drain pipe and discharge into the existing storm system south of the site. The remainder of the storm water will discharge via surface flow into Thomas Rd.
- Subject site is currently located in Flood Plain Zone AE per FEMA No. 04013C2235L.

## 7. REFERENCES

1. *Design Standards & Policies Manual Chapter 4 Grading and Drainage, City of Scottsdale, Dated January, 2010.*
2. *Drainage Design Manual For Maricopa County, Arizona, Volume I, Hydrology, Flood Control District Of Maricopa County, February 2011.*
3. *Drainage Design Manual For Maricopa County, Arizona, Volume II, Hydraulics, Flood Control District Of Maricopa County, January 1996.*  
*Flood Insurance Rate Map (F.I.R.M.) Maricopa County, Arizona and Incorporated areas, Panel 2235 of 4425*
4. *Granite Reef Wash FloodPlain Delineation Study (FCD 95-29), Entellus, May 1997.*

## 8. LIMITATIONS

This report is focused on providing practical design information, evaluation, and calculations for statistical flood events up to and including the 100-year frequency flood. The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices. Additionally, the criteria for this evaluation is designed to conform to currently applicable ordinances, regulations and policies effected by the appropriate jurisdictional regulatory authorities for the site.

The analysis presented herein focuses on developing design estimates of storm water runoff resulting from a statistical evaluation of storm events of particular duration and frequency up to and including a 100-year frequency event. A storm event exceeding the 100-year frequency event may cause or create the risk of greater flood impact than is addressed and presented herein. However, the scope of this assessment does not include evaluation of storm water runoff resulting from storm events exceeding the 100-year frequency event. Hubbard Engineering assumes no responsibility for actual flood damage, increased risks of flood damage, or increased construction or development cost resulting from or related to any such events. Nor shall Hubbard Engineering be responsible for any changes in, or additions to, regulatory requirements which may result from, or be related to, any such events or changes in hydrologic or hydraulic conditions within the watershed.

In performing the services contained herein, Hubbard Engineering has received or will receive information prepared or compiled by others. Hubbard Engineering, as engineering professionals, are not required to verify the information, but may rely on the information unless actual knowledge concerning the validity of the information is known or is obvious to the professional. Therefore, Hubbard Engineering is entitled to rely upon the accuracy and completeness of this information without independent evaluation or verification.

**Appendix A**  
Reference Data  
*Pima Storage*

**FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY**  
**FLOOD DELINEATION STUDY OF  
GRANITE REEF WASH**  
 F.C.D. CONTRACT NO. FCD 96-29

**LEGEND**

100-YR FLOODPLAIN BOUNDARY					
100-YR FLOODWAY BOUNDARY					
HYDRAULIC BASE LINE & RIVER MILE					
CROSS SECTION	<table border="0"> <tr> <td>FP= 1207.8</td> <td>0.627</td> </tr> <tr> <td>FW= 1207.8</td> <td>Q= 1417</td> </tr> </table>	FP= 1207.8	0.627	FW= 1207.8	Q= 1417
FP= 1207.8	0.627				
FW= 1207.8	Q= 1417				
ELEVATION REFERENCE MARK					
BASE FLOOD ELEVATIONS	1500				
ZONE DESIGNATIONS	<b>ZONE AE</b>				
CORPORATE LIMITS	Corporate Limits				
SECTION LINE	Section Boundary				

**ELEVATION REFERENCE MARKS**

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICA VERTICAL DATUM OF 1988

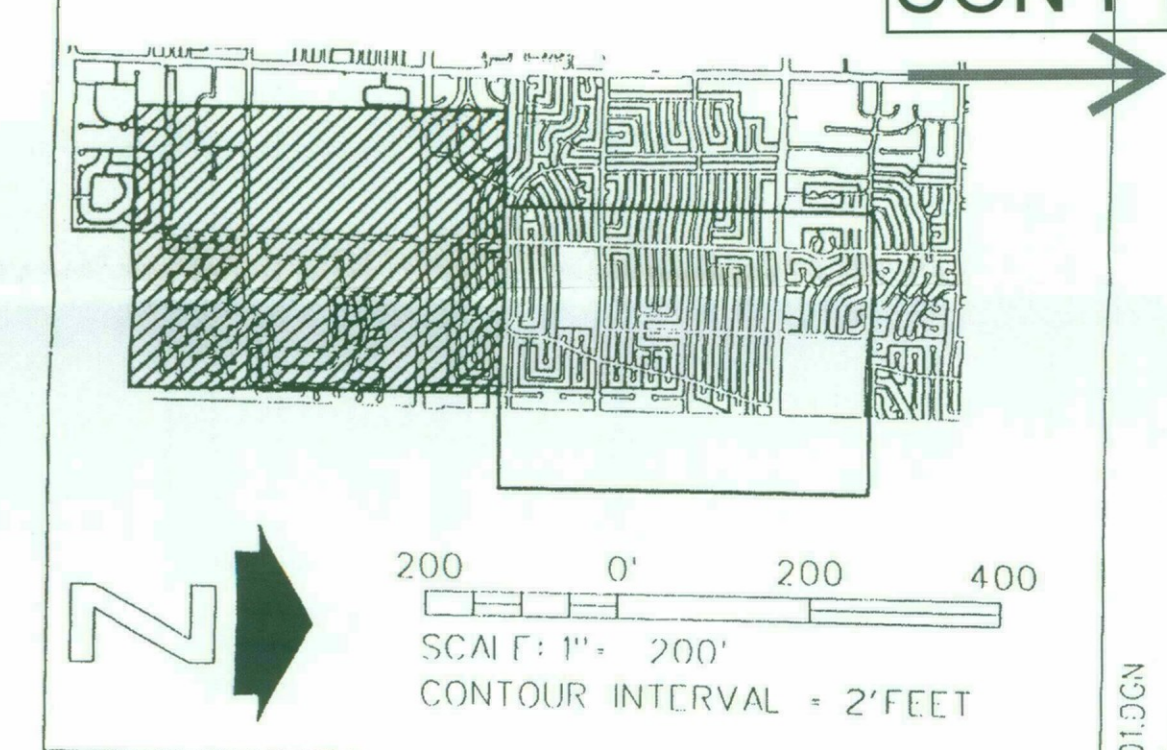
I.D. NUM.	ELEV. (FT)	DESCRIPTION/LOCATION
1	1188.06	ARIZONA DEPARTMENT OF TRANSPORTATION BRASS CAP, AT INTERSECTION OF MCKELLIPS ROAD & GRANITE REEF ALIGNMENT
2	1202.70	C.O.S. BRASS CAP IN HAND HOLE INTERSECTION OF ROOSEVELT STREET & GRANITE REEF ROAD.
3	1218.10	MARICOPA COUNTY BRASS CAP, IN HAND HOLE, INTERSECTION OF McDOWELL ROAD & GRANITE REEF ROAD.

**NOTES**

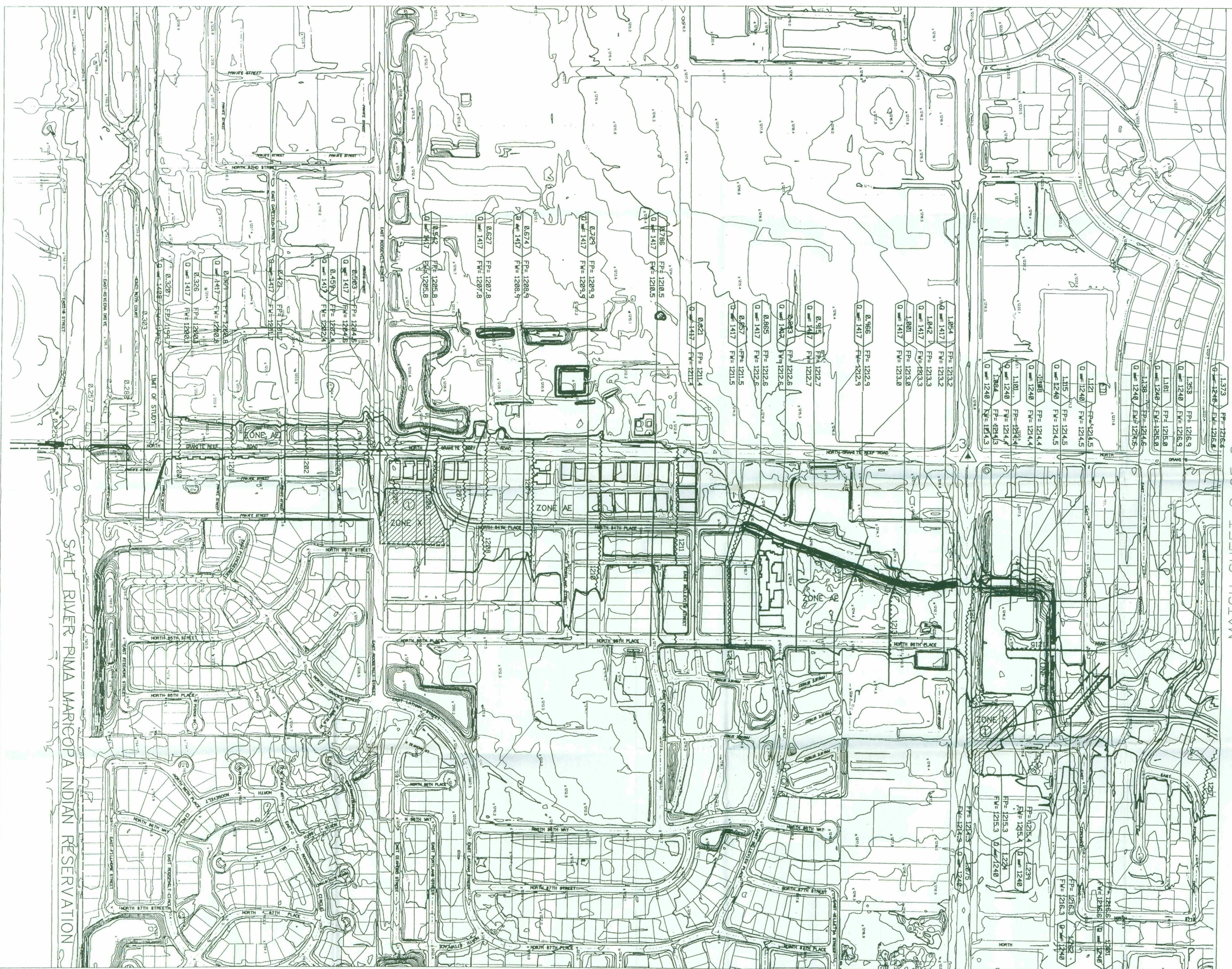
① ZONE X - AREAS OF 100-YEAR FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVELS FROM 100 YEAR FLOOD. SEE SPECIAL PROBLEM SECTION



INDEX MAP  
**CONT**

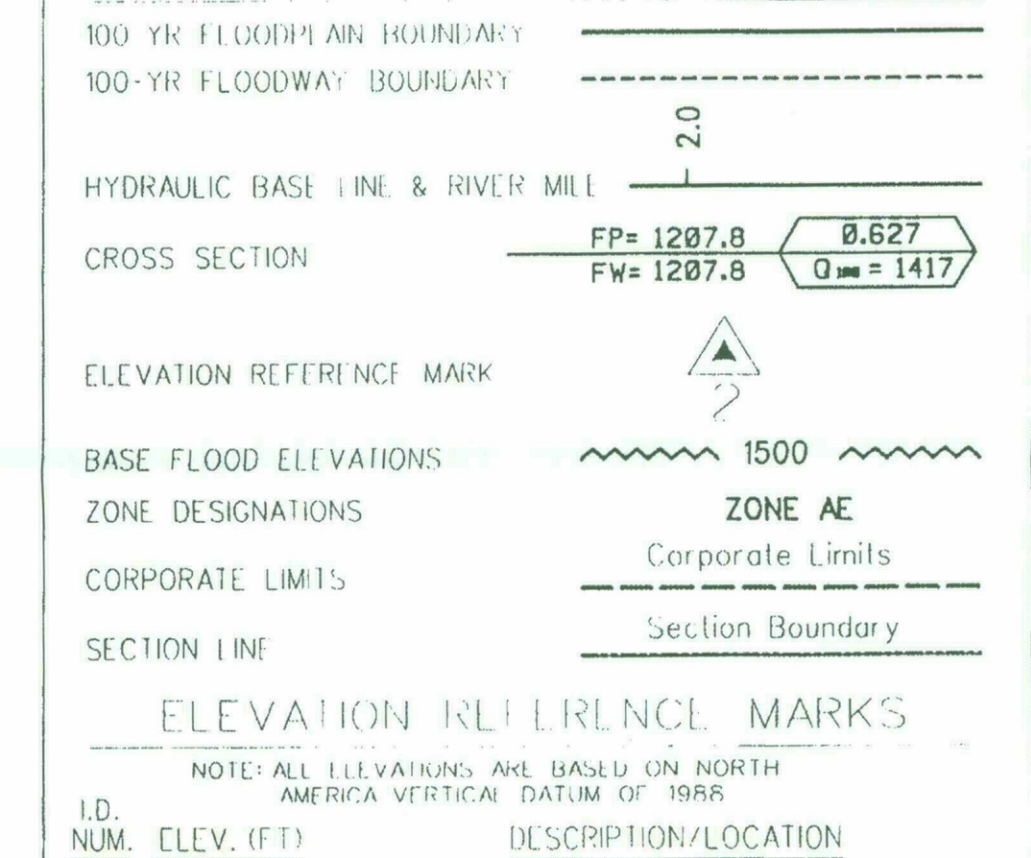


		2855 N. 44th St., Suite 300 Phoenix, AZ 85008 Phone (602) 244-2506 Fax (602) 244-0947	
DESIGN	BY HAA	DATE	05/97
DESIGN CHK.	SFK	DATE	05/97
PLANS	ECES	DATE	05/97
PLANS CHK.	HAA	DATE	05/97
SUBMITTED BY:	DATE:		
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY		RECOMMENDED BY:	
APPROVED BY:		DATE:	
CHIEF ENGINEER AND GENERAL MANAGER		DATE:	
SHEET		1 OF 2	



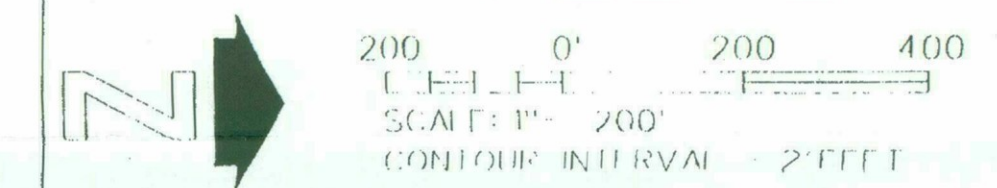
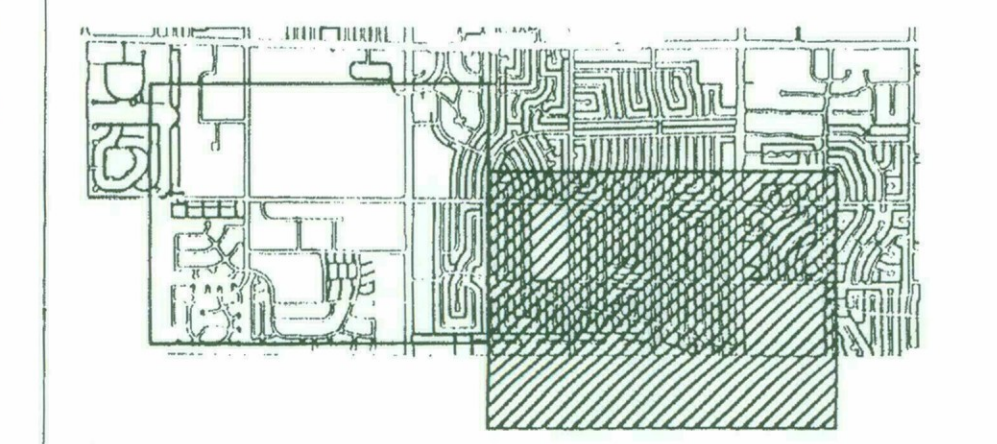
MATCH SHEET 2 OF 2

**FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY**  
FLOOD DELINEATION STUDY OF  
GRANITE REEF WASH  
F.C.D. CONTRACT NO. FCD 96-29  
LEGEND

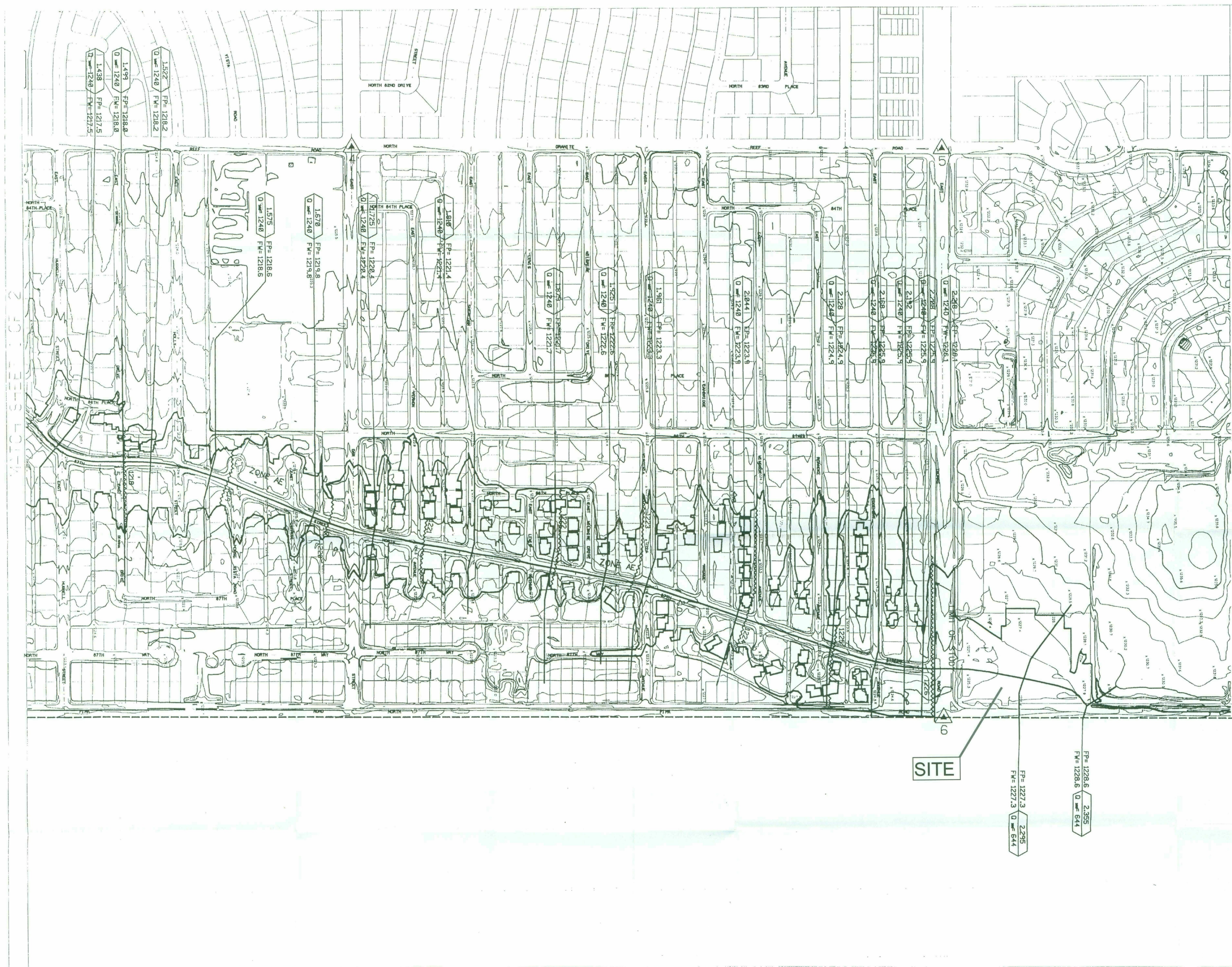


NOTES

INDEX MAP



		2255 N. 44th St., Suite 330 Phoenix, AZ 85018 Phone (602) 244-2556 Fax (602) 244-9947	
DESIGN	BY HAA	DATE 05/97	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	SEK	05/97	
PLANS	UCS	05/97	
PLANS CHK.	HAA	05/97	
SUBMITTED BY:	HAA	05/97	



100 Scale Mapping: Michael Baker Corp.  
Flight Date: 04/97

THE CONTOURS AND ELEVATION VALUES FOR THE 100 SCALE MAPPING WERE DERIVED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS 1:100 HORIZONTAL SCALE AND 1:100 VERTICAL SCALE.

Dwg. Name: C:\GIS\97\9705\FCD9629\100SCALE.DWG  
Date: 05/97

**Appendix B**  
Rational Peak Flow Calculations  
*Pima Storage*

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-1**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	158.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	29.00	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.35	[ft]
Drainage Area (A)=	0.53	[acres]	Elevation <sub>Difference</sub> :	1.65	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01044	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group	--
Vegetation Cover	<25 [%]
Classification Type	A (Reference: Table 3-1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>2.1</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L	[mi]	K <sub>b</sub> = m Log A + b
S	[ft/mi]	m = -0.00625
i	[in/hr]	b = 0.04
		A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.041745	4.0	4.72
50	-0.00625	0.04	0.041745	3.0	6.6
100	-0.00625	0.04	0.041745	3.0	7.48

Peak Discharge (Q):  
 $Q = C_i * A$  [cfs]

A	[acres]
i	[in/hr]
C <sub>i</sub>	Runoff Coefficient
	C <sub>10</sub> <sup>-1h</sup> = 0.90
	C <sub>50</sub> <sup>-1h</sup> = 0.93
	C <sub>100</sub> <sup>-1h</sup> = 0.95

Q <sub>10</sub>	= 2.23	[cfs]
Q <sub>50</sub>	= 3.23	[cfs]
Q <sub>100</sub>	= 3.74	[cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume, Version 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-2**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	227.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	31.00	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.60	[ft]
Drainage Area (A)=	0.67	[acres]	Elevation <sub>Difference</sub> :	3.40	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01498	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference: Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>(1)</sup>  
 $T_c = 11.4 * L^{0.5} * K_b * 0.52 * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi]                      Kb = m Log A + b  
 S [ft/mi]                    m = -0.00625  
 i [in/hr]                    b = 0.04  
                                   A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.04108	4.0	4.72
50	-0.00625	0.04	0.04108	3.0	6.6
100	-0.00625	0.04	0.04108	3.0	7.48

Peak Discharge (Q):  
 $Q = C_i * i * A$  [cfs]

A [acres]  
 i<sup>(1)</sup> [in/hr]  
 C<sup>(1)</sup> Runoff Coefficient  
           C<sub>10</sub><sup>(1)</sup> = 0.90  
           C<sub>50</sub><sup>(1)</sup> = 0.93  
           C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 2.85 [cfs]  
 Q<sub>50</sub> = 4.12 [cfs]  
 Q<sub>100</sub> = 4.77 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270



**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-4**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	36.50	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max.</sub>	28.27	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min.</sub>	27.70	[ft]
Drainage Area (A)=	0.07	[acres]	Elevation <sub>Difference</sub> :	0.57	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01562	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference, Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>(2)</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [m]                      K<sub>b</sub> = m Log A + b  
 S [ft/m]                    m = -0.00625  
 i [in/hr]                    b = 0.04  
                                     A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.047201	2.0	4.72
50	-0.00625	0.04	0.047201	1.0	6.6
100	-0.00625	0.04	0.047201	1.0	7.48

Peak Discharge (Q):  
 $Q = C_i * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sub>i</sub> Runoff Coefficient  
     C<sub>10</sub><sup>(3)</sup> = 0.90  
     C<sub>50</sub><sup>(3)</sup> = 0.93  
     C<sub>100</sub><sup>(3)</sup> = 0.95

Q<sub>10</sub> = 0.30 [cfs]  
 Q<sub>50</sub> = 0.43 [cfs]  
 Q<sub>100</sub> = 0.50 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-5**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	41.50	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.27	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.70	[ft]
Drainage Area (A)=	0.07	[acres]	Elevation <sub>Difference</sub> :	0.57	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01373	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group:	--
Vegetation Cover:	<25 [%]
Classification Type:	A (Reference: Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>0.75</sup>:  
 $T_c = 11.4 * [0.5 * K_b * 0.52 * S - 0.31 * i - 0.38 + \text{Time to Retention}]$

L	[mi]	K <sub>b</sub> = m Log A + b
S	[ft/mi]	m = -0.00625
i	[in/hr]	b = 0.04
		A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.047261	2.0	4.72
50	-0.00625	0.04	0.047261	2.0	6.6
100	-0.00625	0.04	0.047261	2.0	7.48

Peak Discharge (Q):  
 $Q = C_i * i * A$  [cfs]

A	[acres]
i <sup>3</sup>	[in/hr]
C <sup>i</sup>	Runoff Coefficient
	C <sub>10</sub> <sup>(i)</sup> = 0.90
	C <sub>50</sub> <sup>(i)</sup> = 0.93
	C <sub>100</sub> <sup>(i)</sup> = 0.95

Q <sub>10</sub>	= 0.29	[cfs]
Q <sub>50</sub>	= 0.42	[cfs]
Q <sub>100</sub>	= 0.49	[cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume, Version 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-6**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	213.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>MAX</sub> :	30.20	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>MIN</sub> :	27.00	[ft]
Drainage Area (A)=	0.23	[acres]	Elevation <sub>Difference</sub> :	3.20	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01502	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference, Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (Tc)<sup>(2)</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi]                      Kb = m Log A + b  
 S [ft/mi]                    m = -0.00625  
 i [in/hr]                    b = 0.04  
                                   A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.043974	4.0	4.72
50	-0.00625	0.04	0.043974	3.0	6.6
100	-0.00625	0.04	0.043974	3.0	7.48

Peak Discharge (Q):  
 $Q = C_i * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sub>i</sub> Runoff Coefficient  
     C<sub>10</sub><sup>(1)</sup> = 0.90  
     C<sub>50</sub><sup>(1)</sup> = 0.93  
     C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 0.98 [cfs]  
 Q<sub>50</sub> = 1.42 [cfs]  
 Q<sub>100</sub> = 1.64 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume, Version 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
 Hubbard Engineering  
 Project No. 15138

**Concentration Point ID: DA-7A**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Location Data**

State: Arizona

County: Maricopa

Jurisdiction: City of  
 Scottsdale

**Design Data**

Design Frequency	100	[yrs]	Flow Path Length (L)=	82.60	[ft]
Check Frequency	50	[yrs]	Elevation <sub>Start</sub> :	28.12	[ft]
Check Frequency	10	[yrs]	Elevation <sub>Min</sub> :	27.60	[ft]
Drainage Area (A)=	0.24	[acres]	Elevation <sub>Reference</sub> :	0.52	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.00630	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference, Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>(2)</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi] Kb = m Log A + b  
 S [ft/mi] m = -0.00625  
 i [in/hr] b = 0.04  
 A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.043871	3.0	4.72
50	-0.00625	0.04	0.043871	3.0	6.6
100	-0.00625	0.04	0.043871	3.0	7.48

Peak Discharge (Q):  
 $Q = C_i * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sup>i</sup> Runoff Coefficient  
 C<sub>10</sub><sup>(1)</sup> = 0.90  
 C<sub>50</sub><sup>(1)</sup> = 0.93  
 C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 1.02 [cfs]  
 Q<sub>50</sub> = 1.47 [cfs]  
 Q<sub>100</sub> = 1.71 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-7B**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona                      County: Maricopa                      Jurisdiction: City of Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	72.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.93	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.50	[ft]
Drainage Area (A)=	0.19	[acres]	Elevation <sub>Difference</sub> :	1.43	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01986	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
Vegetation Cover: <25 [%]  
Classification Type: A (Reference, Table 3.1, Page 3-3)

**Rational Method Computations**

**Time of Concentration, (Tc)<sup>(2)</sup>:**  
 $T_c = 11.4 * L^{0.5} * K_b * 0.52 * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi]                       $K_b = m \log A + b$   
S [ft/mi]                       $m = -0.00625$   
i [in/hr]                       $b = 0.04$   
    $A = \text{Area [acres]}$

Frequency [yr]	m	b	$K_b$	$T_c$ [min]	i [in/hr]
10	-0.00625	0.04	0.044525	2.0	4.72
50	-0.00625	0.04	0.044525	2.0	6.6
100	-0.00625	0.04	0.044525	2.0	7.48

**Peak Discharge (Q):**  
 $Q = C_i * A$  [cfs]

A [acres]  
i' [in/hr]  
C' Runoff Coefficient  
 $C_{10}^{(1)} = 0.90$   
 $C_{50}^{(1)} = 0.93$   
 $C_{100}^{(1)} = 0.95$

$Q_{10} = 0.80$  [cfs]  
 $Q_{50} = 1.16$  [cfs]  
 $Q_{100} = 1.34$  [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume, Version 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-8**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency	100	[yrs]	Flow Path Length (L)=	45.00	[ft]
Check Frequency	50	[yrs]	Elevation <sub>Max.</sub>	28.90	[ft]
Check Frequency	10	[yrs]	Elevation <sub>Min.</sub>	27.90	[ft]
Drainage Area (A)=	0.10	[acres]	Elevation <sub>Difference</sub>	1.00	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.02222	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group --  
 Vegetation Cover <25 [%]  
 Classification Type A (Reference, Table 3-1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>(2)</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi] Kb = m Log A + b  
 S [ft/mi] m = -0.00625  
 i [in/hr] b = 0.04  
 A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.046317	2.0	4.72
50	-0.00625	0.04	0.046317	1.0	6.6
100	-0.00625	0.04	0.046317	1.0	7.48

Peak Discharge (Q):  
 $Q = C_i * i * A$  [cfs]

A [acres]  
 i<sup>1</sup> [in/hr]  
 C<sup>1</sup> Runoff Coefficient  
 C<sub>10</sub><sup>(3)</sup> = 0.90  
 C<sub>50</sub><sup>(3)</sup> = 0.93  
 C<sub>100</sub><sup>(3)</sup> = 0.95

Q<sub>10</sub> = 0.41 [cfs]  
 Q<sub>50</sub> = 0.60 [cfs]  
 Q<sub>100</sub> = 0.69 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270



**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-10**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona

County: Maricopa

Jurisdiction: City of Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	153.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.20	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.90	[ft]
Drainage Area (A)=	0.10	[acres]	Elevation Difference:	0.30	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.00196	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
Vegetation Cover: <25 [%]  
Classification Type: A (Reference, Table 3-1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>min</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi]                      Kb = m Log A + b  
S [ft/mi]                    m = -0.00625  
i [in/hr]                    b = 0.04  
                                    A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.046233	6.0	4.44
50	-0.00625	0.04	0.046233	6.0	6.3
100	-0.00625	0.04	0.046233	5.0	7.48

Peak Discharge (Q):  
 $Q = C_{100} * i * A$  [cfs]

A [acres]  
i [in/hr]  
C<sup>1</sup> Runoff Coefficient  
C<sub>10</sub><sup>10</sup> = 0.90  
C<sub>50</sub><sup>50</sup> = 0.93  
C<sub>100</sub><sup>100</sup> = 0.95

Q<sub>10</sub> = 0.40 [cfs]  
Q<sub>50</sub> = 0.58 [cfs]  
Q<sub>100</sub> = 0.72 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume, Version 5, Maricopa Station ID 02:5270

**HYDROLOGIC DESIGN DATA SHEET  
RATIONAL METHOD  
Hubbard Engineering  
Project No. 15138**

**Concentration Point ID: DA-11**

Project Name: Pima Storage  
Project No.: 15138

Prepared by: BAH  
Revised by:

Date: 10/12/16  
Date:

**Location Data**

State: Arizona

County: Maricopa

Jurisdiction: City of  
Scottsdale

**Design Data**

Design Frequency	100	[yrs]	Flow Path Length (L)=	153.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.30	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.90	[ft]
Drainage Area (A)=	0.13	[acres]	Elevation <sub>Difference</sub> :	0.40	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.00261	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
Vegetation Cover: <25 [%]  
Classification Type: A (Reference, Table 3-1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>(2)</sup>:  
T<sub>c</sub> = 11.4 \* L<sup>0.5</sup> \* K<sub>b</sub> \* 0.52 \* S<sup>-0.31</sup> \* i<sup>-0.38</sup> + Time to Retention

L [mi]                      K<sub>b</sub> = m Log A + b  
S [ft/mi]                    m = -0.00625  
i [in/hr]                    b = 0.04  
A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.045489	6.0	4.44
50	-0.00625	0.04	0.045489	5.0	6.6
100	-0.00625	0.04	0.045489	5.0	7.48

Peak Discharge (Q):  
Q = C<sub>1</sub> \* A [cfs]

A [acres]  
i<sup>1</sup> [in/hr]  
C<sup>1</sup> Runoff Coefficient  
C<sub>10</sub><sup>(1)</sup> = 0.90  
C<sub>50</sub><sup>(1)</sup> = 0.93  
C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 0.53 [cfs]  
Q<sub>50</sub> = 0.81 [cfs]  
Q<sub>100</sub> = 0.94 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-12**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	156.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.30	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.90	[ft]
Drainage Area (A)=	0.13	[acres]	Elevation <sub>Difference</sub> :	0.40	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.00256	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference, Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>2.1</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi]                      Kb = m Log A + b  
 S [ft/mi]                    m = -0.00625  
 i [in/hr]                    b = 0.04  
                                   A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.045444	6.0	4.44
50	-0.00625	0.04	0.045444	5.0	6.6
100	-0.00625	0.04	0.045444	5.0	7.48

Peak Discharge (Q):  
 $Q = C_{100} * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sup>1</sup> Runoff Coefficient  
 C<sub>10</sub><sup>(1)</sup> = 0.90  
 C<sub>50</sub><sup>(1)</sup> = 0.93  
 C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 0.54 [cfs]  
 Q<sub>50</sub> = 0.83 [cfs]  
 Q<sub>100</sub> = 0.96 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270



**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-14**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	155.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.30	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.75	[ft]
Drainage Area (A)=	0.14	[acres]	Elevation <sub>Difference</sub> :	0.55	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.00355	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference: Table 3.1, Page 3-3)

**Rational Method Computations**

**Time of Concentration, (T<sub>c</sub>)<sup>(1)</sup>:**  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} * \text{Time to Retention}$

L	[mi]	K <sub>b</sub> = m Log A + b
S	[ft/mi]	m = -0.00625
i	[in/hr]	b = 0.04
		A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.045415	5.0	4.72
50	-0.00625	0.04	0.045415	5.0	6.6
100	-0.00625	0.04	0.045415	4.0	7.48

**Peak Discharge (Q):**  
 $Q = C * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sup>(1)</sup> Runoff Coefficient  
 C<sub>10</sub><sup>(1)</sup> = 0.90  
 C<sub>50</sub><sup>(1)</sup> = 0.93  
 C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 0.58 [cfs]  
 Q<sub>50</sub> = 0.83 [cfs]  
 Q<sub>100</sub> = 0.97 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume, Version 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-15**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Location Data**

State: Arizona

County: Maricopa

Jurisdiction: City of  
 Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	166.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.30	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.75	[ft]
Drainage Area (A)=	0.10	[acres]	Elevation <sub>Difference</sub> :	0.55	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.00331	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference, Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>[1]</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi] Kb=m Log A + b  
 S [ft/mi] m= -0.00625  
 i [in/hr] h= 0.04  
 A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.046121	6.0	4.44
50	-0.00625	0.04	0.046121	5.0	6.6
100	-0.00625	0.04	0.046121	5.0	7.48

Peak Discharge (Q):  
 $Q = C * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sup>[1]</sup> Runoff Coefficient  
 C<sub>10</sub><sup>[1]</sup> = 0.90  
 C<sub>50</sub><sup>[1]</sup> = 0.93  
 C<sub>100</sub><sup>[1]</sup> = 0.95

Q<sub>10</sub> = 0.42 [cfs]  
 Q<sub>50</sub> = 0.64 [cfs]  
 Q<sub>100</sub> = 0.75 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270





**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-18**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Revised by:**

**Date:** 10/12/16  
**Date:**

**Location Data**

State: Arizona

County: Maricopa

City of  
 Jurisdiction: Scottsdale

**Design Data**

Design Frequency	100	[yrs]	Flow Path Length (L)=	183.00	[ft]
Check Frequency	50	[yrs]	Elevation <sub>Max</sub> :	27.50	[ft]
Check Frequency	10	[yrs]	Elevation <sub>Min</sub> :	26.85	[ft]
Drainage Area (A)=	0.22	[acres]	Elevation <sub>Difference</sub> :	0.65	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.00355	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference: Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>(2)</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} * \text{Time to Retention}$

L [mi]                      Kb = m Log A + b  
 S [ft/mi]                    m = -0.00625  
 i [in/hr]                    h = 0.04  
                                     A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.044054	6.0	4.44
50	-0.00625	0.04	0.044054	5.0	6.6
100	-0.00625	0.04	0.044054	5.0	7.48

Peak Discharge (Q):  
 $Q = C * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sup>1</sup> Runoff Coefficient  
     C<sub>10</sub><sup>(1)</sup> = 0.90  
     C<sub>50</sub><sup>(1)</sup> = 0.93  
     C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 0.90 [cfs]  
 Q<sub>50</sub> = 1.38 [cfs]  
 Q<sub>100</sub> = 1.60 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-19**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Location Data**

State: Arizona                      County: Maricopa                      Jurisdiction: City of Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	122.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	28.10	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	26.20	[ft]
Drainage Area (A)=	0.21	[acres]	Elevation <sub>Difference</sub> :	1.90	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01557	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference: Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (Tc)<sup>(2)</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi]                      Kb = m Log A + b  
 S [ft/mi]                      m = -0.00625  
 i [in/hr]                      b = 0.04  
    A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.044221	3.0	4.72
50	-0.00625	0.04	0.044221	3.0	6.6
100	-0.00625	0.04	0.044221	2.0	7.48

Peak Discharge (Q):  
 $Q = C * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sup>(1)</sup> Runoff Coefficient  
           C<sub>10</sub><sup>(1)</sup> = 0.90  
           C<sub>50</sub><sup>(1)</sup> = 0.93  
           C<sub>100</sub><sup>(1)</sup> = 0.95

**Q<sub>10</sub> = 0.90 [cfs]**  
**Q<sub>50</sub> = 1.30 [cfs]**  
**Q<sub>100</sub> = 1.50 [cfs]**

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume 5, Maricopa Station ID 02-5270

**HYDROLOGIC DESIGN DATA SHEET**  
**RATIONAL METHOD**  
**Hubbard Engineering**  
**Project No. 15138**

**Concentration Point ID: DA-20**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Location Data**

State: Arizona                      County: Maricopa                      Jurisdiction: City of Scottsdale

**Design Data**

Design Frequency:	100	[yrs]	Flow Path Length (L)=	75.00	[ft]
Check Frequency:	50	[yrs]	Elevation <sub>Max</sub> :	27.75	[ft]
Check Frequency:	10	[yrs]	Elevation <sub>Min</sub> :	27.00	[ft]
Drainage Area (A)=	0.08	[acres]	Elevation <sub>Difference</sub> :	0.75	[ft]
			Flow Path Slope <sub>Average</sub> (S)=	0.01000	[ft/ft]

**Watershed Characteristics**

Hydrologic Soil Group: --  
 Vegetation Cover: <25 [%]  
 Classification Type: A (Reference: Table 3.1, Page 3-3)

**Rational Method Computations**

Time of Concentration, (T<sub>c</sub>)<sup>(2)</sup>:  
 $T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38} + \text{Time to Retention}$

L [mi]                      Kb=m Log A + b  
 S [ft/mi]                      m= -0.00625  
 i [in/hr]                      b= 0.04  
    A = Area [acres]

Frequency [yr]	m	b	K <sub>b</sub>	T <sub>c</sub> [min]	i [in/hr]
10	-0.00625	0.04	0.046782	3.0	4.72
50	-0.00625	0.04	0.046782	2.0	6.6
100	-0.00625	0.04	0.046782	2.0	7.48

Peak Discharge (Q):  
 $Q = C^1 * i * A$  [cfs]

A [acres]  
 i [in/hr]  
 C<sup>1</sup> Runoff Coefficient  
           C<sub>10</sub><sup>(1)</sup> = 0.90  
           C<sub>50</sub><sup>(1)</sup> = 0.93  
           C<sub>100</sub><sup>(1)</sup> = 0.95

Q<sub>10</sub> = 0.35 [cfs]  
 Q<sub>50</sub> = 0.50 [cfs]  
 Q<sub>100</sub> = 0.58 [cfs]

**Reference:**

1. Scottsdale Drainage Design Policy
2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology
3. NOAA Atlas 14, Volume, Version 5, Maricopa Station ID 02-5270

**Appendix C**  
*Onsite Hydraulic Calculations*  
Pima Storage

**INLETS SUMMARY SHEET**  
**Summary of Inlets**  
**Hubbard Engineering**  
**15138**

Project Name: Pima Storage  
 Project No.: 15138

Prepared By: BAH  
 Revised By: BAH

Date: 10/12/16  
 Date: 02/08/17

Complete calculations for each concentration point are presented in the attached hydrologic calculation sheets

$$Q = C_w P d^{1.49}$$

Q=discharge capacity  
 C<sub>w</sub> = 3.0 weir coefficient  
 P=inlet perimeter  
 d=flow depth

Reference 2

Inlet ID	Q <sub>100</sub>	INLET DESCRIPTION	d (ft)	C <sub>w</sub>	P or L (ft)	INLET CAPACITY W / Clogging	CLOGGING FACTOR
I-2	4.77	2-30" NYLOPLAST-STD	0.5	3	15.7	8.33	50%
I-3	0.59	24" NYLOPLAST-STD	0.25	3	6.28	1.18	50%
I-4	0.50	24" NYLOPLAST-STD	0.25	3	6.28	1.18	50%
I-5	0.49	30" NYLOPLAST-STD	0.15	3	7.85	0.68	50%
I-6	1.64	30" NYLOPLAST-STD	0.15	3	7.85	0.68	50%
I-7A	1.71	30" NYLOPLAST-STD	0.3	3	7.85	1.93	50%
I-7B	1.34	30" NYLOPLAST-STD	0.6	3	7.85	5.47	150%
I-8	0.69	24" NYLOPLAST-STD	0.2	3	6.28	0.84	50%
I-9	1.12	30" NYLOPLAST-STD	0.2	3	7.85	1.05	50%
I-10	0.72	30" NYLOPLAST-STD	0.2	3	7.85	1.05	50%
I-11	0.94	30" NYLOPLAST-STD	0.2	3	7.85	1.05	50%
I-12	0.96	30" NYLOPLAST-STD	0.2	3	7.85	1.05	50%
I-13	0.96	30" NYLOPLAST-STD	0.2	3	7.85	1.05	50%
I-14	0.97	30" NYLOPLAST-STD	0.2	3	7.85	1.05	50%
I-15	0.74	30" NYLOPLAST-STD	0.2	3	7.85	1.05	50%
I-16	3.17	2-Type 'F' Catch Basin	0.25	3	17.5	3.28	50%
I-17	1.04	2-30" NYLOPLAST-STD	0.15	3	15.7	1.37	50%
I-18	1.60	2-30" NYLOPLAST-STD	0.15	3	15.7	1.37	50%
I-19	1.50	30" NYLOPLAST-STD	0.25	3	7.85	1.47	50%
I-20	0.58	2-30" NYLOPLAST-STD	0.15	3	15.7	1.37	50%

**Appendix D**  
Retention Dissipation Calculations  
*Pima Storage*

**HYDRAULIC CALCULATION SHEET**  
**Retention Calculations**  
**Hubbard Engineering**  
**Project No. 15138**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised By:

Date: 10/12/16  
 Date:

**Purpose:** Evaluate the required and provided retention volumes in order to assess conformance to project criteria

**Methodology:** Calculate the volume of stormwater required to be retained using City of Scottsdale criteria. Calculate the estimated volume of stormwater retained using retention basin geometry.

**Criteria:** Retain the calculated stormwater run-off for the 100-YEAR 2-HOUR duration storm event

**References:** 1. Scottsdale Drainage Design Policy  
 2. Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics, September 2003.

**Calculations:** Volume Required =  $C_{Composite} * D / 12 * A$  [ft<sup>3</sup>] (Reference 1)

D = 2.2 [in] (Reference 1)  
 C = 0.45 (Desert landscape) (Reference 1)

$$\text{Composite } C = (C1 * A1 + C2 * A2 + \dots + Cn * An) / (A1 + A2 + \dots + An)$$

$$\text{Volume Required} = \text{Composite } C * P / 12 * A$$

**Results:**

Identifiers	CALCULATE RETENTION VOLUME REQUIRED		Volume Required		
	Contributory Area III	Area [acres]	C	[acre-ft]	[ft <sup>3</sup> ]
DA-21	0.23	0.45	0.02	820.88	
<b>Total Area:</b>	<b>0.23</b>	<b>TOTAL VOLUME REQUIRED:</b>	<b>0.02</b>	<b>820.88</b>	

# HYDRAULIC CALCULATION SHEET

**Retention Provided  
Hubbard Engineering  
Project No. 15138**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared By:** BAH  
**Revised By:**

**Date:** 10/12/16  
**Date:**

RETENTION BASINS					
Drainage Area	HW Area ft <sup>2</sup>	Bottom ft <sup>2</sup>	H ft	Volume Provided ft <sup>3</sup>	Drainage Areas contributing to Basins
RB-1	4,550.00	3,100.00	0.85	3,231.60	
				0.00	
Total ->				3,231.60	

4,550.00 <= Total Area @ H.W.'s

$$\text{Volume Provided} = H/3 * (A_{HW} + A_{BOTTOM} + (A_{HW} * A_{BOTTOM})^{0.5})$$

**HYDRAULIC CALCULATION SHEET**  
**Retention Basin Drain Time Calculations**  
**Hubbard Engineering**  
**Project No. 15138**

Project Name: Pima Storage  
 Project No.: 15138

Prepared by: BAH  
 Revised by:

Date: 10/12/16  
 Date:

**Purpose:** Calculate the number of drywells required to facilitate drainage of the required volume within 36 hours

**Methodology:** Calculate the number of drywells necessary to drain the retention basin within 36 hours, assuming a drywell infiltration rate of 0.1 cfs.

**Criteria:**

1. Drywell drainage capacity must discharge the retention volume provided within 36 hours
2. Percolation rates obtained from testing performed on the site will be reduced 50% for use in calculations.

- References:**
1. Scottsdale Drainage Design Policy
  2. Flood Control District of Maricopa County Drainage Design Manual, Hydrology

**Calculations:**

$$\text{Number of Drywells Required} = V_{DW} / (\text{Drywell Infiltration Rate} * 3600 * 36 \text{ hours})$$

$$\text{Drywell Infiltration Rate} = 0.1 \quad \text{[cfs]} \quad \text{(Reference 2)}$$

**Results:**

Identifiers	Infiltration Drainage Capacity Calculations				V <sub>DW</sub> [ft <sup>3</sup> ]	Number of Drywells Required	
	Retention Basin ID	Volume <sup>(Ref 1)</sup> Provided [ft <sup>3</sup> ]	Bottom <sup>(Ref 1)</sup> Area [ft <sup>2</sup> ]	Percolation Rate <sup>(Ref 2)</sup>			
				Test Location			[ft <sup>3</sup> /hr/ft <sup>2</sup> ]
	3,232.0	3,100.0	--	0.10	5,580.000	0	
			--	0.00	0.000	0	
			--	0.00	0.000	0	
			--	0.00	0.000	0	
<b>Total Number of Drywells =</b>						<b>0</b>	

**Conclusion:** These calculations indicate that the number of drywells required will adequately drain the calculated volume required from the retention basins within the project criteria. However, no percolation test data was available for use in analyzing the performance of the basins. Therefore, only the drywell infiltration rate was used for the determining the number of drywells. These numbers will be revised when the field data becomes available.

Total Vol. = 3,232.0 [ft<sup>3</sup>]  
 D.W. Rate = 0.1 cfs  
 1347 seconds  
 0.4 Hours (with no surface infiltration)

**Appendix E**  
Storm Drain Calculations  
*Pima Storage*

**HYDROLOGIC CALCULATION SHEET  
INFLOW HYDROGRAPH RESULTS  
HUBBARD ENGINEERING  
Project No.: 15138**

**Project Name:** Pima Storage  
**Project No.:** 15138

**Prepared by:** BAH  
**Prepared by:**

**Purpose:** Determine the inflow hydrograph for the detention basin from the contributing drainage area for a 2-hour duration storm event

**Methodology:** Inflow hydrograph developed using the 2-hour hypothetical storm distribution developed by the Flood Control District of Maricopa County (Reference 1)

**Criteria:** 100-year frequency, 2-hour duration

- References:** 1. Drainage Design Manual for Maricopa County, Arizona, Volume I: Hydrology, August 2013  
2. Design Standards & Policies Manual City of Scottsdale, January 2010

**Calculations:**  $Q = C \cdot i \cdot A$

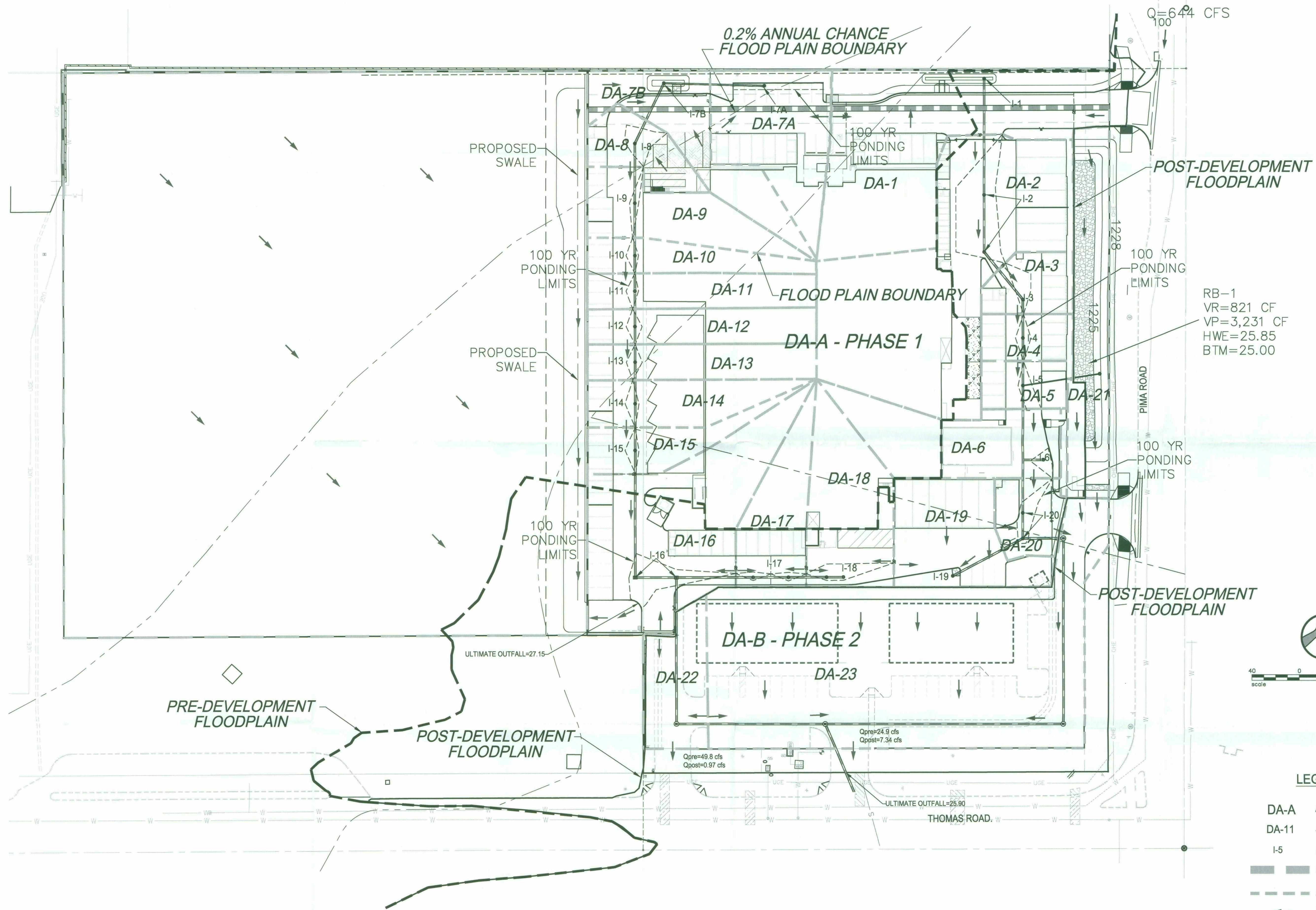
Where:

C = Post-Development Composite Runoff Coefficient  
i = Rainfall intensity in inches per hour  
A = Area of contributing sub-basin in acres

PARCEL					
Return Period	A [acres]	C	I [in/hr]	Q [cfs]	Pipe Volume [cf]
100-Year Post	4.16	0.95	7.48	29.84	3,208.00

INFLOW HYDROGRAPH					
Time (min)	Depth (%)	Q/Qp (%)	Q (Post) (cfs)	Volume (Post) (cf)	Volume (Post) - Pipe Volume (cf)
0	0.000	0.000	0.000	0.000	
2	0.002	0.025	0.746	89.520	-3,118.48
4	0.007	0.087	2.596	311.530	-2,896.47
6	0.020	0.160	4.774	572.928	-2,635.07
8	0.036	0.243	7.251	870.134	-2,337.87
10	0.063	0.346	10.325	1238.957	-1,969.04
12	0.096	0.451	13.458	1614.941	-1,593.06
14	0.136	0.576	17.188	2062.541	-1,145.46
16	0.180	0.738	22.022	2642.630	-565.37
18	0.253	0.887	26.168	3176.170	-31.83
20	0.325	1.000	29.840	3580.800	<b>372.80</b>
22	0.400	0.924	27.572	3308.659	<b>100.66</b>
24	0.464	0.839	25.036	3004.291	<b>-203.71</b>
26	0.523	0.756	22.559	2707.085	<b>-500.92</b>
28	0.578	0.678	20.232	2427.782	<b>-780.22</b>
30	0.627	0.604	18.023	2162.803	<b>-1,045.20</b>
32	0.671	0.545	16.263	1951.536	<b>-1,256.46</b>
34	0.707	0.482	14.383	1725.946	<b>-1,482.05</b>
36	0.742	0.424	12.652	1518.259	<b>-1,689.74</b>
38	0.773	0.372	11.100	1332.058	<b>-1,875.94</b>
40	0.799	0.323	9.638	1156.598	<b>-2,051.40</b>
42	0.841	0.241	7.191	862.973	<b>-2,345.03</b>
44	0.875	0.179	5.311	640.963	<b>-2,567.04</b>
46	0.900	0.136	4.058	486.989	<b>-2,721.01</b>
48	0.917	0.102	3.044	365.242	<b>-2,842.76</b>
50	0.932	0.078	2.328	279.302	<b>-2,928.70</b>
52	0.953	0.049	1.462	175.459	<b>-3,032.54</b>
54	0.965	0.030	0.895	107.424	<b>-3,100.58</b>
56	0.973	0.020	0.597	71.616	<b>-3,136.38</b>
58	0.979	0.012	0.358	42.970	<b>-3,165.03</b>
60	0.983	0.008	0.239	28.616	<b>-3,179.35</b>
62	1.000	0.000	0.000	0.000	<b>-3,208.00</b>
			<b>TOTAL (CF)=</b>	<b>40,517</b>	<b>238</b>

**Exhibits**  
*Pima Storage*



**LEGEND**

- DA-A DRAINAGE AREA ID
- DA-11 SUB-DRAINAGE AREA ID
- I-5 INLET ID
- DRAINAGE AREA DESIGNATION
- - - SUB-DRAINAGE AREA DESIGNATION
- FLOW ARROW
- - - STORM DRAIN

1840 S. Stapley Dr.  
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Mesa, AZ 85204  
Ph: 480.892.3313

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**DRAINAGE EXHIBIT - 1**  
PIMA SELF STORAGE

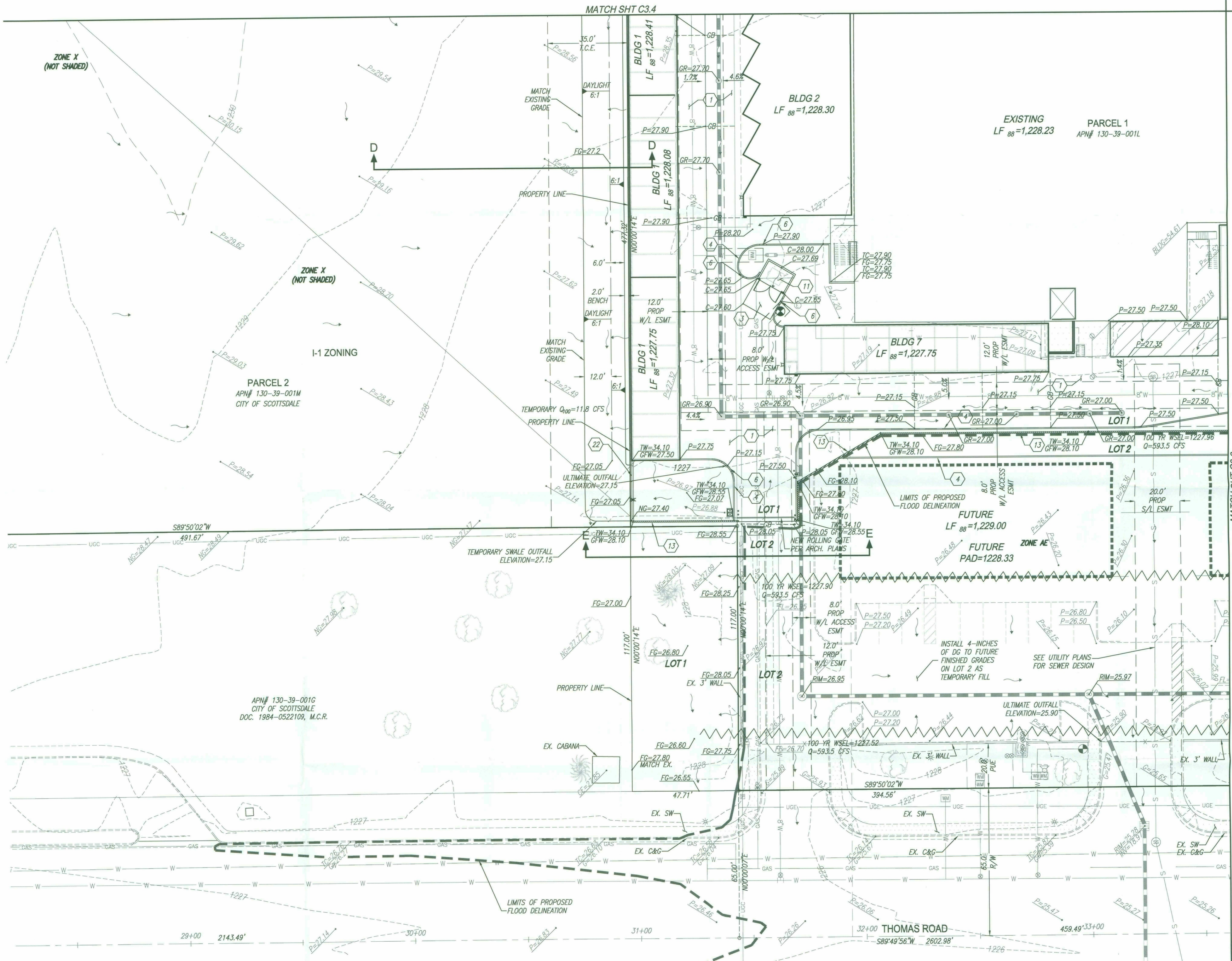
Date	02/08/17	Project Eng.	M.S.W., P.E.
Project No.	15138	Project Mgr.	SDH



CONSTRUCTION NOTES

GRADING NOTES:

- 1 CONSTRUCT ASPHALT PAVEMENT, 3" AC OVER 6" ABC OVER 12" PREPARED SUBGRADE FOR TRUCK PARKING, MAIN DRIVES, & FIRE LANES. ALTERNATIVE PAVEMENT FOR AREAS 6" POOP OVER 12" PREPARED SUBGRADE PER GEOTECHNICAL REPORT DONE BY "SPEEDIE AND ASSOCIATES" DATED FEBRUARY 18, 2017 PROJECT NO. 1609825A. SEE DETAILS ON SHEET C1.2 FOR PAVEMENT CROSS-SECTIONS.
- 3 INSTALL 6" THICK PORTLAND CEMENT CONCRETE OVER 12" PREPARED SUBGRADE PER GEOTECHNICAL REPORT DONE BY "SPEEDIE AND ASSOCIATES" DATED FEBRUARY 18, 2017 PROJECT NO. 1609825A.
- 4 INSTALL SINGLE CURB PER M.A.G. STD. DTL. 222 TYPE 'A'.
- 6 CONSTRUCT 3' CURB OPENING. SEE DETAIL 3 ON SHEET C1.2.
- 11 CONSTRUCT TRASH ENCLOSURE PER COS STD. DTL. 2146-1.
- 13 PROPOSED SITE WALL PER ARCHITECTS DETAIL ON SHEET 5/AB.0 AND STRUCTURAL SHEET 14/S1.01.
- 22 PROPOSED SITE FENCE PER ARCHITECTS DETAIL ON SHEET 20/AB.0.



NOTE:  
FROM A CONSTRUCTION STAND POINT THE APPROVAL OF THE CLOMR BY F.E.M.A. WILL BE BASED ON THE FOLLOWING; THE GRADING OF THE SWALE AND THE CONSTRUCTION OF THE RETAINING WALL ALONG THE WEST SIDE OF PIMA RD, THE GRADING OF LOT 2 TO PROPOSED FINISHED GRADES, GRADING THE EAST AND SOUTH PORTIONS OF LOT 1 ALONG THE PROPOSED FLOODPLAIN DELINEATION LINE SHOWN ON THE PLANS TO FINISHED GRADES.

811  
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602.263.1100

38925  
MICHAEL S. WOLF  
Professional Engineer  
Arizona, U.S.A.

**GRADING PLAN SHEET**  
**PIMA SELF STORAGE**  
A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 05 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.1

**HUBBARD ENGINEERING**  
www.hubbardengineering.com  
1201 S. Alma School Rd., Ste. 12000 - Mesa, AZ 85210  
PH: 480.892.3313

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CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

CONSTRUCTION NOTES

GRADING NOTES:

- 1 CONSTRUCT ASPHALT PAVEMENT, 3" AC OVER 6" ABC OVER 12" PREPARED SUBGRADE FOR TRUCK PARKING, MAIN DRIVES, & FIRE LANES. ALTERNATIVE PAVEMENT FOR AREAS 6" PCPP OVER 12" PREPARED SUBGRADE PER GEOTECHNICAL REPORT DONE BY "SPEEDIE AND ASSOCIATES" DATED FEBRUARY 18, 2017 PROJECT NO. 160982SA. SEE DETAILS ON SHEET C1.2 FOR PAVEMENT CROSS-SECTIONS.
- 2 CONSTRUCT ASPHALT PAVEMENT, 2" AC OVER 4" ABC OVER 12" PREPARED SUBGRADE FOR PARKING SPACES. ALTERNATIVE PAVEMENT OPTION 6" PCPP OVER 12" PREPARED SUBGRADE PER GEOTECHNICAL REPORT DONE BY "SPEEDIE AND ASSOCIATES" DATED FEBRUARY 18, 2017 PROJECT NO. 160982SA. SEE DETAILS ON SHEET C1.2 FOR PAVEMENT CROSS-SECTIONS.
- 4 INSTALL SINGLE CURB PER M.A.G. STD. DTL. 222 TYPE 'A'.
- 5 INSTALL CURB AND GUTTER PER M.A.G. STD. DTL. 220-1 TYPE 'A'.
- 6 CONSTRUCT 3' CURB OPENING. SEE DETAIL 3 ON SHEET C1.2.
- 8 CONSTRUCT CONCRETE SIDEWALK PER M.A.G. STD. DTL. 230. WIDTH VARIES, REFER TO PLAN.
- 9 PROPOSED CROSSWALK. REFER TO ARCHITECT'S PLAN FOR DETAILS.
- 10 CONSTRUCT SIDEWALK RAMP PER DETAIL 4 ON SHEET C1.2.
- 12a INSTALL 3"-6" GROUTED RIP RAP, DEPTH=1'. GREY COLOR NATIVE STONE.
- 12b INSTALL 3"-6" RIP RAP, DEPTH=1'. GREY COLOR NATIVE STONE.
- 13 PROPOSED SITE WALL PER ARCHITECT'S DETAIL ON SHEET S/A2.0 AND STRUCTURAL SHEET 14/S11.01.
- 14 CONSTRUCT RETAINING WALL PER STRUCTURAL DETAIL 9 ON STRUCTURAL SHEET S11.02.
- 19 SAWCUT 2' ASPHALT, REMOVE AND REPLACE PER COS STD DTL 2200.
- 20 INSTALL 6" VALLEY GUTTER AND MODIFIED APRON PER COS STD DTL 2240.
- 21 INSTALL CURB RAMP PER MAG STD DTL 235-1 MODIFY PER PLAN.

NOTE:  
FROM A CONSTRUCTION STAND POINT THE APPROVAL OF THE CLOMR BY F.E.M.A. WILL BE BASED ON THE FOLLOWING; THE GRADING OF THE SWALE AND THE CONSTRUCTION OF THE RETAINING WALL ALONG THE WEST SIDE OF PIMA RD, THE GRADING OF LOT 2 TO PROPOSED FINISHED GRADES, GRADING THE EAST AND SOUTH PORTIONS OF LOT 1 ALONG THE PROPOSED FLOODPLAIN DELINEATION LINE SHOWN ON THE PLANS TO FINISHED GRADES.

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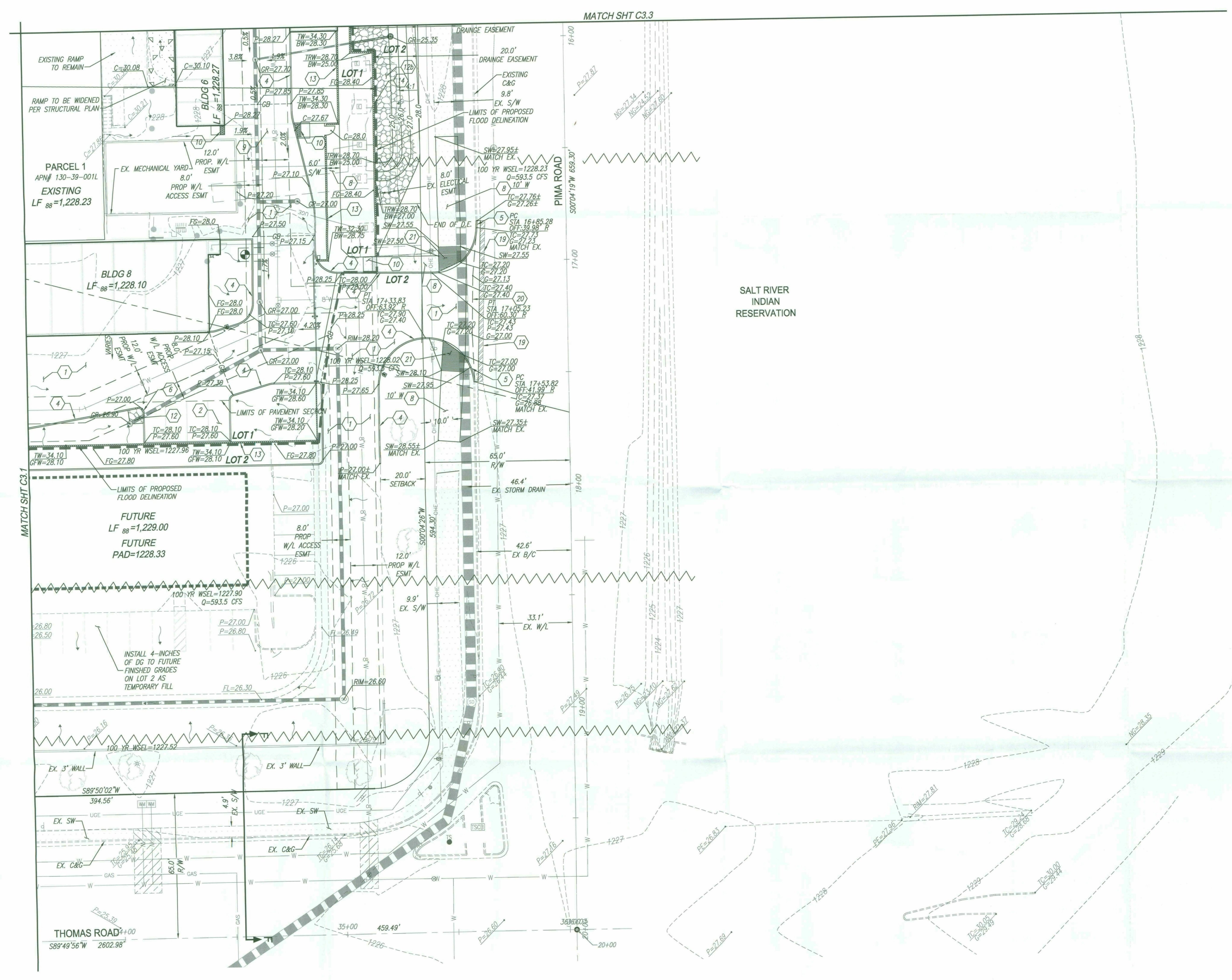
38929  
MICHAEL S. WOLF  
Professional Engineer  
Arizona U.S.A.

GRADING PLAN SHEET  
PIMA SELF STORAGE

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 06 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.2

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CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

# CONSTRUCTION NOTES

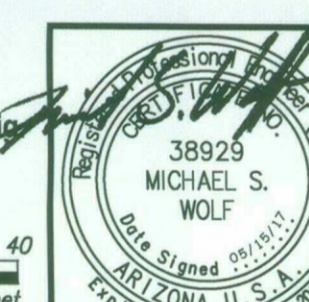
## GRADING NOTES:

- 1 CONSTRUCT ASPHALT PAVEMENT, 3" AC OVER 6" ABC OVER 12" PREPARED SUBGRADE FOR TRUCK PARKING, MAIN DRIVES, & FIRE LANES. ALTERNATIVE PAVEMENT FOR AREAS 6" PCP OVER 12" PREPARED SUBGRADE PER GEOTECHNICAL REPORT DONE BY "SPEEDIE AND ASSOCIATES" DATED FEBRUARY 18, 2017 PROJECT NO. 160982SA. SEE DETAILS ON SHEET C1.2 FOR PAVEMENT CROSS-SECTIONS.
- 4 INSTALL SINGLE CURB PER M.A.G. STD. DTL. 222 TYPE 'A'.
- 5 INSTALL CURB AND GUTTER PER M.A.G. STD. DTL. 220-1 TYPE 'A'.
- 7 CONSTRUCT SIDEWALK SCUPPER PER M.A.G. STD. DTL. 206 WIDTH=6'.
- 8 CONSTRUCT CONCRETE SIDEWALK PER M.A.G. STD. DTL. 230. WIDTH VARIES, REFER TO PLAN.
- 12a INSTALL 3"-6" GROUDED RIP RAP, DEPTH=1'. GREY COLOR. NATIVE STONE.
- 12b INSTALL 3"-6" RIP RAP, DEPTH=1'. GREY COLOR. NATIVE STONE.
- 14 CONSTRUCT RETAINING WALL PER STRUCTURAL DETAIL 9 ON STRUCTURAL SHEET S11.02.
- 15 GRADE SWALE/BASIN PER PLAN.
- 17 GRADE DETENTION BASIN PER PLAN.
- 19 SAWCUT 2' ASPHALT, REMOVE AND REPLACE PER COS STD DTL 2200.
- 20 INSTALL 6" VALLEY GUTTER AND MODIFIED APRON PER COS STD DTL 2240.
- 21 INSTALL CURB RAMP PER MAG STD DTL 235-1 MODIFY PER PLAN.

NOTE:  
FROM A CONSTRUCTION STAND POINT THE APPROVAL OF THE CLOMR BY F.E.M.A. WILL BE BASED ON THE FOLLOWING: THE GRADING OF THE SWALE AND THE CONSTRUCTION OF THE RETAINING WALL ALONG THE WEST SIDE OF PIMA RD, THE GRADING OF LOT 2 TO PROPOSED FINISHED GRADES, GRADING THE EAST AND SOUTH PORTIONS OF LOT 1 ALONG THE PROPOSED FLOODPLAIN DELINEATION LINE SHOWN ON THE PLANS TO FINISHED GRADES.



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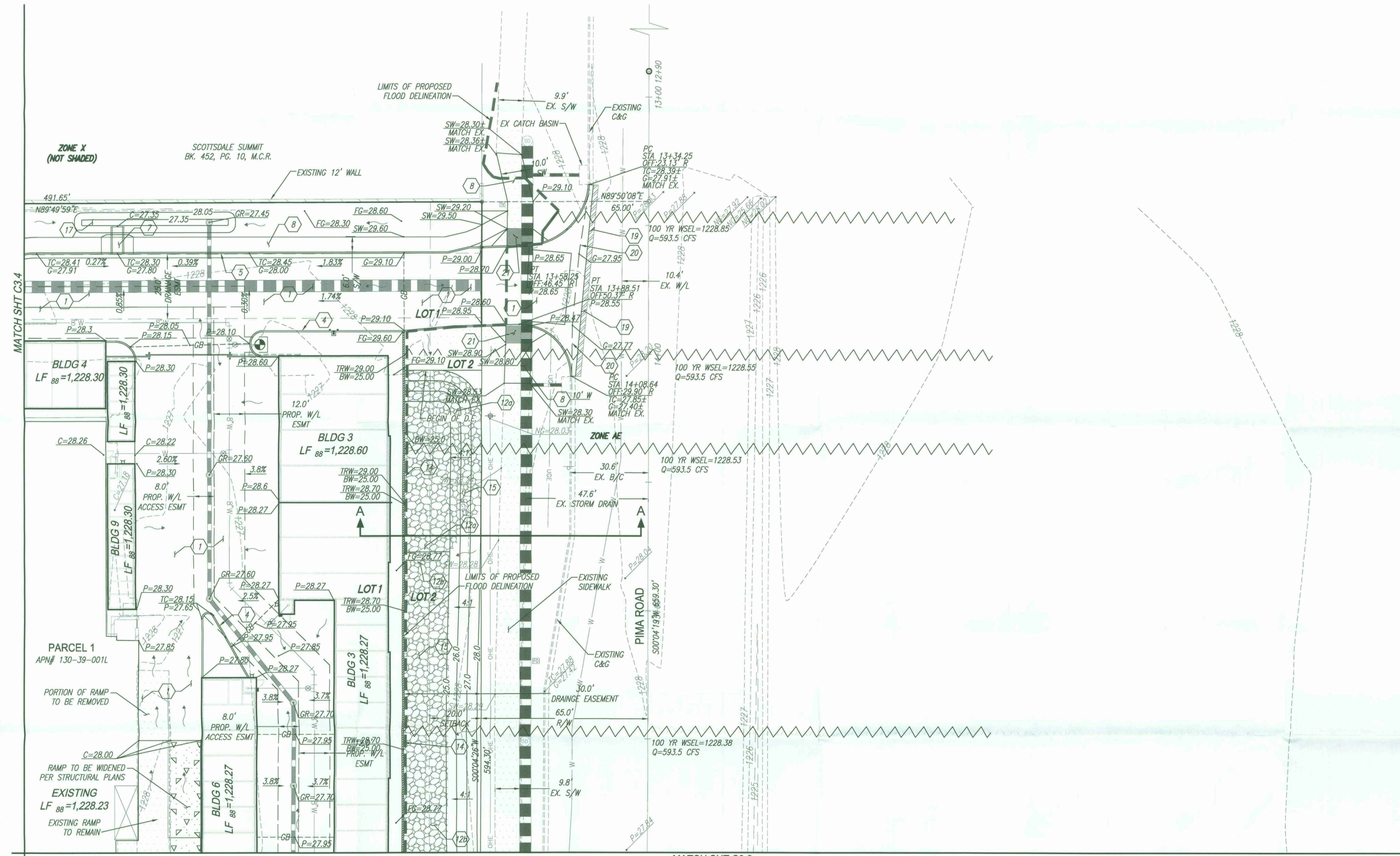


scale 0 20 40 feet

### GRADING PLAN SHEET PIMA SELF STORAGE

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 07 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.3



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CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

CONSTRUCTION NOTES

GRADING NOTES:

- 1 CONSTRUCT ASPHALT PAVEMENT, 3" AC OVER 6" ABC OVER 12" PREPARED SUBGRADE FOR TRUCK PARKING, MAIN DRIVES, & FIRE LANES. ALTERNATIVE PAVEMENT FOR AREAS 6" PCPP OVER 12" PREPARED SUBGRADE PER GEOTECHNICAL REPORT DONE BY "SPEEDIE AND ASSOCIATES" DATED FEBRUARY 18, 2017 PROJECT NO. 160982SA. SEE DETAILS ON SHEET C1.2 FOR PAVEMENT CROSS-SECTIONS.
- 2 CONSTRUCT ASPHALT PAVEMENT, 2" AC OVER 4" ABC OVER 12" PREPARED SUBGRADE FOR PARKING SPACES. ALTERNATIVE PAVEMENT OPTION 6" PCPP OVER 12" PREPARED SUBGRADE PER GEOTECHNICAL REPORT DONE BY "SPEEDIE AND ASSOCIATES" DATED FEBRUARY 18, 2017 PROJECT NO. 160982SA. SEE DETAILS ON SHEET C1.2 FOR PAVEMENT CROSS-SECTIONS.
- 4 INSTALL SINGLE CURB PER M.A.G. STD. DTL. 222 TYPE 'A'.
- 5 INSTALL CURB AND GUTTER PER M.A.G. STD. DTL. 220-1 TYPE 'A'.
- 7 CONSTRUCT SIDEWALK SCUPPER PER M.A.G. STD. DTL. 206 WIDTH=6".
- 9 PROPOSED CROSSWALK. REFER TO ARCHITECT'S PLAN FOR DETAILS.
- 10 CONSTRUCT SIDEWALK RAMP PER DETAIL 4 ON SHEET C1.2.
- 120 INSTALL 3"-6" GROUTED RIP RAP, DEPTH = 1'. GRAY COLOR. NATIVE STONE.
- 13 PROPOSED SITE WALL PER ARCHITECT'S DETAIL ON SHEET 5/AB.0 AND STRUCTURAL SHEET 14/S11.01.
- 16 GRADE SWALE PER PLAN.
- 17 GRADE DETENTION BASIN PER PLAN.
- 18 CONSTRUCT CONCRETE RAMP PER DETAIL ON SHEET C3.4.

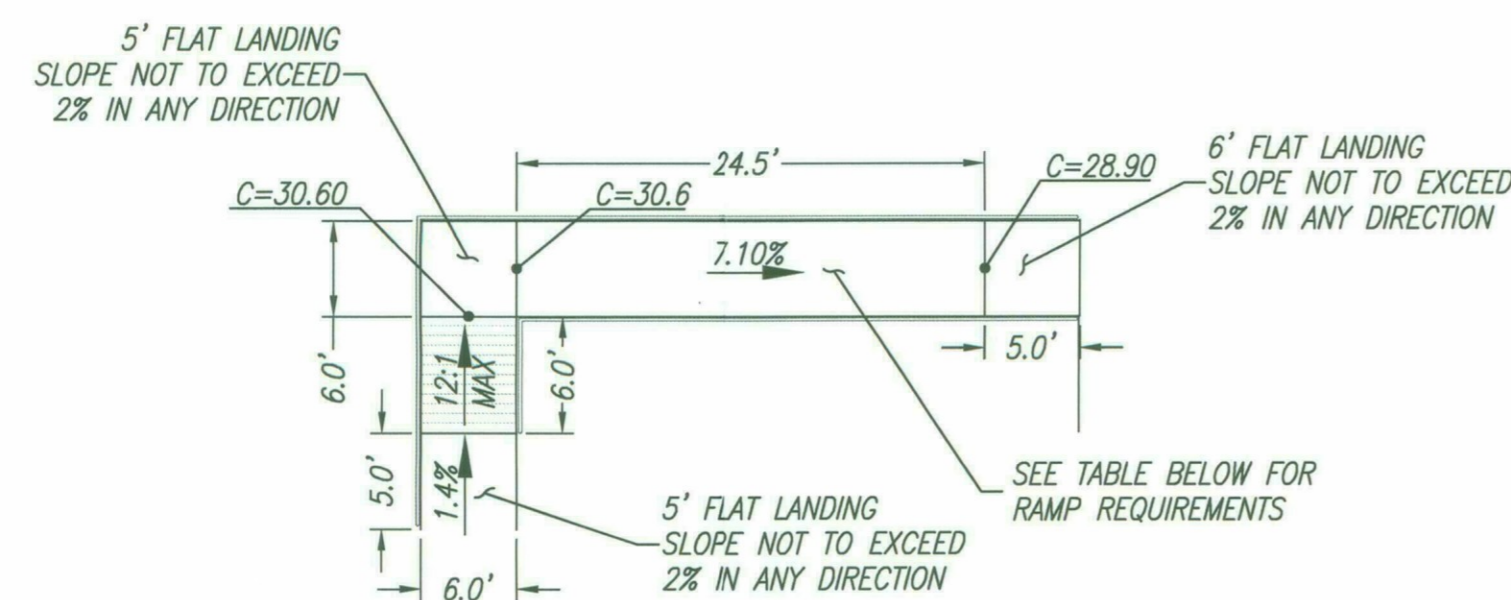


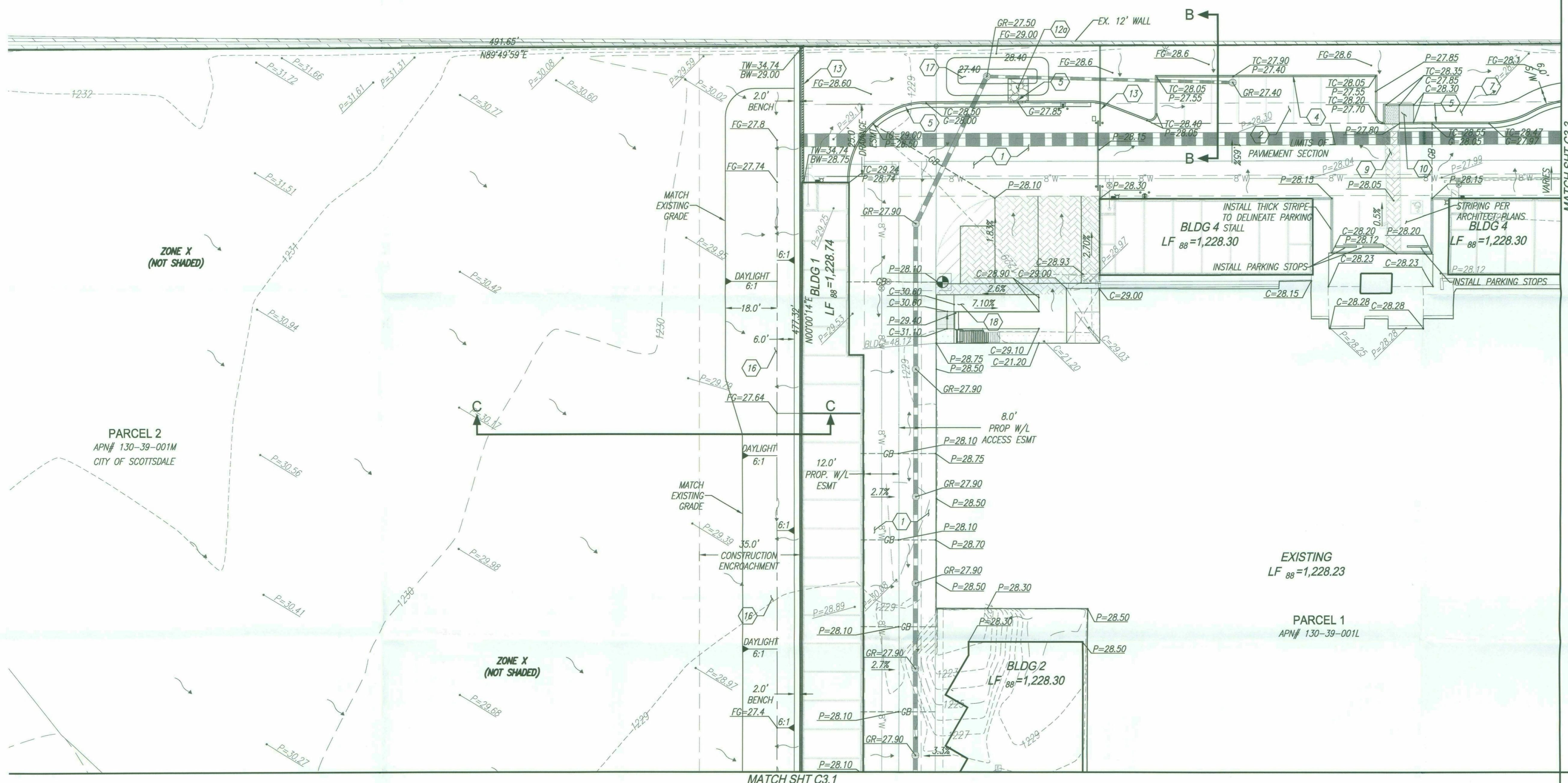
TABLE: SIDEWALK RAMP DESIGN CRITERIA

SLOPE	MAX RISE	MAX HORIZONTAL PROJECTION
1:12 TO < 1:16	30 INCHES	30 FEET
1:16 TO < 1:20	30 INCHES	40 FEET

ADA RAMP GRADING CRITERIA DETAIL

SCALE: 1"=10'

SCOTTSDALE SUMMIT  
BK. 452, PG. 10, M.C.R.



GRADING PLAN SHEET  
PIMA SELF STORAGE

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 08 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.4

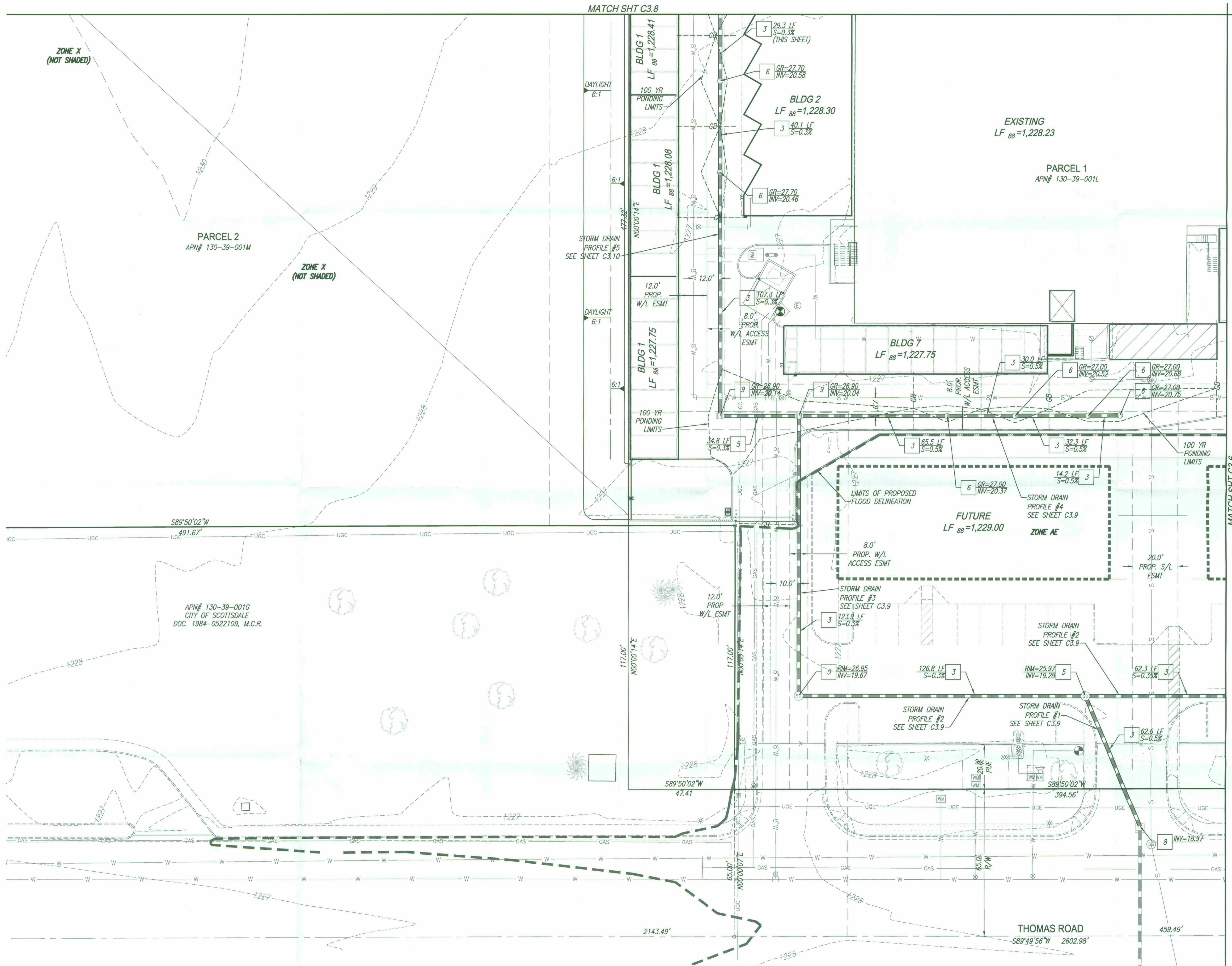
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CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

CONSTRUCTION NOTES

STORM DRAIN NOTES:

- 3 INSTALL 18" HDPE STORM DRAIN PIPE. LENGTH AND SLOPE PER PLAN.
- 5 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 30" STANDARD ASSEMBLY.
- 6 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 30" GRATE ASSEMBLY.
- 8 CONNECT TO EXISTING. SIZE AND INVERT PER PLANS.
- 9 INSTALL TYPE "F" CATCH BASIN PER M.A.G. STD. DTL. 535.



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Professional Engineer  
Arizona U.S.A.

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scale feet

**STORM DRAIN PLAN**  
**PIMA SELF STORAGE**  
A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 09 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.5

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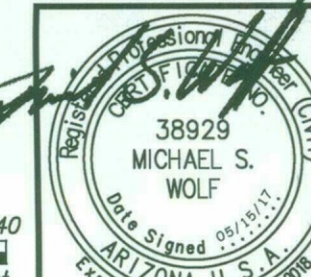
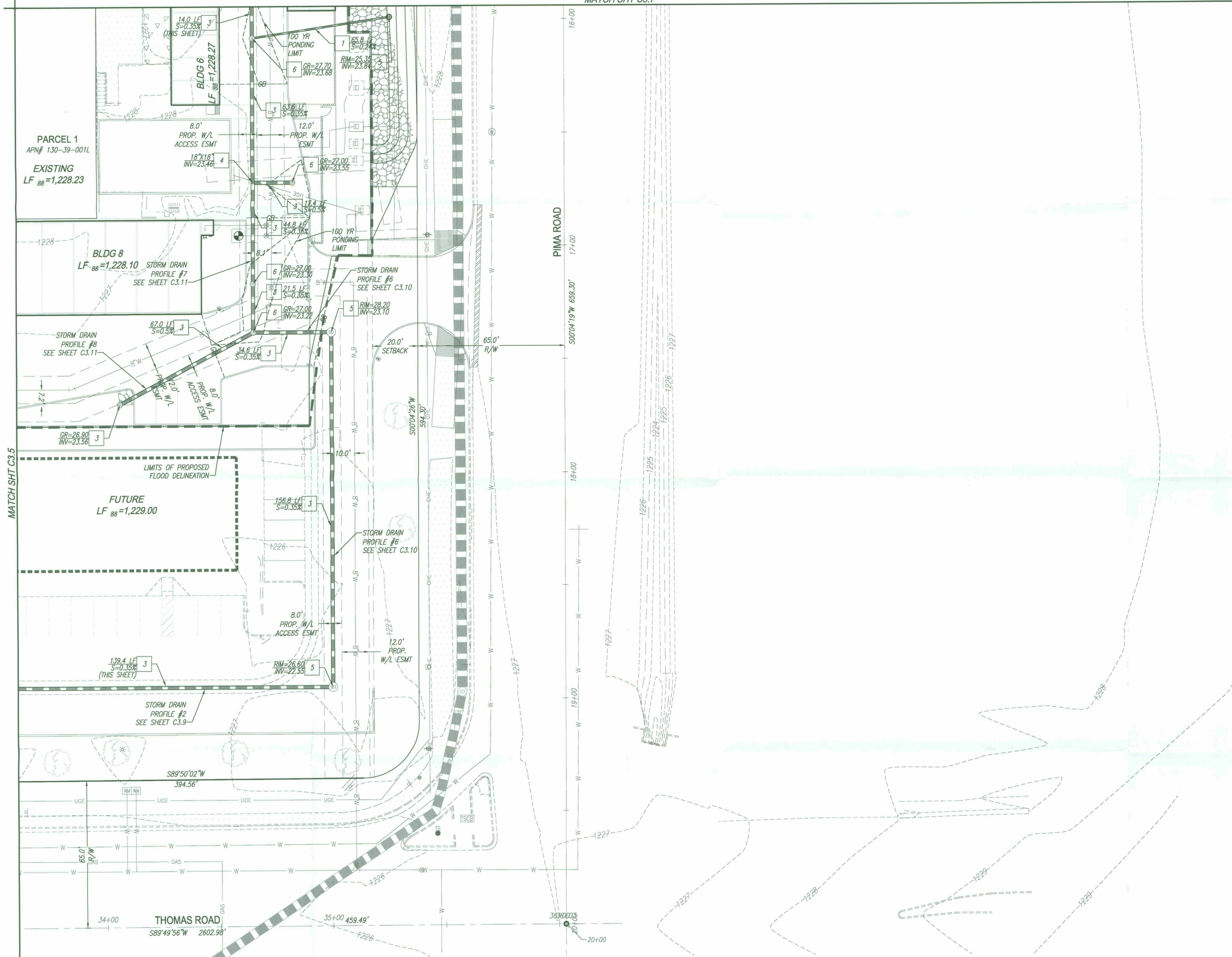
CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

CONSTRUCTION NOTES

STORM DRAIN NOTES:

- 1 INSTALL 8" HDPE STORM DRAIN PIPE. LENGTH AND SLOPE PER PLAN.
- 3 INSTALL 18" HDPE STORM DRAIN PIPE. LENGTH AND SLOPE PER PLAN.
- 4 INSTALL HDPE STORM DRAIN TEE. SIZE PER PLAN.
- 5 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 30" STANDARD ASSEMBLY.
- 6 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 30" GRATE ASSEMBLY.

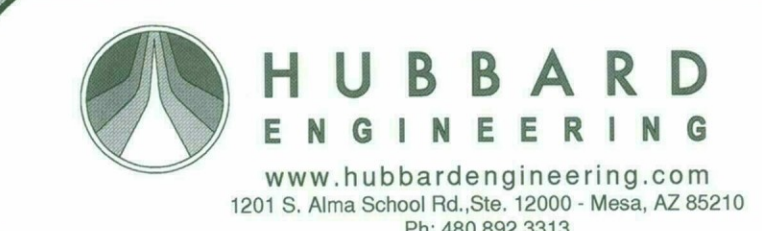
MATCH SHT C3.7



**STORM DRAIN PLAN**  
**PIMA SELF STORAGE**

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 10 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.6



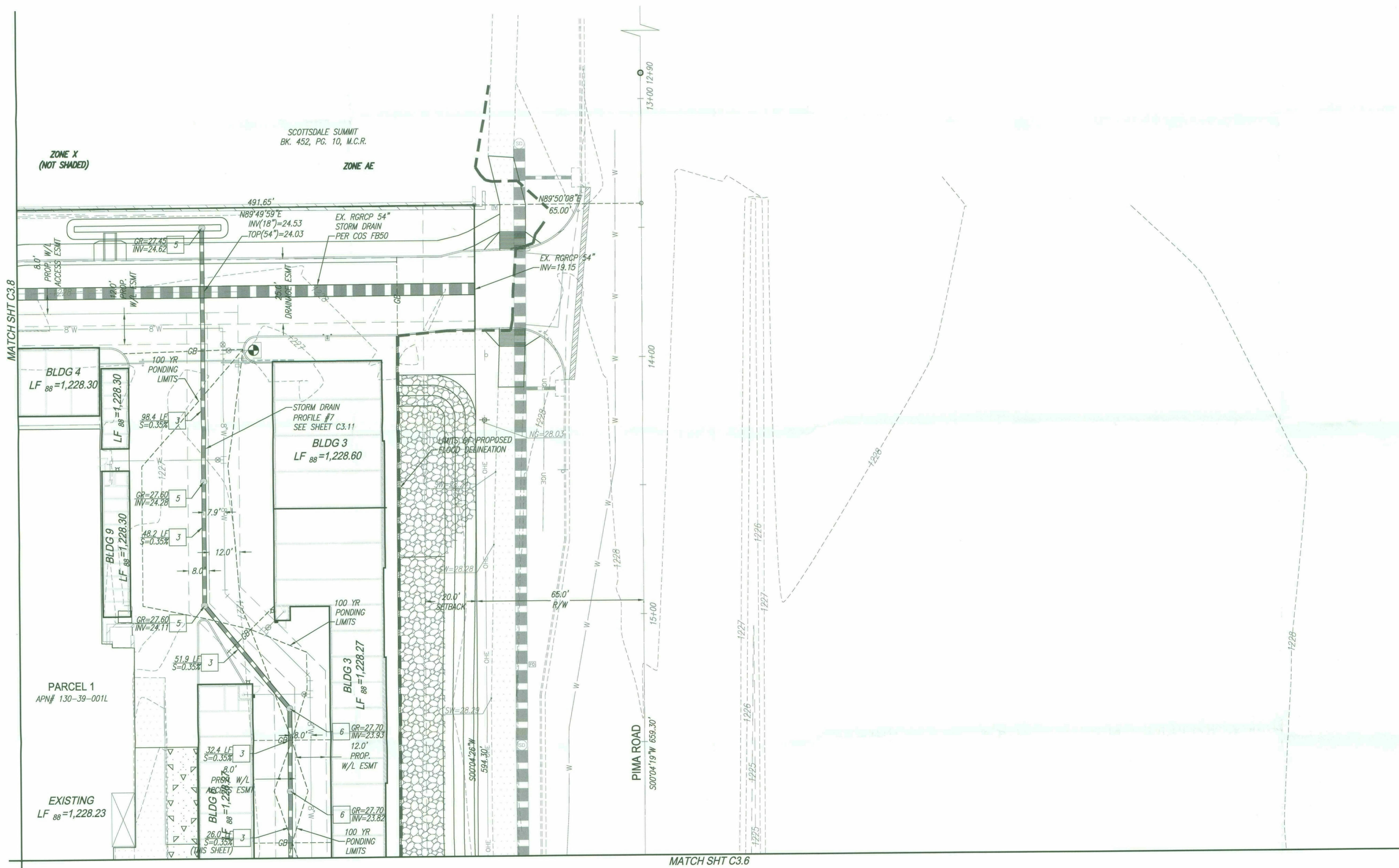
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CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

CONSTRUCTION NOTES

STORM DRAIN NOTES:

- 3 INSTALL 18" HDPE STORM DRAIN PIPE. LENGTH AND SLOPE PER PLAN.
- 5 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 30" STANDARD ASSEMBLY.
- 6 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 30" GRATE ASSEMBLY.



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Professional Engineer  
State of Arizona U.S.A.

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scale feet

STORM DRAIN PLAN  
PIMA SELF STORAGE

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 11 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.7

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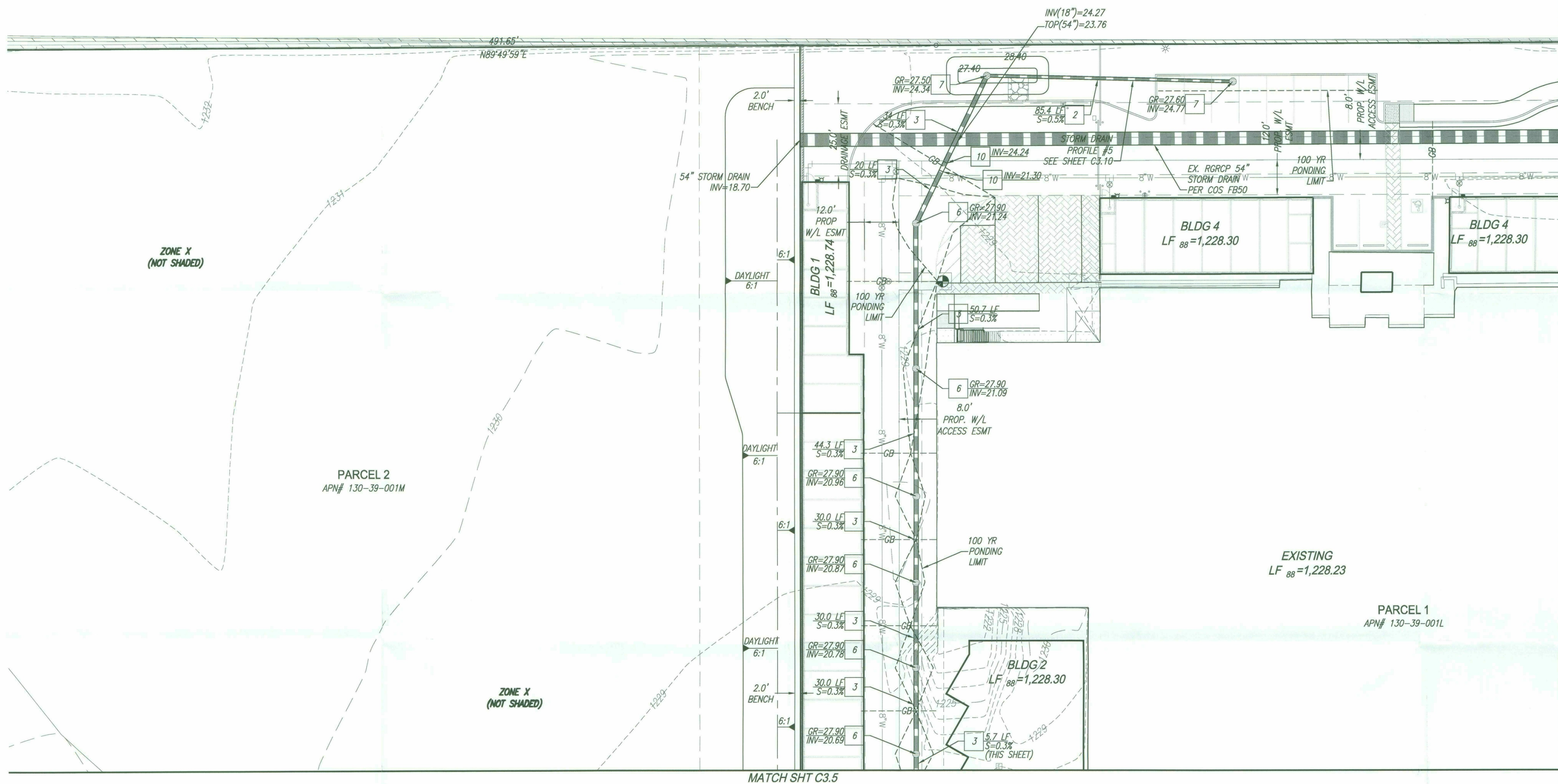
CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

CONSTRUCTION NOTES

STORM DRAIN NOTES:

- 2 INSTALL 12" HDPE STORM DRAIN PIPE. LENGTH AND SLOPE PER PLAN.
- 3 INSTALL 18" HDPE STORM DRAIN PIPE. LENGTH AND SLOPE PER PLAN.
- 6 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 30" GRATE ASSEMBLY.
- 7 INSTALL 12" NYLOPLAST POLYPROPYLENE STORM DRAIN RISER WITH STANDARD 24" GRATE ASSEMBLY.
- 10 INSTALL HDPE 45° VERTICAL BEND.

SCOTTSDALE SUMMIT  
BK. 452, PG. 10, M.C.R.



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Scale: 0 20 40 feet

**STORM DRAIN PLAN**  
**PIMA SELF STORAGE**  
A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25  
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER  
MERIDIAN, MARICOPA COUNTY, ARIZONA

Project No. 15138	Date 05/15/2017	Sheet No. SHT: 12 OF 17
Project Manager B. HAMMERSLAND	Project Engineer M. WOLF, P.E.	C3.8

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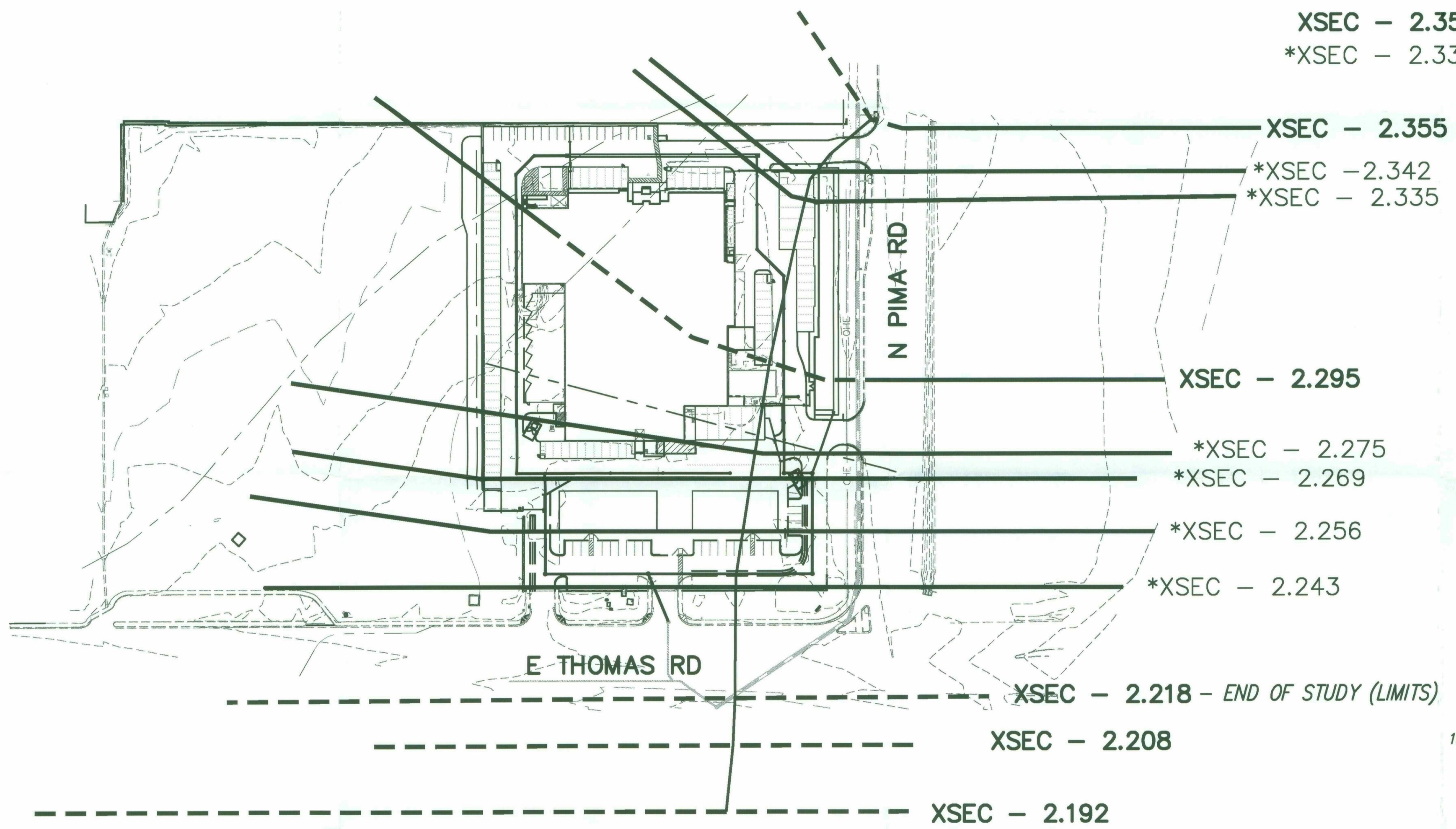
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CASE #57-DR-2015 (PLAN CHECK #6995-16-1)

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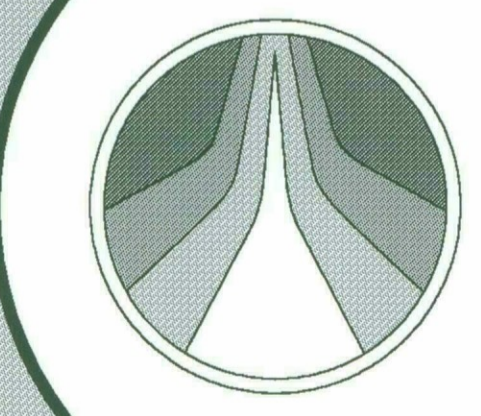
### LEGEND

- EXISTING CROSS SECTIONS
- ADDITIONAL/EXTENDED CROSS SECTIONS
- XSEC - 2.355** EXISTING CROSS SECTIONS
- \*XSEC - 2.335** ADDITIONAL CROSS SECTIONS



Proj. No. 15138	Date 3/30/16
Sht: 1 of 1	

**HEC-RAS CROSS SECTIONS  
EXHIBIT 3  
PIMA STORAGE**



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Mesa, AZ 85210  
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14 May 2019

Phillip Kercher  
Traffic Engineering & Operations Manager, City of Scottsdale  
7447 East Indian School Road, Suite 205  
Scottsdale, Arizona 85251

**SUBJECT: PT COMMERCIAL  
THOMAS ROAD/PIMA ROAD  
TRIP GENERATION COMPARISON**

Dear Mr. Kercher,

Please find enclosed a brief trip generation comparison (TGC) regarding the proposed PT Commercial project located on the northwest corner of Thomas Road/Pima Road in Scottsdale, Arizona. The site vicinity is located as shown in **Figure 1**. The project will consist of a 4,000 square foot retail building served by two existing access points, as shown in **Figure 2**.

The purpose of this comparison is to estimate the traffic generation associated with the proposed project and compare those trips with the estimated trip generation of a possible land use under the current zoning.

**Trip Generation**

Trip generation for the proposed project and existing zoning were developed utilizing nationally agreed upon data contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation, 10<sup>th</sup> Edition*, 2017. The PT Commercial project proposes the construction of a 4,000 square foot retail building. Trip generation for the PT Commercial project was based on ITE Land Use Code 814 (LUC 814), Variety Store. The expected weekday trip generation for the PT Commercial project is shown in **Table 1**.

**1-ZN-2019 / 1-GP-2019**  
**6/1/19**

**Table 1 – Proposed Weekday Trip Generation**

Time Period	Variety Store (LUC 814)	34 % Pass-By Reduction
AM Peak Hour, Inbound (vtph)	7	-2
AM Peak Hour, Outbound (vtph)	6	-2
<b>Total AM Peak</b>	<b>13</b>	<b>-4</b>
PM Peak Hour, Inbound (vtph)	15	-5
PM Peak Hour, Outbound (vtph)	13	-4
<b>Total PM Peak</b>	<b>28</b>	<b>-10</b>

vtpd - vehicle trips per day, vtph -

Variety Stores do not typically generate all new traffic on a roadway system. The ITE publication *Trip Generation, 10th Edition, 2017* defines pass by trips as intermediate stops on the way from an origin to a primary trip destination without a route diversion. Primary trips are trips where the primary purpose of the trip is to visit a specific location (i.e. variety store). Pass-by trips are trips where the secondary purpose of the trip is to visit the store, in conjunction with some other primary trip purpose (such as driving home from work). Pass by trips originate from roadways directly fronting the generator.

The ITE publication *Trip Generation, 10th Edition, 2017* provides pass by trip percentages based on land use. ITE data estimates that 34% of trips to the variety store on the PT Commercial site will be from pass-by trips. The number of pass-by trips expected at the PT Commercial variety store are shown in **Table 2**.

**Table 2 – Weekday Project Site Pass-By Trips**

Time Period	Variety Store (LUC 814)	34 % Pass-By Reduction	New Trips (With Pass-By Reduction)
AM Peak Hour, Inbound (vtph)	7	-2	5
AM Peak Hour, Outbound (vtph)	6	-2	4
<b>Total AM Peak</b>	<b>13</b>	<b>-4</b>	<b>9</b>
PM Peak Hour, Inbound (vtph)	15	-5	10
PM Peak Hour, Outbound (vtph)	13	-4	9
<b>Total PM Peak</b>	<b>28</b>	<b>-10</b>	<b>18</b>

vtpd - vehicle trips per day, vtph - vehicle trips per hour

To contextualize the impact of the proposed project, a baseline trip generation can be established under the existing City of Scottsdale zoning. The project site is currently zoned as I-1 (Industrial Park) and may include uses such as data processing, storage, warehousing, light manufacturing, and educational land uses (excluding elementary and secondary school). Trip generation for a possible use on the site under the existing Scottsdale I-1 zoning was based on an assumed 10,000 square foot light industrial building and ITE LUC 110, General Light Industrial. The result is the expected weekday trip generation for the I-1 zoning, as shown in **Table 3**.

**Table 3 – Scottsdale I-1 Zoning Weekday Trip Generation**

Time Period	I-1 Zoning General Light Industrial (LUC 110)
AM Peak Hour, Inbound (vtph)	6
AM Peak Hour, Outbound (vtph)	1
<b>Total AM Peak</b>	<b>7</b>
PM Peak Hour, Inbound (vtph)	1
PM Peak Hour, Outbound (vtph)	6
<b>Total PM Peak</b>	<b>7</b>

vtpd - vehicle trips per day, vtph - vehicle trips per hour

**Table 4** shows the difference in trip generation between the Scottsdale I-1 zoning and the proposed PT Commercial project.

**Table 4 – I-1 Zoning and Proposed Project Weekday Trip Generation Comparison**

Time Period	I-1 Zoning General Light Industrial (LUC 110)	Proposed Project	Difference
AM Peak Hour, Inbound (vtph)	6	5	-1
AM Peak Hour, Outbound (vtph)	1	4	3
<b>Total AM Peak</b>	<b>7</b>	<b>9</b>	<b>2</b>
PM Peak Hour, Inbound (vtph)	1	10	9
PM Peak Hour, Outbound (vtph)	6	9	3
<b>Total PM Peak</b>	<b>7</b>	<b>18</b>	<b>11</b>

vtpd - vehicle trips per day, vtph - vehicle trips per hour

**Conclusion**

The proposed site is expected to generate two more trips in the AM peak hour and eleven more PM peak hour trips when compared to an allowable land use under the City of Scottsdale I-1 zoning. While the estimated trip generation for the proposed site is slightly higher when compared to the existing zoning, the trips are not expected to have a significant impact on the surrounding roadway network.

Various residential and recreational land uses neighbor the PT Commercial site. The proposed coffee shop and retail space would serve residents, supplement nearby recreation, and be in character with the surrounding land uses

Thank you again for your time and review of this TGC. If you have any questions regarding the TGC, please feel free to contact me at 602.266.7983.

Respectfully Submitted,



Andrew Smigielski, PE, PTOE, PTP  
Southwest Traffic Engineering LLC  
Senior Traffic Engineer




cc: Justin Gregonis, Vertical Design Studios

Attachments: Figure 1 – Vicinity Map  
Figure 2 – Site Plan  
Trip Generation Calculations

Figure 1 – Vicinity Map



**LEGEND:**

- = *New Access*
- = *Existing Road*
-  = *Project Site*



## Variety Store

Proposed

LAND USE: 4,000 Square Feet Variety Store

TRIP GENERATION CALCULATIONS ARE BASED ON THE INSTITUTE OF TRANSPORTATION ENGINEERS' TRIP GENERATION, 10TH EDITION. THE ITE LAND USE CODE IS Variety Store (814), General Urban/Suburban

### Weekday

Average Rate = 63.47 Trips per 1000 Square Feet (sqft)

$$T = 63.47 \text{ Trips} \times 4000 \text{ sqft} / 1000$$

$$T = 254 \text{ VTPD}$$

$$\text{ENTER: } (0.5) \times (254) = 127 \text{ VTPD}$$

$$\text{EXIT: } (0.5) \times (254) = 127 \text{ VTPD}$$

### AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)

Average Rate = 3.18 Trips per 1000 Square Feet (sqft)

$$T = 3.18 \text{ Trips} \times 4000 \text{ sqft} / 1000$$

$$T = 13 \text{ VPH}$$

$$\text{ENTER: } (0.57) \times (13) = 7 \text{ VPH}$$

$$\text{EXIT: } (0.43) \times (13) = 6 \text{ VPH}$$

### PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)

Average Rate = 6.84 Trips per 1000 Square Feet (sqft)

$$T = 6.84 \text{ Trips} \times 4000 \text{ sqft} / 1000$$

$$T = 28 \text{ VPH}$$

$$\text{ENTER: } (0.52) \times (28) = 15 \text{ VPH}$$

$$\text{EXIT: } (0.48) \times (28) = 13 \text{ VPH}$$

\*where, T = trip ends

### TRIP GENERATION SUMMARY

#### SATURDAY

254 VTPD

#### AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)

13 VPH

#### PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)

28 VPH

# General Light Industrial

Proposed

LAND USE: 10,000 Square Feet General Light Industrial

TRIP GENERATION CALCULATIONS ARE BASED ON THE INSTITUTE OF TRANSPORTATION ENGINEERS' TRIP GENERATION, 10TH EDITION. THE ITE LAND USE CODE IS General Light Industrial (110), General Urban/Suburban

## Weekday

Average Rate = 4.96 Trips per 1000 Square Feet (sqft)

$$T = 4.96 \text{ Trips} \times 10000 \text{ sqft} / 1000$$

$$T = 50 \text{ VTPD}$$

$$\text{ENTER: } (0.5) \times (50) = 25 \text{ VTPD}$$

$$\text{EXIT: } (0.5) \times (50) = 25 \text{ VTPD}$$

## AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)

Average Rate = 0.7 Trips per 1000 Square Feet (sqft)

$$T = 0.7 \text{ Trips} \times 10000 \text{ sqft} / 1000$$

$$T = 7 \text{ VPH}$$

$$\text{ENTER: } (0.88) \times (7) = 6 \text{ VPH}$$

$$\text{EXIT: } (0.12) \times (7) = 1 \text{ VPH}$$

## PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)

Average Rate = 0.63 Trips per 1000 Square Feet (sqft)

$$T = 0.63 \text{ Trips} \times 10000 \text{ sqft} / 1000$$

$$T = 7 \text{ VPH}$$

$$\text{ENTER: } (0.13) \times (7) = 1 \text{ VPH}$$

$$\text{EXIT: } (0.87) \times (7) = 6 \text{ VPH}$$

\*where, T = trip ends

## TRIP GENERATION SUMMARY

SATURDAY

50 VTPD

AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)

7 VPH

PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)

7 VPH