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ENGINEER | PLAN | SURVEY | MANAGE

MASTER WATER REPORT

FOR

LEVINE GENERAL MOTORS 170

MESA, ARIZONA

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May 2019
Project No. 2063.01

mesa·az
PLANNING DIVISION
APPROVED BY CITY
COUNCIL
WITH STIPULATIONS

HILGARTWILSON

MASTER WATER REPORT
FOR
LEVINE GENERAL MOTORS 170

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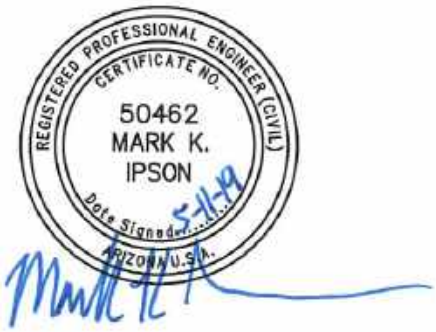

APPENDICES

FIGURES

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1.0 EXECUTIVE SUMMARY

Levine General Motors 170 (the Project) is a proposed approximate 157.2-acre master planned mixed-use development generally located west of 22nd Street, east of Crismon Road, north of the future SR-24 alignment (Frye Road) and south of Williams Field Road in the City of Mesa, Arizona. The Project will consist of up to 1,191 residential units, approximately 11.0 acres of commercial land use, and approximately 36.4 acres of developed open space.

This Master Water Report has been prepared in support of the General Plan Amendment (GPA) for the Project. This report identifies and evaluates the proposed water system infrastructure for serving the Project in accordance with City of Mesa design criteria. Estimated water demands for the Project have been calculated based on the proposed land uses and current City design criteria. This report also identifies the anticipated average day, maximum day, peak hour, and maximum day plus fire flow demands.

The Project lies within the Desert Wells water service zone. The proposed water system has been designed in accordance with current City of Mesa design criteria as outlined in the City's *Engineering Procedure Manual: 2017 Engineering & Design Standards* (City of Mesa, 2017). The average day, maximum day, and peak hour demands anticipated for the Project are 527,562 gpd (366.4 gpm), 894,964 gpd (621.5 gpm), and 1,262,366 gpd (876.6 gpm), respectively.

The water system identified in this report will comprise the backbone of the Project's water system and consists of proposed looped 8-inch water distribution mains. The Project will be served by the Brown Road Water Treatment Plant (BRWTP) and the Signal Butte Water Treatment Plant (SBWTP). It is anticipated that the water infrastructure serving the Project will be owned and operated by the City of Mesa.

The Project is anticipated to be developed in phases and the water system infrastructure will similarly be constructed in phases as required to serve each parcel in the Project. As such, the offsite water infrastructure required to serve the Project will be constructed at the same time each parcel is developed. Furthermore, the water mains that are installed in each phase will be sized for build-out conditions.

A hydraulic model was prepared for the proposed water system for average day, maximum day, peak hour, and maximum day plus fire flow conditions. The model results show the proposed water system meets current City of Mesa design criteria and can adequately convey projected demands throughout the development.

2.0 INTRODUCTION

1.1 Background and Project Location

Levine General Motors 170 (the Project) is located in the City of Mesa (the City) within Section 35 of Township 1 South, Range 7 East of the Gila and Salt River Base and Meridian. The Project is comprised of an approximate 157.2-acre mixed-use development in the larger Pacific Proving Grounds development. The Project is generally bound by Williams Field Road on the north, Crismon Road on the west, the future SR-24 alignment on the south, and 22nd Street on the east.

Figure 1 in Appendix A provides a vicinity map for the Project.

1.2 General Description

The Project is planned as a mixed-use development, which will include single family, medium density, and high density residential areas, parks and open space, along with commercial areas. The site currently consists completely of undeveloped desert rangeland. The site generally slopes from east to west at approximately 0.4 percent. Portions of the Project are within the City limits, with the remaining area under the jurisdiction of Maricopa County. It is assumed the areas within Maricopa County will be annexed into the City of Mesa and a General Plan Amendment and PAD Rezone will be processed and approved by the City.

The Project is located within the City of Mesa water service area within the Desert Wells service zone (pressure zone). Water infrastructure for the Project will be owned and operated by the City of Mesa.

1.3 Purpose of Report

This Master Water Report has been prepared in support of the General Plan Amendment for Levine General Motors 170. The purpose of this Master Water Report is to identify and evaluate the proposed water infrastructure and distribution system required to serve the Project based on the current land use plan and current City of Mesa design standards.

This report identifies the projected water demands for the Project for average day, maximum day, peak hour, and maximum day plus fire flow conditions. It also presents results from a hydraulic model of the proposed water infrastructure. The demand calculations presented in this Master Water Report are based on the current land uses planned for each parcel. As the Project progresses into the pre-plat phase, the demand calculations for the Project will be refined and the projected demands may change. The water analysis presented in this report is based on the City of Mesa *Engineering Procedure Manual: 2017 Engineering & Design Standards* (City of Mesa, 2017).

1.4 Previous Studies

There are no known previous water studies or plans for the Project site.

3.0 DESIGN CRITERIA

3.1 City of Mesa Design Criteria

The proposed water system for the Project has been designed in accordance with current City of Mesa design criteria as outlined in the City of Mesa *Engineering Procedure Manual: 2017 Engineering & Design Standards* (City of Mesa, 2017). A summary of the design criteria is provided in Table 1.

TABLE 1 WATER SYSTEM DESIGN CRITERIA			
Category		Value	Unit
Population Density			
	Medium Density Residential (LDR) (2-4 DU/acre)	3.0	per dwelling unit
	Medium Density Residential (LMDR) (4-6 DU/acre)	3.2	per dwelling unit
	Medium Density Residential (MDR) (6-10 DU/acre)	2.7	per dwelling unit
	High Density Residential (MHDR) (10-15 DU/acre)	2.0	per dwelling unit
	High Density Residential (HDR) (15+ DU/acre)	1.7	per dwelling unit
Demand Factors			
	Medium Density Residential (LDR) (2-4 DU/acre)	420	gpd/du
	Medium Density Residential (LMDR) (4-6 DU/acre)	400	gpd/du
	Medium Density Residential (MDR) (6-10 DU/acre)	254	gpd/du
	High Density Residential (MHDR) (10-15 DU/acre)	194	gpd/du
	High Density Residential (HDR) (15+ DU/acre)	154	gpd/du
	Commercial, Office, Industrial, Research & Development	1,500	gpad
Peaking Factors			
	Maximum Day	2.0	x Average Day Demand
	Peak Hour	3.0	x Average Day Demand
Peaking Factors (Developed Open Space)			
	Maximum Day	N/A	
	Peak Hour	N/A	
Average Day, Maximum Day, and Peak Hour System Performance			
	Minimum Pressure (static)	40	psi
	Maximum Pressure*	80	psi
	Maximum Velocity	5	fps
Maximum Day + Fire Flow System Performance			
	Minimum Pressure	20	psi
	Maximum Velocity	10	fps
	Residential Fire Flow**	1,500	gpm for 2 hours
	Commercial/Industrial Fire Flow**	3,000	gpm for 2 hours
Minimum Pipe Diameter		8	inches
Hazen Williams 'C' Factor		130	

Notes:
*Any structure experiencing pressures greater than 80 psi shall have an individual PRV.
** Fire Flow based on City of Mesa Fire Code

4.0 WATER DEMANDS

4.1 Land Use

The Project will consist of up to 1,191 residential units and up to 11.0 acres of non-residential commercial uses. The Project will also incorporate approximately 36.4 acres of open space including parks and amenities. Land use allocations and densities are assumed from the *Levine General Motors 170 Community Plan* (Greey Pickett, 2018). Figure 2 in Appendix A shows the anticipated land uses and densities throughout the Project. Table 2 below summarizes these anticipated land uses and Table B.1 in Appendix B shows the land use budget for each parcel within the Project. Land uses, areas, densities, and dwelling unit counts are subject to change as the Project moves from master planning to preliminary and final design.

TABLE 2
PROPOSED LAND USE SUMMARY

Parcel	Proposed Land Use	Gross Area	Open Space	Assumed Density	Potential Dwelling Units	Commercial Area
		(ac)	(ac)	(du/ac)	(du)	(ac)
A	Commercial	11.0	1.1	-	-	11.0
B	High Density Residential (HDR)	7.0	1.4	20.0	140	-
C	High Density Residential (HDR)	11.0	2.2	20.0	220	-
D	Medium Density Residential (MDR)	13.5	2.7	10.0	135	-
E	Low/Medium Density Residential (LMDR)	9.3	1.9	6.0	56	-
F	Low/Medium Density Residential (LMDR)	10.4	2.1	6.0	63	-
G	Low/Medium Density Residential (LMDR)	12.3	2.5	6.0	74	-
H	Low/Medium Density Residential (LMDR)	8.8	1.8	6.0	53	-
I	Low/Medium Density Residential (LMDR)	18.2	3.7	6.0	110	-
J	Low/Medium Density Residential (LMDR)	13.8	2.8	6.0	83	-
K	Low/Medium Density Residential (LMDR)	11.8	2.4	6.0	71	-
L	Low/Medium Density Residential (LMDR)	11.2	2.3	6.0	68	-
M	Medium Density Residential (MDR)	11.8	2.4	10.0	118	-
Parks	Parks/Open Space	7.1	7.1	-	-	-
GRAND TOTAL:		**157.2**	**36.4**	**-**	**1,191**	**11.0**

4.2 Water Demand Calculations

Anticipated water demands for the Project have been calculated in accordance with the design criteria listed in Table 1 and the land uses and densities listed in Table 2. A summary of the total water demands for the Project is presented in Table 3 below. Table B.1 in Appendix B presents more detailed water demand calculations for the Project.

TABLE 3 TOTAL WATER DEMAND SUMMARY						
Parcel	Average Day Demand		Maximum Day Demand		Peak Hour Demand	
	gpd	gpm	gpd	gpm	gpd	gpm
A	21,340	14.8	37,840	26.3	54,340	37.7
B	27,720	19.3	49,280	34.2	70,840	49.2
C	43,560	30.3	77,440	53.8	111,320	77.3
D	46,170	32.1	80,460	55.9	114,750	79.7
E	30,760	21.4	53,160	36.9	75,560	52.5
F	34,440	23.9	59,640	41.4	84,840	58.9
G	40,600	28.2	70,200	48.8	99,800	69.3
H	29,120	20.2	50,320	34.9	71,520	49.7
I	60,280	41.9	104,280	72.4	148,280	103.0
J	45,520	31.6	78,720	54.7	111,920	77.7
K	38,960	27.1	67,360	46.8	95,760	66.5
L	37,320	25.9	64,520	44.8	91,720	63.7
M	40,532	28.1	70,504	49.0	100,476	69.8
Parks	31,240	21.7	31,240	21.7	31,240	21.7
GRAND TOTAL:	**527,562**	**366.4**	**894,964**	**621.5**	**1,262,366**	**876.6**

5.0 WATER SYSTEM INFRASTRUCTURE

5.1 Water Service Zones

The Project falls entirely within the Desert Wells service zone. The service zone boundary generally runs north-south along Ellsworth Road and along the SR-24 alignment north of Ray Road. All parcels west of this service zone boundary fall within the Falcon Field service zone while parcels east of this boundary fall within the Desert Wells service zone. This service zone boundary is shown on Figure 2 in Appendix A.

5.2 Existing Desert Wells Water System Infrastructure

Water for the Desert Wells service zone is sourced from the Central Arizona Project and a network of wells distributed throughout the area. Water treatment is currently provided by the CAP Brown Road Water Treatment Plant and the Signal Butte Water Treatment Plant (SBWTP).

As shown in Figure 2 in Appendix A, existing water infrastructure in the Project vicinity includes 16-inch water mains in Ellsworth Road, Ray Road, Eastmark Parkway, and Pecos Road. Similarly, a 16-inch water main exists in Crismon Road for approximately 2,180 feet south of Ray Road to stub out just south of Tucaman Ave. The southern 1,000 feet of this 16-inch water main is newly installed and currently waiting for

acceptance from the City. A 12-inch water main exists within Cadence Parkway. 24-inch water mains exist in Signal Butte Road from Ray Road to Williams Field Road and along Williams Field Road from Signal Butte Road to Crismon Road. These 24-inch water mains are in the ground, however, have not been accepted by the City. The City plans to accept and incorporate these water mains in early 2019.

5.3 Proposed Water System Improvements

As shown on Figure 2 in Appendix A, the Project will be served by a network of looped 8-inch water mains. The Project will require connections to the existing water system at the existing 24-inch water main in Williams Field Road and at the existing 16-inch water main in Crismon Road. Stub outs for adjoining offsite developments are anticipated. The locations of these stub outs will be identified during the preliminary and final design stages.

5.4 City Required Water Main Upsizing

Per discussions with the City of Mesa and requirements set forth in the *Engineering Procedure Manual: 2017 Engineering & Design Standards* (City of Mesa, 2017), certain water mains within the Project must be upsized. While Figure 2 in Appendix A illustrates the minimum pipe sizing required to meet the demands, pressures, and fire flows of the Project, Figure 3 in Appendix A illustrates the necessary upsizing of specific water mains to meet the City's design and future water resources planning requirements. Listed below are the changes as noted on Figure 2 in Appendix A and illustrated in Figure 3 in Appendix A:

- A 24-inch water main is required in Williams Field Road along the entire northern boundary of the Project. A 24-inch water main is also required along the Crismon Road frontage of the Project south of William Fields Road.
- All lateral connections to transmission mains 24-inch and larger must be a minimum of 12-inches.
- All mile streets have 16-inch water mains and all ½-mile streets have 12-inch water mains.
    - Crismon Road is a one-mile street and pipes in Crismon Road will need to be upsized to 16-inches.
    - Although 222nd Street is not a half-mile or one-mile street, the City is requiring that the water main in 222nd Street be 12-inches in diameter and extend along the entire frontage of the Project.

5.5 Water Improvements Phasing

It is anticipated that the Project will be developed in several phases. The water mains required to serve each phase will similarly be constructed in phases as required to adequately serve each phase of development. For any given phase, the offsite water infrastructure required to serve that phase will be constructed at the same time as said phase is developed. Furthermore, the water mains that are installed will be sized for build-out conditions, will provide adequate looping in the water system (i.e. two points of connection), and will meet the required fire flows for the area that is developed.

6.0 HYDRAULIC MODEL AND RESULTS

6.1 Design Methodology

The proposed system was modeled using WaterCAD V8i by Bentley Systems, Inc. Five scenarios were modeled: average day, maximum day, peak hour, residual fire flow plus maximum day conditions, and available fire flow during maximum day conditions. A residual fire flow analysis applies the required fire flow to each corresponding junction in the system to confirm the system's ability to meet the minimum pressure and maximum velocity requirements while providing the required fire flow during maximum day conditions. The available fire flow analysis estimates the maximum flow available at each junction while maintaining the minimum allowable residual pressure throughout the proposed system during maximum day conditions.

Figure 2 in Appendix A provides an overview of the minimum required water system improvements for the Project and forms the basis for the hydraulic modeling results expressed in Section 6.2. Figure 3 in Appendix A illustrates the necessary improvements required by the City to meet City design and master planning criteria.

A hydrant flow test was conducted along the existing 16-inch offsite water main in Ray Road at the intersection of Crismon Road on February 14, 2019 at 7:36 AM by EJ Flow Tests, LLC, to identify existing system pressures in the Project vicinity. The hydrant flow test was performed by flowing two hydrants along the 16-inch water main. The flow test results at this location show a static pressure of 84.0 psi and a residual pressure of 74.0 psi at a total flow of 2,123 gpm. The flow test results and associated pump curves are located in Appendix C of this report. The flow test results were used to establish the boundary conditions for the hydraulic model of the existing and proposed water infrastructure to serve the Project.

6.2 Hydraulic Model Results

Detailed hydraulic model results for the Project are provided in Appendix D. Table 4 below summarizes the results. As shown in the table and results, pressures throughout the modeled area remained between 73.6 psi and 91.7 psi for the domestic scenarios modeled. Velocities and head losses for the peak hour scenario fall within the allowable limits established in Table 1. Furthermore, the fire flow analysis showed that the proposed system can adequately provide the required fire flow while maintaining a residual pressure of at least 20 psi. A single junction, Junction J-17, falls slightly short of the required 3,000 gpm available fire flow for the commercial sector, with an available fire flow of 2,963.4 gpm when using a maximum velocity of 10 fps. However, if the maximum allowable velocity is increased slightly to 10.3 fps, J-17 will meet and exceed the required 3,000 gpm of fire flow. Although fire flow is modeled here at a conservative 3,000 gpm, the actual required fire flow is anticipated to be lower as fire flows will be based on building size and type as the Project moves from master planning to preliminary and final design.

The hydraulic modeling summary detailed below is for the minimum required pipe sizes needed to serve the Project and based on Figure 2 in Appendix A. Upsizing

pipes as required by the City will result in increased pressures and available flows in the modeled area.

TABLE 4
HYDRAULIC MODELING SUMMARY

	Average Day		Maximum Day		Peak Hour	
	Value	**Location**	**Value**	**Location**	**Value**	**Location**
Minimum Pressure (psi)	75.3	J-3	74.6	J-3	73.6	J-3
Maximum Pressure (psi)	91.7	J-17	90.8	J-17	89.5	J-17
Maximum Velocity (fps)	1.00	P-64, P-65	1.69	P-64, P-65	2.39	P-64, P-65
Maximum Head loss (feet/1,000 feet of pipe)	0.589	P-65	1.563	P-64, P-65	2.954	P-64

Maximum Day Demand + Fire Flow - Residual			
	Value	**Location**	**Fire Flow Location and Flow**
Minimum Residual Pressure (psi)	44.0	J-17	J-17 @ 2,963.4 GPM
Maximum Velocity (fps)	10.0	P-24	J-17 @ 2,963.4 GPM

Maximum Day Demand + Fire Flow - Available		
	Value	**Location**
Minimum Available Fire Flow - Residential (gpm)	1,780.6	J-48
Minimum Available Fire Flow - Commercial (gpm)**	2,963.4	J-17

Notes:
* Full model results are provided in Appendix D.
** See explanation of fire flow model results in Section 6.2 of this report.

7.0 CONCLUSIONS

The proposed water system will adequately serve the Project. This report has determined that:

- The average day, maximum day, and peak hour demands anticipated for the Project are 527,562 gpd (366.4 gpm), 894,964 gpd (621.5 gpm), and 1,262,366 gpd (876.6 gpm), respectively.
- The hydraulic model shows that the Project can be adequately served by the proposed system of 8-inch water mains, with connections to the existing 16-inch and 24-inch water mains in Crismon Road and Williams Field Road, respectively.
- Hydraulic model results show that pressures, velocities, and head losses for the proposed system fall within the allowable limits established by the City of Mesa during the domestic scenarios modeled.
- The proposed system can provide the required 1,500 gpm residential and 3,000 gpm commercial fire flow while maintaining the minimum required residual pressure of 20 psi.

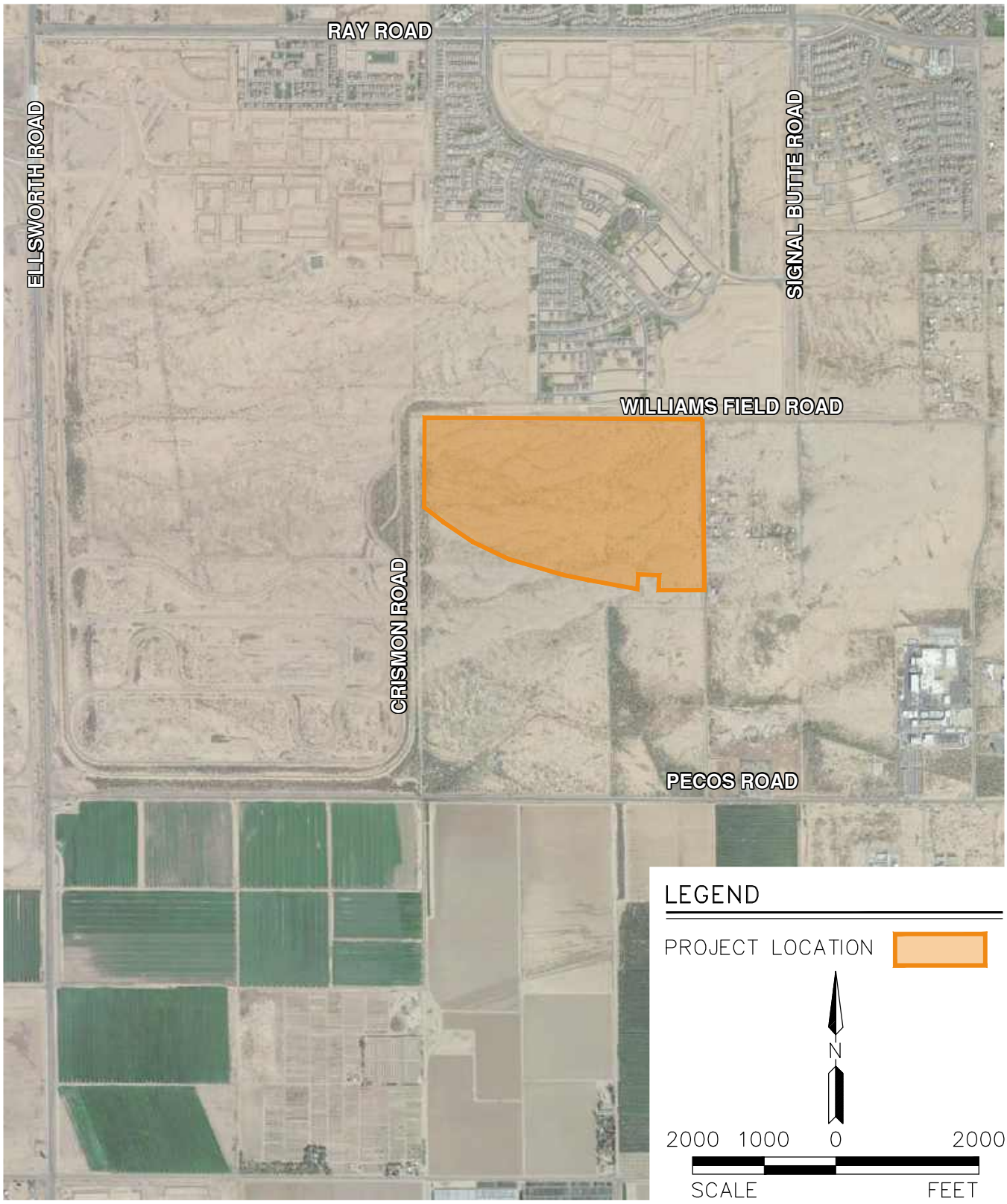
- The City will require upsizing of the proposed offsite water mains to meet City standards and master planning criteria.

8.0 REFERENCES

City of Mesa. (2017). *Engineering Procedure Manual: 2017 Engineering & Design Standards*. 2017, Mesa, AZ

APPENDIX A

FIGURES



PROJ.NO.:	2063
DATE:	FEB 2019
SCALE:	1" = 2,000'
DRAWN BY:	SL
CHECKED BY:	BB

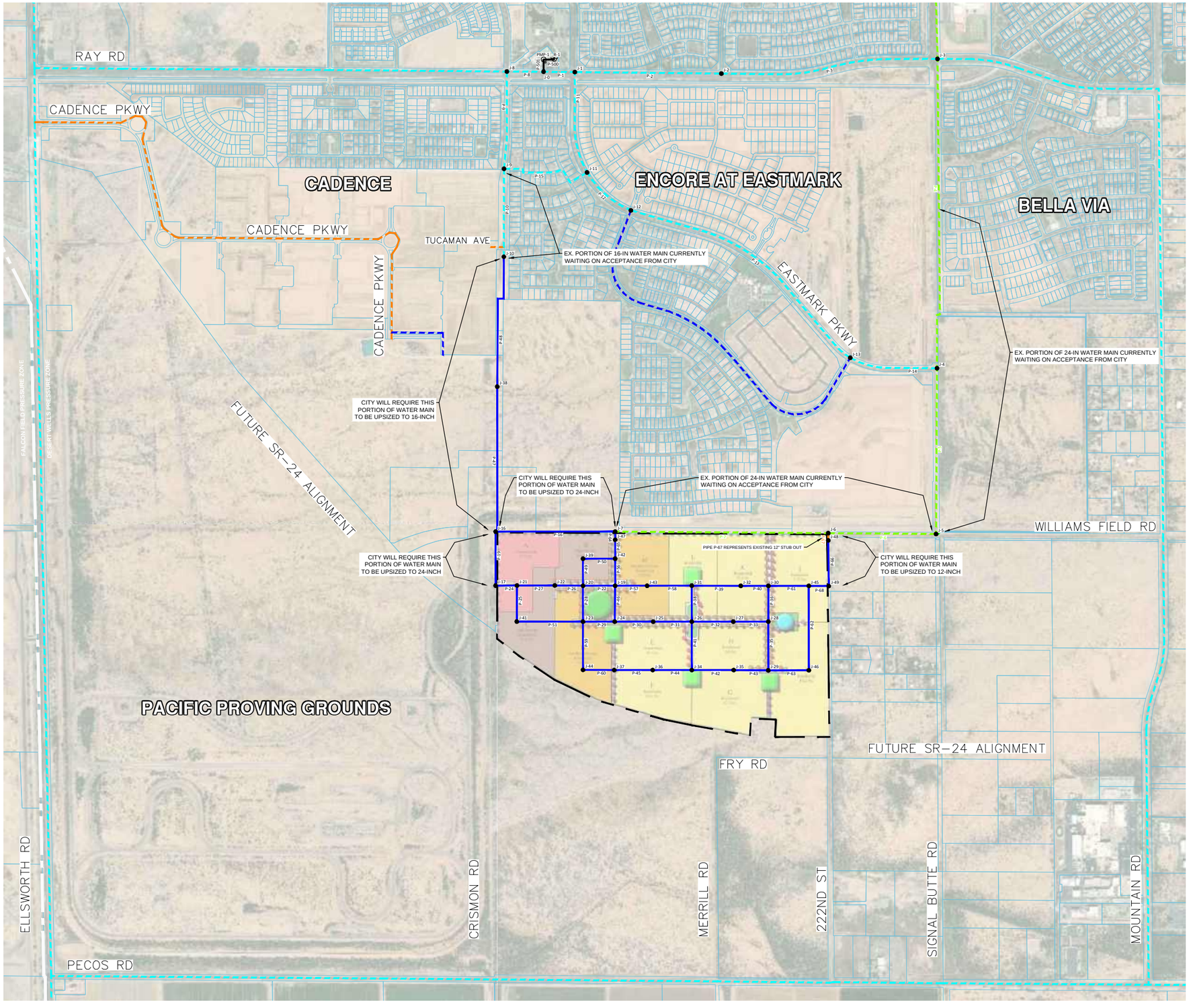
LEVINE GM 170

SEC CRISMON RD & WILLIAMS FIELD RD
MESA, ARIZONA

FIG 1: VICINITY MAP

HILGARTWILSON
2141 E. HIGHLAND AVE., STE. 250
PHOENIX, AZ 85016
P: 602.490.0535 / F: 602.368.2436

U:\2000\2063\ENGR\EXHIBITS\2063 FIG 1 – Vicinity Map.dwg 2/18/2019 1:23 PM



LEGEND

- PROJECT BOUNDARY
- PRESSURE ZONE BOUNDARY
- PROPOSED WATER MAIN
- EXISTING WATER MAIN
- FUTURE WATER MAIN
- JUNCTION
- RESERVOIR
- PUMP

PIPE DIAMETER LEGEND
8.0 INCHES
12.0 INCHES
16.0 INCHES
24.0 INCHES

NOTES

1) LAND USE PLAN IS CONCEPTUAL AND SUBJECT TO CHANGE.
2) WATER MAIN ALIGNMENTS ARE CONCEPTUAL AND SUBJECT TO CHANGE.

N

1200 600 0 1200
SCALE FEET

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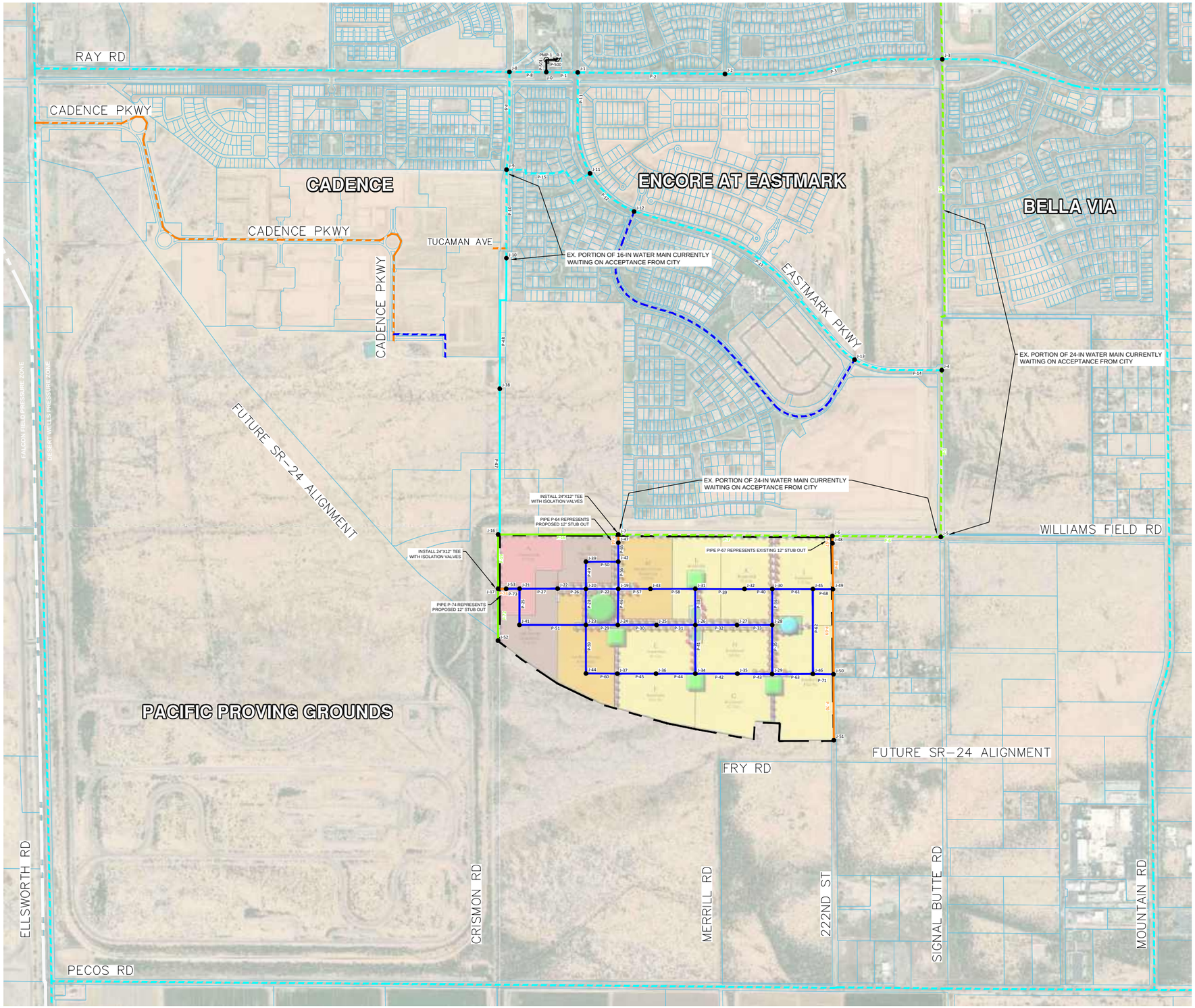
LEVINE GM 170
WILLIAMS FIELD RD & CRISMON RD
MESA, AZ

FIG 2: MINIMUM REQUIRED WATER SYSTEM IMPROVEMENTS

PROJ. NO.:	2063
DATE:	MAY 2019
SCALE:	1"=1200'
DRAWN BY:	MAJ
CHECKED BY:	MI



LEGEND

- PROJECT BOUNDARY
- PRESSURE ZONE BOUNDARY
- PROPOSED WATER MAIN
- EXISTING WATER MAIN
- FUTURE WATER MAIN
- JUNCTION
- RESERVOIR
- PUMP

PIPE DIAMETER LEGEND
8.0 INCHES
12.0 INCHES
16.0 INCHES
24.0 INCHES

NOTES

1) LAND USE PLAN IS CONCEPTUAL AND SUBJECT TO CHANGE.
2) WATER MAIN ALIGNMENTS ARE CONCEPTUAL AND SUBJECT TO CHANGE.

N

1200 600 0 1200
SCALE FEET

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LEVINE GM 170
WILLIAMS FIELD RD & CRISMON RD
MESA, AZ

FIG 3: CITY REQUIRED WATER SYSTEM IMPROVEMENTS

PROJ. NO.: 2063
DATE: MAY 2019
SCALE: 1"=1200'
DRAWN BY: MAJ
CHECKED BY: MI

APPENDIX B

SUPPLEMENTARY TABLES

Table B.1 - Water Demand Calculations

General Motors Levine 170

Mesa, Arizona
May, 2019

Calculated By: MAJ
Checked By: MI

Parcel Label	Land Use	Gross Area	Open Space[6]	Assumed Density	Potential Dwelling Units	Commercial Area	Population	Average Day Demand				Max Day Demand		Peak Hour Demand	
								Land Use	Open Space	Total					
		(ac)	(ac)	(du/ac)	(du)	(ac)		(gpd)	(gpd)	(gpd)	(gpm)	(gpd)	(gpm)	(gpd)	(gpm)
A	Commercial	11.0	1.1	-	-	11.0	-	16,500	4,840	21,340	14.8	37,840	26.3	54,340	37.7
B	HDR	7.0	1.4	20.0	140	-	238	21,560	6,160	27,720	19.3	49,280	34.2	70,840	49.2
C	HDR	11.0	2.2	20.0	220	-	374	33,880	9,680	43,560	30.3	77,440	53.8	111,320	77.3
D	MDR	13.5	2.7	10.0	135	-	365	34,290	11,880	46,170	32.1	80,460	55.9	114,750	79.7
E	LMDR	9.3	1.9	6.0	56	-	179	22,400	8,360	30,760	21.4	53,160	36.9	75,560	52.5
F	LMDR	10.4	2.1	6.0	63	-	202	25,200	9,240	34,440	23.9	59,640	41.4	84,840	58.9
G	LMDR	12.3	2.5	6.0	74	-	237	29,600	11,000	40,600	28.2	70,200	48.8	99,800	69.3
H	LMDR	8.8	1.8	6.0	53	-	170	21,200	7,920	29,120	20.2	50,320	34.9	71,520	49.7
I	LMDR	18.2	3.7	6.0	110	-	352	44,000	16,280	60,280	41.9	104,280	72.4	148,280	103.0
J	LMDR	13.8	2.8	6.0	83	-	266	33,200	12,320	45,520	31.6	78,720	54.7	111,920	77.7
K	LMDR	11.8	2.4	6.0	71	-	227	28,400	10,560	38,960	27.1	67,360	46.8	95,760	66.5
L	LMDR	11.2	2.3	6.0	68	-	218	27,200	10,120	37,320	25.9	64,520	44.8	91,720	63.7
M	MDR	11.8	2.4	10.0	118	-	319	29,972	10,560	40,532	28.1	70,504	49.0	100,476	69.8
Parks	Open Space	7.1	7.1	-	-	-	-	0	31,240	31,240	21.7	31,240	21.7	31,240	21.7
GRAND TOTAL:		**157.2**	**36.4**	**-**	**1,191**	**11.0**	**3,145**	**367,402**	**160,160**	**527,562**	**366.4**	**894,964**	**621.5**	**1,262,366**	**876.6**

Notes:

Demand Factors:

Medium Density Residential (LDR):	420	gal/dwelling unit/day
Medium Density Residential (LMDR):	400	gal/dwelling unit/day
Medium Density Residential (MDR):	254	gal/dwelling unit/day
High Density Residential (MHDR):	194	gal/dwelling unit/day
High Density Residential (HDR):	154	gal/dwelling unit/day
High Density Condominium:	185	gal/dwelling unit/day
Commercial[3]:	1,500	gal/acre/day
Office[3]:	1,500	gal/acre/day
Turf/Irrigation:	4,400	gallons/acre/day

Density:

2 - 4	du/ac
4 - 6	du/ac
6 - 10	du/ac
10 - 15	du/ac
15 +	du/ac

Population Factor:

3.0	Persons/du
3.2	Persons/du
2.7	Persons/du
2.0	Persons/du
1.7	Persons/du
1.7	Persons/du

Peaking Factors:

Maximum Day Demand:	2.0	x Average Day Demand
Peak Hour Demand:	3.0	x Average Day Demand

Fire Flow[4]:

Residential:	1,500 gpm	for 2 hours
Commercial:	3,000 gpm	for 2 hours

(1) Demand factors from the Engineering Procedure Manual - Engineering & Design Standards (City of Mesa, 2017).
(2) Values shown include inside and outside water use.
(3) Commercial/Office demand factor averaged from surrounding towns as City of Mesa standard is determined by actual square footage of building.
(4) Fire Flow assumed from City of Mesa Fire Code for general planning. Actual fire flow will be based on building size/type as these become known in preliminary/final design.
(5) Park/Open Space demands are not peaked as demands are anticipated to remain constant.
(6) Open space values assumed at 10% of the gross area for commercial parcels and 20% of the gross area for residential parcels.

APPENDIX C
HYDRANT FLOW TEST & PUMP CURVE

Flow Test Summary

Project Name:	EJFT 19034
Project Address:	10040 E Ray Rd, Mesa, AZ 85212
Date of Flow Test:	2019-02-14
Time of Flow Test:	7:36 AM
Data Reliable Until:	2019-08-14
Conducted By:	Austin Gourley & Eder Cueva (EJ Flow Tests) 602.999.7637
Witnessed By:	Wes Price (City of Mesa) 480.826.9666
City Forces Contacted:	City of Mesa (480.826.9666)
Permit Number:	ROW19-01563

Raw Flow Test Data

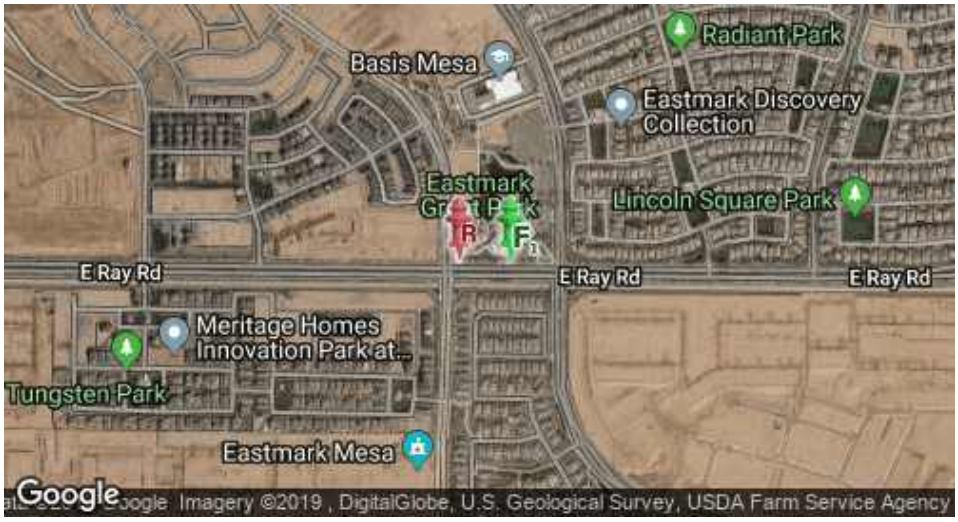
Static Pressure:	84.0 PSI
Residual Pressure:	74.0 PSI
Flowing GPM:	2,123
GPM @ 20 PSI:	5,785

Data with a 10 % Safety Factor

Static Pressure:	75.6 PSI
Residual Pressure:	65.6 PSI
Flowing GPM:	2,123
GPM @ 20 PSI:	5,362

Hydrant F_1

Pitot Pressure (1):	40	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	2.5	inches
Pitot Pressure (2):	40	PSI
Coefficient of Discharge (2):	0.9	
Hydrant Orifice Diameter (2):	2.5	inches



Static-Residual Hydrant

Flow Hydrant

Main Size
16 inches

Distance Between F_1 and R
356 ft (measured linearly)

Static-Residual Elevation
1423 ft (above sea level)

Flow Hydrant (F_1) Elevation
1423 ft (above sea level)

Elevation & distance values are approximate

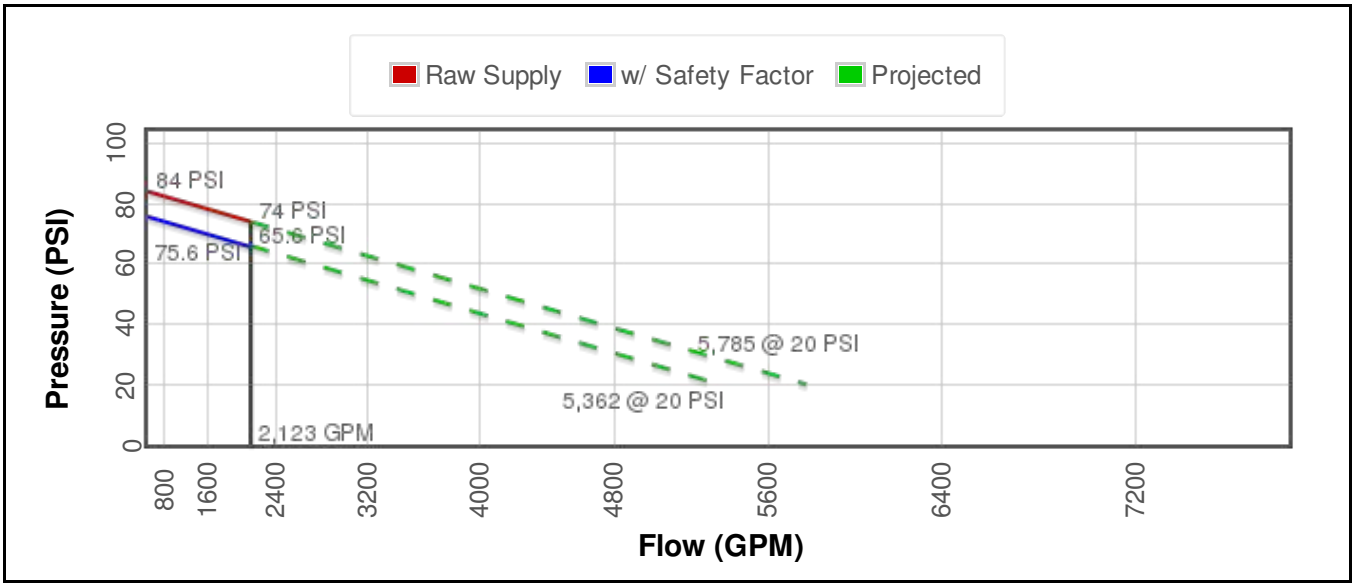
Flow Test Summary

Static-Residual Hydrant

Flow Hydrant (only hydrant F1 shown for clarity)

Approximate Project Site

Water Supply Curve $N^{1.85}$ Graph



FLOW TEST PUMP CURVE

Levine General Motors 170
Mesa, AZ
Flow Test Date: February 14, 2019 (7:36 AM)

HILGARTWILSON
ENGINEER | PLAN | SURVEY | MANAGE

Fire Flow Test Results

Static Pressure at Test Hydrant (psi)	84
Residual Pressure at Test Hydrant (psi)	74
Total Discharge at Flowed Hydrants, Qf (gpm)	2,123

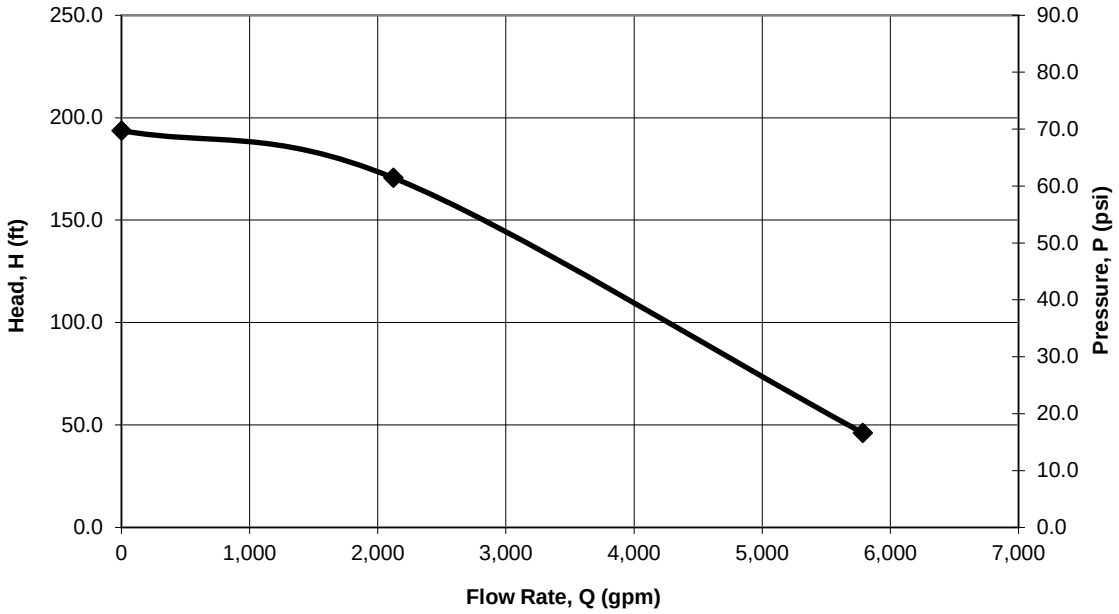
Calculations

Desired Fire Flow Residual Pressure (psi)	20.0
Pressure Drop During Test, hf (psi)	10.0
Pressure Drop During Test (%)	12%
Pressure Drop at Desired Residual Pressure, hr (psi)	64.0
Available Flow at Desired Residual Pressure, Qr (gpm)	5,785

Pump Curve

Q (gpm)	P (psi)	H (ft)
0	84.0	193.7
2,123	74.0	170.6
5,785	20.0	46.1

Pump Curve Extrapolated from Fire Flow Test Results



APPENDIX D
HYDRAULIC MODEL RESULTS

AVERAGE DAY DEMAND

FlexTable: Junction Table

Label	Elevation (ft)	Demand (gal/min)	Hydraulic Grade (ft)	Pressure (psi)
J-0	1,422.60	0.0	1,615.80	83.6
J-1	1,424.89	0.0	1,615.79	82.6
J-2	1,431.46	0.0	1,615.75	79.7
J-3	1,441.63	0.0	1,615.69	75.3
J-4	1,430.00	0.0	1,615.68	80.3
J-5	1,427.59	0.0	1,615.66	81.4
J-6	1,423.19	0.0	1,615.65	83.3
J-7	1,409.40	0.0	1,615.64	89.2
J-8	1,421.62	0.0	1,615.80	84.0
J-9	1,419.65	0.0	1,615.79	84.9
J-10	1,410.00	0.0	1,615.78	89.0
J-11	1,421.82	0.0	1,615.78	83.9
J-12	1,421.62	0.0	1,615.77	84.0
J-13	1,424.00	0.0	1,615.70	82.9
J-16	1,404.78	0.0	1,615.57	91.2
J-17	1,403.52	0.0	1,615.45	91.7
J-19	1,409.85	2.7	1,615.38	88.9
J-20	1,408.12	2.7	1,615.39	89.7
J-21	1,404.70	14.8	1,615.40	91.2
J-22	1,406.46	0.0	1,615.39	90.4
J-23	1,408.73	2.7	1,615.36	89.4
J-24	1,409.87	2.7	1,615.36	88.9
J-25	1,411.00	0.0	1,615.34	88.4
J-26	1,413.00	0.0	1,615.31	87.5
J-27	1,415.00	0.0	1,615.31	86.7
J-28	1,416.57	2.7	1,615.31	86.0
J-29	1,417.00	2.7	1,615.29	85.8
J-30	1,417.89	0.0	1,615.32	85.4
J-31	1,414.60	28.6	1,615.31	86.8
J-32	1,416.00	27.1	1,615.31	86.2
J-34	1,413.00	2.7	1,615.29	87.5
J-35	1,415.51	48.4	1,615.28	86.4
J-36	1,411.71	45.3	1,615.28	88.1
J-37	1,410.25	0.0	1,615.29	88.7
J-38	1,406.20	0.0	1,615.68	90.6
J-39	1,409.29	19.3	1,615.41	89.2
J-41	1,404.61	30.3	1,615.37	91.2
J-42	1,409.82	0.0	1,615.45	89.0
J-43	1,411.87	28.1	1,615.34	88.0
J-44	1,409.00	32.1	1,615.30	89.3
J-45	1,420.17	31.6	1,615.35	84.4
J-46	1,418.43	41.9	1,615.29	85.2
J-47	1,410.31	0.0	1,615.58	88.8
J-48	1,422.65	0.0	1,615.64	83.5
J-49	1,421.20	0.0	1,615.44	84.0

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (Absolute) (gal/min)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-1	369	J-0	J-1	16	130.0	247.1	0.39	0.047
P-2	1,726	J-1	J-2	16	130.0	164.2	0.26	0.022
P-3	2,563	J-2	J-3	16	130.0	164.2	0.26	0.022
P-4	3,678	J-3	J-4	24	130.0	164.2	0.12	0.003
P-5	1,953	J-4	J-5	24	130.0	319.4	0.23	0.010
P-6	1,271	J-5	J-6	24	130.0	319.4	0.23	0.010
P-7	2,510	J-6	J-7	24	130.0	195.9	0.14	0.004
P-8	433	J-0	J-8	16	130.0	119.3	0.19	0.012
P-9	1,147	J-8	J-9	16	130.0	119.3	0.19	0.012
P-10	1,036	J-9	J-10	16	130.0	47.0	0.08	0.002
P-11	1,208	J-1	J-11	16	130.0	82.9	0.13	0.006
P-12	694	J-11	J-12	16	130.0	155.2	0.25	0.020
P-13	3,210	J-12	J-13	16	130.0	155.2	0.25	0.020
P-14	1,043	J-13	J-4	16	130.0	155.2	0.25	0.020
P-15	1,154	J-9	J-11	16	130.0	72.3	0.12	0.005
P-16	1,409	J-7	J-16	8	130.0	39.4	0.25	0.046
P-19	637	J-16	J-17	8	130.0	86.4	0.55	0.196
P-22	379	J-19	J-20	8	130.0	19.5	0.12	0.012
P-24	253	J-21	J-17	8	130.0	86.4	0.55	0.196
P-25	425	J-21	J-41	8	130.0	49.2	0.31	0.069
P-26	332	J-20	J-22	8	130.0	22.4	0.14	0.016
P-27	445	J-22	J-21	8	130.0	22.4	0.14	0.016
P-28	423	J-20	J-23	8	130.0	46.3	0.30	0.062
P-29	374	J-23	J-24	8	130.0	2.8	0.02	0.000
P-30	454	J-24	J-25	8	130.0	41.8	0.27	0.051
P-31	454	J-25	J-26	8	130.0	41.8	0.27	0.051
P-32	489	J-26	J-27	8	130.0	8.7	0.06	0.003
P-33	412	J-27	J-28	8	130.0	8.7	0.06	0.003
P-35	574	J-28	J-29	8	130.0	30.7	0.20	0.029
P-36	422	J-28	J-30	8	130.0	24.8	0.16	0.019
P-38	424	J-26	J-31	8	130.0	5.4	0.03	0.001
P-39	577	J-31	J-32	8	130.0	3.9	0.03	0.001
P-40	326	J-32	J-30	8	130.0	23.1	0.15	0.017
P-41	570	J-26	J-34	8	130.0	38.5	0.25	0.044
P-42	493	J-34	J-35	8	130.0	18.3	0.12	0.011
P-43	408	J-35	J-29	8	130.0	30.1	0.19	0.028
P-44	461	J-34	J-36	8	130.0	17.5	0.11	0.010
P-45	454	J-36	J-37	8	130.0	27.8	0.18	0.024
P-46	423	J-19	J-24	8	130.0	41.7	0.27	0.051
P-47	1,714	J-16	J-38	8	130.0	47.0	0.30	0.063
P-48	1,598	J-38	J-10	8	130.0	47.0	0.30	0.063
P-49	319	J-20	J-39	8	130.0	46.2	0.29	0.062
P-50	379	J-39	J-42	8	130.0	65.5	0.42	0.117
P-51	780	J-23	J-41	8	130.0	19.0	0.12	0.012
P-56	319	J-42	J-19	8	130.0	91.0	0.58	0.215
P-57	376	J-19	J-43	8	130.0	66.1	0.42	0.119
P-58	527	J-43	J-31	8	130.0	37.9	0.24	0.043
P-59	568	J-23	J-44	8	130.0	59.8	0.38	0.099
P-60	368	J-44	J-37	8	130.0	27.8	0.18	0.024

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (Absolute) (gal/min)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-61	475	J-30	J-45	8	130.0	47.9	0.31	0.066
P-62	995	J-45	J-46	8	130.0	44.0	0.28	0.056
P-63	478	J-46	J-29	8	130.0	2.1	0.01	0.000
P-64	97	J-7	J-47	8	130.0	156.4	1.00	0.588
P-65	222	J-47	J-42	8	130.0	156.4	1.00	0.589
P-66	538	J-49	J-48	8	130.0	123.5	0.79	0.380
P-67	85	J-48	J-6	12	130.0	123.5	0.35	0.053
P-68	234	J-45	J-49	8	130.0	123.5	0.79	0.380
P-500	125	R-1	PMP-1	36	130.0	366.4	0.12	0.002
P-501	143	PMP-1	J-0	36	130.0	366.4	0.12	0.002

Label	Elevation (ft)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gal/min)	Pump Head (ft)
PMP-1	1,422.60	1,423.00	1,615.80	366.4	192.80

FlexTable: Reservoir Table

Label	Elevation (ft)	Flow (Out net) (gal/min)	Hydraulic Grade (ft)
R-1	1,423.00	366.4	1,423.00

MAXIMUM DAY DEMAND

Label	Elevation (ft)	Demand (gal/min)	Hydraulic Grade (ft)	Pressure (psi)
J-0	1,422.60	0.0	1,614.32	82.9
J-1	1,424.89	0.0	1,614.27	81.9
J-2	1,431.46	0.0	1,614.17	79.0
J-3	1,441.63	0.0	1,614.02	74.6
J-4	1,430.00	0.0	1,613.99	79.6
J-5	1,427.59	0.0	1,613.94	80.6
J-6	1,423.19	0.0	1,613.90	82.5
J-7	1,409.40	0.0	1,613.87	88.5
J-8	1,421.62	0.0	1,614.30	83.4
J-9	1,419.65	0.0	1,614.27	84.2
J-10	1,410.00	0.0	1,614.26	88.4
J-11	1,421.82	0.0	1,614.25	83.3
J-12	1,421.62	0.0	1,614.22	83.3
J-13	1,424.00	0.0	1,614.05	82.2
J-16	1,404.78	0.0	1,613.70	90.4
J-17	1,403.52	0.0	1,613.37	90.8
J-19	1,409.85	2.7	1,613.19	88.0
J-20	1,408.12	2.7	1,613.21	88.7
J-21	1,404.70	26.3	1,613.24	90.2
J-22	1,406.46	0.0	1,613.22	89.5
J-23	1,408.73	2.7	1,613.14	88.4
J-24	1,409.87	2.7	1,613.14	87.9
J-25	1,411.00	0.0	1,613.07	87.4
J-26	1,413.00	0.0	1,613.01	86.5
J-27	1,415.00	0.0	1,613.01	85.7
J-28	1,416.57	2.7	1,613.01	85.0
J-29	1,417.00	2.7	1,612.96	84.8
J-30	1,417.89	0.0	1,613.03	84.4
J-31	1,414.60	47.5	1,613.01	85.8
J-32	1,416.00	46.8	1,613.01	85.2
J-34	1,413.00	2.7	1,612.95	86.5
J-35	1,415.51	83.7	1,612.93	85.4
J-36	1,411.71	78.3	1,612.93	87.1
J-37	1,410.25	0.0	1,612.96	87.7
J-38	1,406.20	0.0	1,613.99	89.9
J-39	1,409.29	34.2	1,613.26	88.2
J-41	1,404.61	53.8	1,613.16	90.2
J-42	1,409.82	0.0	1,613.38	88.1
J-43	1,411.87	49.0	1,613.07	87.0
J-44	1,409.00	55.9	1,612.98	88.3
J-45	1,420.17	54.7	1,613.11	83.5
J-46	1,418.43	72.4	1,612.96	84.2
J-47	1,410.31	0.0	1,613.72	88.0
J-48	1,422.65	0.0	1,613.89	82.7
J-49	1,421.20	0.0	1,613.35	83.1

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (Absolute) (gal/min)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-1	369	J-0	J-1	16	130.0	419.1	0.67	0.125
P-2	1,726	J-1	J-2	16	130.0	278.5	0.44	0.058
P-3	2,563	J-2	J-3	16	130.0	278.5	0.44	0.058
P-4	3,678	J-3	J-4	24	130.0	278.5	0.20	0.008
P-5	1,953	J-4	J-5	24	130.0	541.7	0.38	0.028
P-6	1,271	J-5	J-6	24	130.0	541.7	0.38	0.028
P-7	2,510	J-6	J-7	24	130.0	332.1	0.24	0.011
P-8	433	J-0	J-8	16	130.0	202.4	0.32	0.032
P-9	1,147	J-8	J-9	16	130.0	202.4	0.32	0.032
P-10	1,036	J-9	J-10	16	130.0	79.8	0.13	0.006
P-11	1,208	J-1	J-11	16	130.0	140.6	0.22	0.016
P-12	694	J-11	J-12	16	130.0	263.3	0.42	0.053
P-13	3,210	J-12	J-13	16	130.0	263.3	0.42	0.053
P-14	1,043	J-13	J-4	16	130.0	263.3	0.42	0.053
P-15	1,154	J-9	J-11	16	130.0	122.6	0.20	0.013
P-16	1,409	J-7	J-16	8	130.0	67.0	0.43	0.122
P-19	637	J-16	J-17	8	130.0	146.7	0.94	0.522
P-22	379	J-19	J-20	8	130.0	32.6	0.21	0.032
P-24	253	J-21	J-17	8	130.0	146.7	0.94	0.523
P-25	425	J-21	J-41	8	130.0	83.9	0.54	0.185
P-26	332	J-20	J-22	8	130.0	36.6	0.23	0.040
P-27	445	J-22	J-21	8	130.0	36.6	0.23	0.040
P-28	423	J-20	J-23	8	130.0	78.5	0.50	0.164
P-29	374	J-23	J-24	8	130.0	3.0	0.02	0.000
P-30	454	J-24	J-25	8	130.0	71.1	0.45	0.136
P-31	454	J-25	J-26	8	130.0	71.1	0.45	0.137
P-32	489	J-26	J-27	8	130.0	14.2	0.09	0.007
P-33	412	J-27	J-28	8	130.0	14.2	0.09	0.007
P-35	574	J-28	J-29	8	130.0	52.7	0.34	0.078
P-36	422	J-28	J-30	8	130.0	41.3	0.26	0.050
P-38	424	J-26	J-31	8	130.0	8.9	0.06	0.003
P-39	577	J-31	J-32	8	130.0	7.5	0.05	0.002
P-40	326	J-32	J-30	8	130.0	39.3	0.25	0.045
P-41	570	J-26	J-34	8	130.0	65.8	0.42	0.118
P-42	493	J-34	J-35	8	130.0	31.7	0.20	0.030
P-43	408	J-35	J-29	8	130.0	52.0	0.33	0.077
P-44	461	J-34	J-36	8	130.0	31.4	0.20	0.030
P-45	454	J-36	J-37	8	130.0	46.9	0.30	0.063
P-46	423	J-19	J-24	8	130.0	70.8	0.45	0.135
P-47	1,714	J-16	J-38	8	130.0	79.8	0.51	0.169
P-48	1,598	J-38	J-10	8	130.0	79.8	0.51	0.169
P-49	319	J-20	J-39	8	130.0	77.2	0.49	0.159
P-50	379	J-39	J-42	8	130.0	111.4	0.71	0.314
P-51	780	J-23	J-41	8	130.0	30.1	0.19	0.028
P-56	319	J-42	J-19	8	130.0	153.8	0.98	0.570
P-57	376	J-19	J-43	8	130.0	112.9	0.72	0.321
P-58	527	J-43	J-31	8	130.0	63.9	0.41	0.112
P-59	568	J-23	J-44	8	130.0	102.8	0.66	0.270
P-60	368	J-44	J-37	8	130.0	46.9	0.30	0.063

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (Absolute) (gal/min)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-61	475	J-30	J-45	8	130.0	80.5	0.51	0.172
P-62	995	J-45	J-46	8	130.0	74.4	0.47	0.149
P-63	478	J-46	J-29	8	130.0	2.0	0.01	0.000
P-64	97	J-7	J-47	8	130.0	265.2	1.69	1.563
P-65	222	J-47	J-42	8	130.0	265.2	1.69	1.563
P-66	538	J-49	J-48	8	130.0	209.6	1.34	1.011
P-67	85	J-48	J-6	12	130.0	209.6	0.59	0.141
P-68	234	J-45	J-49	8	130.0	209.6	1.34	1.011
P-500	125	R-1	PMP-1	36	130.0	621.5	0.20	0.005
P-501	143	PMP-1	J-0	36	130.0	621.5	0.20	0.005

Label	Elevation (ft)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gal/min)	Pump Head (ft)
PMP-1	1,422.60	1,423.00	1,614.32	621.5	191.32

FlexTable: Reservoir Table

Label	Elevation (ft)	Flow (Out net) (gal/min)	Hydraulic Grade (ft)
R-1	1,423.00	621.5	1,423.00

PEAK HOUR DEMAND

FlexTable: Junction Table

Label	Elevation (ft)	Demand (gal/min)	Hydraulic Grade (ft)	Pressure (psi)
J-0	1,422.60	0.0	1,612.20	82.0
J-1	1,424.89	0.0	1,612.11	81.0
J-2	1,431.46	0.0	1,611.92	78.1
J-3	1,441.63	0.0	1,611.64	73.6
J-4	1,430.00	0.0	1,611.58	78.6
J-5	1,427.59	0.0	1,611.48	79.6
J-6	1,423.19	0.0	1,611.41	81.4
J-7	1,409.40	0.0	1,611.36	87.4
J-8	1,421.62	0.0	1,612.17	82.4
J-9	1,419.65	0.0	1,612.10	83.3
J-10	1,410.00	0.0	1,612.09	87.4
J-11	1,421.82	0.0	1,612.08	82.3
J-12	1,421.62	0.0	1,612.01	82.4
J-13	1,424.00	0.0	1,611.69	81.2
J-16	1,404.78	0.0	1,611.03	89.2
J-17	1,403.52	0.0	1,610.40	89.5
J-19	1,409.85	2.7	1,610.08	86.6
J-20	1,408.12	2.7	1,610.10	87.4
J-21	1,404.70	37.7	1,610.15	88.9
J-22	1,406.46	0.0	1,610.12	88.1
J-23	1,408.73	2.7	1,609.97	87.1
J-24	1,409.87	2.7	1,609.97	86.6
J-25	1,411.00	0.0	1,609.85	86.0
J-26	1,413.00	0.0	1,609.73	85.1
J-27	1,415.00	0.0	1,609.73	84.2
J-28	1,416.57	2.7	1,609.72	83.6
J-29	1,417.00	2.7	1,609.63	83.3
J-30	1,417.89	0.0	1,609.76	83.0
J-31	1,414.60	66.4	1,609.73	84.4
J-32	1,416.00	66.5	1,609.73	83.8
J-34	1,413.00	2.7	1,609.60	85.1
J-35	1,415.51	119.0	1,609.57	84.0
J-36	1,411.71	111.4	1,609.58	85.6
J-37	1,410.25	0.0	1,609.63	86.3
J-38	1,406.20	0.0	1,611.58	88.9
J-39	1,409.29	49.2	1,610.19	86.9
J-41	1,404.61	77.3	1,610.01	88.9
J-42	1,409.82	0.0	1,610.42	86.8
J-43	1,411.87	69.8	1,609.84	85.7
J-44	1,409.00	79.7	1,609.67	86.8
J-45	1,420.17	77.7	1,609.91	82.1
J-46	1,418.43	103.0	1,609.63	82.7
J-47	1,410.31	0.0	1,611.07	86.9
J-48	1,422.65	0.0	1,611.39	81.7
J-49	1,421.20	0.0	1,610.36	81.8

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (Absolute) (gal/min)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-1	369	J-0	J-1	16	130.0	591.2	0.94	0.236
P-2	1,726	J-1	J-2	16	130.0	392.8	0.63	0.111
P-3	2,563	J-2	J-3	16	130.0	392.8	0.63	0.111
P-4	3,678	J-3	J-4	24	130.0	392.8	0.28	0.015
P-5	1,953	J-4	J-5	24	130.0	764.1	0.54	0.053
P-6	1,271	J-5	J-6	24	130.0	764.1	0.54	0.053
P-7	2,510	J-6	J-7	24	130.0	468.4	0.33	0.021
P-8	433	J-0	J-8	16	130.0	285.5	0.46	0.061
P-9	1,147	J-8	J-9	16	130.0	285.5	0.46	0.061
P-10	1,036	J-9	J-10	16	130.0	112.5	0.18	0.011
P-11	1,208	J-1	J-11	16	130.0	198.4	0.32	0.031
P-12	694	J-11	J-12	16	130.0	371.3	0.59	0.100
P-13	3,210	J-12	J-13	16	130.0	371.3	0.59	0.100
P-14	1,043	J-13	J-4	16	130.0	371.3	0.59	0.100
P-15	1,154	J-9	J-11	16	130.0	172.9	0.28	0.024
P-16	1,409	J-7	J-16	8	130.0	94.5	0.60	0.231
P-19	637	J-16	J-17	8	130.0	207.0	1.32	0.988
P-22	379	J-19	J-20	8	130.0	45.7	0.29	0.060
P-24	253	J-21	J-17	8	130.0	207.0	1.32	0.988
P-25	425	J-21	J-41	8	130.0	118.5	0.76	0.351
P-26	332	J-20	J-22	8	130.0	50.8	0.32	0.074
P-27	445	J-22	J-21	8	130.0	50.8	0.32	0.073
P-28	423	J-20	J-23	8	130.0	110.6	0.71	0.309
P-29	374	J-23	J-24	8	130.0	3.3	0.02	0.001
P-30	454	J-24	J-25	8	130.0	100.5	0.64	0.259
P-31	454	J-25	J-26	8	130.0	100.5	0.64	0.259
P-32	489	J-26	J-27	8	130.0	19.7	0.13	0.013
P-33	412	J-27	J-28	8	130.0	19.7	0.13	0.013
P-35	574	J-28	J-29	8	130.0	74.8	0.48	0.150
P-36	422	J-28	J-30	8	130.0	57.8	0.37	0.093
P-38	424	J-26	J-31	8	130.0	12.4	0.08	0.005
P-39	577	J-31	J-32	8	130.0	11.1	0.07	0.004
P-40	326	J-32	J-30	8	130.0	55.4	0.35	0.086
P-41	570	J-26	J-34	8	130.0	93.1	0.59	0.225
P-42	493	J-34	J-35	8	130.0	45.1	0.29	0.059
P-43	408	J-35	J-29	8	130.0	73.9	0.47	0.147
P-44	461	J-34	J-36	8	130.0	45.4	0.29	0.059
P-45	454	J-36	J-37	8	130.0	66.0	0.42	0.119
P-46	423	J-19	J-24	8	130.0	99.8	0.64	0.256
P-47	1,714	J-16	J-38	8	130.0	112.5	0.72	0.319
P-48	1,598	J-38	J-10	8	130.0	112.5	0.72	0.320
P-49	319	J-20	J-39	8	130.0	108.2	0.69	0.297
P-50	379	J-39	J-42	8	130.0	157.3	1.00	0.595
P-51	780	J-23	J-41	8	130.0	41.1	0.26	0.050
P-56	319	J-42	J-19	8	130.0	216.6	1.38	1.075
P-57	376	J-19	J-43	8	130.0	159.7	1.02	0.611
P-58	527	J-43	J-31	8	130.0	89.9	0.57	0.211
P-59	568	J-23	J-44	8	130.0	145.7	0.93	0.516
P-60	368	J-44	J-37	8	130.0	66.0	0.42	0.119

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (Absolute) (gal/min)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-61	475	J-30	J-45	8	130.0	113.2	0.72	0.323
P-62	995	J-45	J-46	8	130.0	104.8	0.67	0.280
P-63	478	J-46	J-29	8	130.0	1.8	0.01	0.000
P-64	97	J-7	J-47	8	130.0	373.9	2.39	2.954
P-65	222	J-47	J-42	8	130.0	373.9	2.39	2.954
P-66	538	J-49	J-48	8	130.0	295.7	1.89	1.913
P-67	85	J-48	J-6	12	130.0	295.7	0.84	0.266
P-68	234	J-45	J-49	8	130.0	295.7	1.89	1.913
P-500	125	R-1	PMP-1	36	130.0	876.6	0.28	0.010
P-501	143	PMP-1	J-0	36	130.0	876.6	0.28	0.009

Label	Elevation (ft)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gal/min)	Pump Head (ft)
PMP-1	1,422.60	1,423.00	1,612.20	876.6	189.20

FlexTable: Reservoir Table

Label	Elevation (ft)	Flow (Out net) (gal/min)	Hydraulic Grade (ft)
R-1	1,423.00	876.6	1,423.00

MAXIMUM DAY DEMAND PLUS FIRE FLOW

RESIDUAL PRESSURE ANALYSIS

AVAILABLE FIRE FLOW ANALYSIS

Label	Demand (gal/min)	Fire Flow (Needed) (gal/min)	Flow (Total Needed) (gal/min)	Fire Flow (Available) (gal/min)	Flow (Total Available) (gal/min)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Pressure (Calculated Zone Lower Limit @ Total Flow Needed) (psi)	Junction w/ Minimum Pressure (Zone @ Total Flow Needed)	Pipe w/ Maximum Velocity	Velocity of Maximum Pipe (ft/s)	Satisfies Fire Flow Constraints?
J-0	0.0	1,500.0	1,500.0	1,501.0	1,501.0	74.0	65.6	J-3	P-64	1.69	True
J-1	0.0	1,500.0	1,500.0	1,501.0	1,501.0	72.8	65.4	J-3	P-1	2.51	True
J-2	0.0	1,500.0	1,500.0	1,501.0	1,501.0	69.2	64.8	J-3	P-1	2.43	True
J-3	0.0	1,500.0	1,500.0	1,501.0	1,501.0	64.3	69.4	J-4	P-1	2.34	True
J-4	0.0	1,500.0	1,500.0	1,501.0	1,501.0	69.3	64.4	J-3	P-1	2.32	True
J-5	0.0	1,500.0	1,500.0	1,501.0	1,501.0	70.1	64.4	J-3	P-1	2.31	True
J-6	0.0	1,500.0	1,500.0	1,501.0	1,501.0	71.9	64.5	J-3	P-1	2.31	True
J-7	0.0	1,500.0	1,500.0	1,501.0	1,501.0	77.7	64.5	J-3	P-1	2.30	True
J-8	0.0	1,500.0	1,500.0	1,501.0	1,501.0	74.2	65.5	J-3	P-8	2.09	True
J-9	0.0	1,500.0	1,500.0	1,501.0	1,501.0	74.8	65.4	J-3	P-1	1.81	True
J-10	0.0	1,500.0	1,500.0	1,501.0	1,501.0	78.5	65.4	J-3	P-10	2.30	True
J-11	0.0	1,500.0	1,500.0	1,501.0	1,501.0	73.9	65.3	J-3	P-1	2.13	True
J-12	0.0	1,500.0	1,500.0	1,501.0	1,501.0	73.7	65.1	J-3	P-12	2.22	True
J-13	0.0	1,500.0	1,500.0	1,501.0	1,501.0	72.0	64.6	J-3	P-1	2.30	True
J-16	0.0	3,000.0	3,000.0	3,001.0	3,001.0	46.4	46.1	J-3	P-16	7.27	True
J-17	0.0	3,000.0	3,000.0	2,963.4	2,963.4	44.0	45.8	J-3	P-24	10.00	False
J-19	2.7	1,500.0	1,502.7	1,501.0	1,503.7	74.0	64.5	J-3	P-64	6.32	True
J-20	2.7	1,500.0	1,502.7	1,501.0	1,503.7	74.7	64.5	J-3	P-64	6.25	True
J-21	26.3	3,000.0	3,026.3	3,001.0	3,027.3	45.4	45.7	J-3	P-64	9.52	True
J-22	0.0	1,500.0	1,500.0	1,501.0	1,501.0	73.9	64.5	J-3	P-64	6.02	True
J-23	2.7	1,500.0	1,502.7	1,501.0	1,503.7	73.8	64.5	J-3	P-64	6.07	True
J-24	2.7	1,500.0	1,502.7	1,501.0	1,503.7	73.0	64.5	J-3	P-64	6.11	True
J-25	0.0	1,500.0	1,500.0	1,501.0	1,501.0	71.0	64.5	J-3	P-64	5.95	True
J-26	0.0	1,500.0	1,500.0	1,501.0	1,501.0	71.2	64.5	J-3	P-64	5.73	True
J-27	0.0	1,500.0	1,500.0	1,501.0	1,501.0	68.4	64.5	J-3	P-64	5.64	True
J-28	2.7	1,500.0	1,502.7	1,501.0	1,503.7	68.7	64.5	J-3	P-64	5.53	True
J-29	2.7	1,500.0	1,502.7	1,501.0	1,503.7	67.8	64.5	J-3	P-64	5.49	True
J-30	0.0	1,500.0	1,500.0	1,501.0	1,501.0	68.5	64.5	J-3	P-64	5.40	True
J-31	47.5	1,500.0	1,547.5	1,501.0	1,548.5	70.0	64.5	J-3	P-64	5.79	True
J-32	46.8	1,500.0	1,546.8	1,501.0	1,547.8	68.1	64.5	J-3	P-64	5.57	True
J-34	2.7	1,500.0	1,502.7	1,501.0	1,503.7	69.7	64.5	J-3	P-64	5.72	True
J-35	83.7	1,500.0	1,583.7	1,501.0	1,584.7	67.3	64.5	J-3	P-64	5.61	True
J-36	78.3	1,500.0	1,578.3	1,501.0	1,579.3	68.1	64.5	J-3	P-44	5.93	True
J-37	0.0	1,500.0	1,500.0	1,501.0	1,501.0	68.5	64.5	J-3	P-64	5.91	True
J-38	0.0	1,500.0	1,500.0	1,501.0	1,501.0	71.6	65.0	J-3	P-48	5.32	True
J-39	34.2	1,500.0	1,534.2	1,501.0	1,535.2	73.2	64.5	J-3	P-64	6.63	True
J-41	53.8	1,500.0	1,553.8	1,501.0	1,554.8	73.5	64.5	J-3	P-64	5.91	True

Label	Demand (gal/min)	Fire Flow (Needed) (gal/min)	Flow (Total Needed) (gal/min)	Fire Flow (Available) (gal/min)	Flow (Total Available) (gal/min)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Pressure (Calculated Zone Lower Limit @ Total Flow Needed) (psi)	Junction w/ Minimum Pressure (Zone @ Total Flow Needed)	Pipe w/ Maximum Velocity	Velocity of Maximum Pipe (ft/s)	Satisfies Fire Flow Constraints?
J-42	0.0	1,500.0	1,500.0	1,501.0	1,501.0	74.7	64.5	J-3	P-64	6.93	True
J-43	49.0	1,500.0	1,549.0	1,501.0	1,550.0	70.8	64.5	J-3	P-64	6.08	True
J-44	55.9	1,500.0	1,555.9	1,501.0	1,556.9	69.7	64.5	J-3	P-59	6.35	True
J-45	54.7	1,500.0	1,554.7	1,501.0	1,555.7	68.1	64.5	J-3	P-68	5.78	True
J-46	72.4	1,500.0	1,572.4	1,501.0	1,573.4	65.4	64.5	J-3	P-63	5.46	True
J-47	0.0	1,500.0	1,500.0	1,501.0	1,501.0	75.9	64.5	J-3	P-64	8.75	True
J-48	0.0	1,500.0	1,500.0	1,501.0	1,501.0	71.9	64.5	J-3	P-67	4.71	True
J-49	0.0	1,500.0	1,500.0	1,501.0	1,501.0	68.3	64.5	J-3	P-66	6.52	True

Label	Demand (gal/min)	Fire Flow (Needed) (gal/min)	Flow (Total Needed) (gal/min)	Fire Flow (Available) (gal/min)	Flow (Total Available) (gal/min)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Pressure (Calculated Zone Lower Limit @ Total Flow Needed) (psi)	Junction w/ Minimum Pressure (Zone @ Total Flow Needed)	Pipe w/ Maximum Velocity	Velocity of Maximum Pipe (ft/s)	Satisfies Fire Flow Constraints?
J-0	0.0	1,500.0	1,500.0	4,745.2	4,745.2	74.0	65.6	J-3	P-64	1.69	True
J-1	0.0	1,500.0	1,500.0	4,682.8	4,682.8	72.8	65.4	J-3	P-1	6.40	True
J-2	0.0	1,500.0	1,500.0	4,521.0	4,521.0	69.2	64.8	J-3	P-1	5.93	True
J-3	0.0	1,500.0	1,500.0	4,369.2	4,369.2	64.3	69.4	J-4	P-1	5.52	True
J-4	0.0	1,500.0	1,500.0	4,397.6	4,397.6	69.3	64.4	J-3	P-1	5.50	True
J-5	0.0	1,500.0	1,500.0	4,401.9	4,401.9	70.1	64.4	J-3	P-1	5.49	True
J-6	0.0	1,500.0	1,500.0	4,404.5	4,404.5	71.9	64.5	J-3	P-1	5.48	True
J-7	0.0	1,500.0	1,500.0	4,408.3	4,408.3	77.7	64.5	J-3	P-1	5.46	True
J-8	0.0	1,500.0	1,500.0	4,719.2	4,719.2	74.2	65.5	J-3	P-8	5.88	True
J-9	0.0	1,500.0	1,500.0	4,675.8	4,675.8	74.8	65.4	J-3	P-9	4.23	True
J-10	0.0	1,500.0	1,500.0	4,671.2	4,671.2	78.5	65.4	J-3	P-10	6.88	True
J-11	0.0	1,500.0	1,500.0	4,647.2	4,647.2	73.9	65.3	J-3	P-1	5.26	True
J-12	0.0	1,500.0	1,500.0	4,598.0	4,598.0	73.7	65.1	J-3	P-12	5.83	True
J-13	0.0	1,500.0	1,500.0	4,443.6	4,443.6	72.0	64.6	J-3	P-1	5.49	True
J-16	0.0	3,000.0	3,000.0	3,968.0	3,968.0	46.4	46.1	J-3	P-16	9.54	True
J-17	0.0	3,000.0	3,000.0	2,963.4	2,963.4	44.0	45.8	J-3	P-24	10.00	False
J-19	2.7	1,500.0	1,502.7	2,680.8	2,683.5	74.0	64.5	J-3	P-64	10.00	True
J-20	2.7	1,500.0	1,502.7	2,731.0	2,733.7	74.7	64.5	J-3	P-64	10.00	True
J-21	26.3	3,000.0	3,026.3	3,188.0	3,214.3	45.4	45.7	J-3	P-64	10.00	True
J-22	0.0	1,500.0	1,500.0	2,788.8	2,788.8	73.9	64.5	J-3	P-26	10.00	True
J-23	2.7	1,500.0	1,502.7	2,847.0	2,849.7	73.8	64.5	J-3	P-64	10.00	True
J-24	2.7	1,500.0	1,502.7	2,819.1	2,821.8	73.0	64.5	J-3	P-64	10.00	True
J-25	0.0	1,500.0	1,500.0	2,917.1	2,917.1	71.0	64.5	J-3	P-64	10.00	True
J-26	0.0	1,500.0	1,500.0	3,083.3	3,083.3	71.2	64.5	J-3	P-64	10.00	True
J-27	0.0	1,500.0	1,500.0	3,072.7	3,072.7	68.4	64.5	J-3	P-32	10.00	True
J-28	2.7	1,500.0	1,502.7	3,261.1	3,263.8	68.7	64.5	J-3	P-64	10.00	True
J-29	2.7	1,500.0	1,502.7	3,299.0	3,301.7	67.8	64.5	J-3	P-64	10.00	True
J-30	0.0	1,500.0	1,500.0	3,318.7	3,318.7	68.5	64.5	J-3	P-68	10.00	True
J-31	47.5	1,500.0	1,547.5	3,036.8	3,084.3	70.0	64.5	J-3	P-64	10.00	True
J-32	46.8	1,500.0	1,546.8	2,794.0	2,840.8	68.1	64.5	J-3	P-40	10.00	True
J-34	2.7	1,500.0	1,502.7	3,091.6	3,094.3	69.7	64.5	J-3	P-64	10.00	True
J-35	83.7	1,500.0	1,583.7	2,980.4	3,064.0	67.3	64.5	J-3	P-43	10.00	True
J-36	78.3	1,500.0	1,578.3	2,582.0	2,660.3	68.1	64.5	J-3	P-44	10.00	True
J-37	0.0	1,500.0	1,500.0	2,855.8	2,855.8	68.5	64.5	J-3	P-59	10.00	True
J-38	0.0	1,500.0	1,500.0	2,873.1	2,873.1	71.6	65.0	J-3	P-48	10.00	True
J-39	34.2	1,500.0	1,534.2	2,526.0	2,560.2	73.2	64.5	J-3	P-64	10.00	True
J-41	53.8	1,500.0	1,553.8	2,762.0	2,815.8	73.5	64.5	J-3	P-25	10.00	True

Label	Demand (gal/min)	Fire Flow (Needed) (gal/min)	Flow (Total Needed) (gal/min)	Fire Flow (Available) (gal/min)	Flow (Total Available) (gal/min)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Pressure (Calculated Zone Lower Limit @ Total Flow Needed) (psi)	Junction w/ Minimum Pressure (Zone @ Total Flow Needed)	Pipe w/ Maximum Velocity	Velocity of Maximum Pipe (ft/s)	Satisfies Fire Flow Constraints?
J-42	0.0	1,500.0	1,500.0	2,371.1	2,371.1	74.7	64.5	J-3	P-64	10.00	True
J-43	49.0	1,500.0	1,549.0	2,595.6	2,644.5	70.8	64.5	J-3	P-57	10.00	True
J-44	55.9	1,500.0	1,555.9	2,431.7	2,487.6	69.7	64.5	J-3	P-59	10.00	True
J-45	54.7	1,500.0	1,554.7	2,870.6	2,925.2	68.1	64.5	J-3	P-68	10.00	True
J-46	72.4	1,500.0	1,572.4	2,786.1	2,858.5	65.4	64.5	J-3	P-63	10.00	True
J-47	0.0	1,500.0	1,500.0	1,780.6	1,780.6	75.9	64.5	J-3	P-64	10.00	True
J-48	0.0	1,500.0	1,500.0	3,553.6	3,553.6	71.9	64.5	J-3	P-67	10.00	True
J-49	0.0	1,500.0	1,500.0	2,465.9	2,465.9	68.3	64.5	J-3	P-66	10.00	True