HUNTER
ENGINEERING

CIVIL AND SURVEY

Water Final Basis of Design Report
For
Scottsdale and Thunderbird
SEC of Thunderbird Rd and Scottsdale Rd
Scottsdale, Arizona 85260

August 2022

Prepared by:
Hunter Engineering, Inc.
10450 North 74th Street, #200
Scottsdale, AZ 85258

WATER FINAL BASIS OF DESIGN REPORT
FOR

SCOTTSDALE AND THUNDERBIRD

SEC OF THUNDERBIRD RD AND SCOTTSDALE RD
SCOTTSDALE, ARIZONA 85260

PREPARED FOR

LGE DESIGN BUILD
1200 NORTH 52ND STREET
PHOENIX, AZ 85008

PREPARED BY

LARRY TALBOTT
HUNTER ENGINEERING, INC.
10450 NORTH 74TH STREET, #200
SCOTTSDALE, AZ 85258
(480) 991-3985

H.E. PROJECT NO. LGEC308

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1.0 INTRODUCTION

This water design report has been prepared under a contract from LGE Design Build, developer of the Scottsdale and Thunderbird project. The purpose of this report is to provide a final water analysis, required by the City of Scottsdale, to support this development. Preparation of this report has been done according to the procedures detailed in Chapter 6 of the *City of Scottsdale Design Standards & Policies Manual dated January 2018 (Reference).*

This development project is located along the south side of Thunderbird/Redfield Road just east of Scottsdale Road within the City of Scottsdale, Maricopa County, Arizona. The proposed project is located within a developed site with multiple buildings, parking and drive areas and landscaping.

The existing parcel is bound by existing commercial/office developments to the north, North Miller Road to the east, the existing church facility to the south and an existing facility and Thunderbird/Redfield Road to the west. The site is specifically located in section 11, Township 3 North, Range 4 East, of the Gila and Salt River Base and Meridian. Figure 1, in Appendix A, illustrates the location of the project site in relation to the City of Scottsdale street system. Access to the site is provided from Thunderbird/Redfield Road.

The development proposes the construction of a new warehouse building. Site improvements will include construction of driveway entrances, a parking lot, sidewalk/hardscape, landscape areas, and supporting infrastructure including new storm water drainage system, water, sewer and fire line service. The overall project site is approximately 17 acres.

2.0 EXISTING CONDITIONS

There is an existing 12" ACP water main in Thunderbird/Redfield Road, an existing 8" ACP water main in Scottsdale Road, an existing 6" ACP water main in Sutton from Scottsdale to 74th Street that turns to an 8" ACP water main from 74th Street to Miller and then an existing 8" DIP water main in Miller Road.

The existing 12" main in Thunderbird and the existing 8" main in Scottsdale Road along the park and ride frontage reside in Pressure Zone 3. The 8" main south of the Park and Ride and the 6" and 8" mains in Sutton and Miller are all within Pressure Zone 2. There is an existing Pressure Reducing Valve (PRV) on the east side of Scottsdale Road near the southwest corner of the Parking and Ride property which separates Zone 3 and Zone 2. This PRV maintains 60 psi for Zone 2 in the immediate vicinity of the PRV.

The site also has an existing 10" ACP private water main that come in along the existing drive from Thunderbird and then heads south to feed the 8" and 10" ACP private water loop through the existing church property.

Per the City of Scottsdale information, the existing water meter for the church property is off of Sutton Drive along the overall church property southern property boundary. Therefore the proposed water main revisions for this project will not affect the existing church domestic metering.

3.0 PROPOSED WATER DISTRIBUTION SYSTEM

A new public 10" waterline will be looped through the site. It will replace the existing 10" water main which enters the site just south of the existing city facility at the west end of the project and loop through to Miller Road. The new main will be in a dedicated public water easement. See the Concept Utility Plans in Appendix A.

The public line will also connect to the existing church's private water system at the south property line near the middle of the site to maintain their service. A backflow preventer will be installed at this connection to prevent private water from the adjacent property from entering the new public water main.

Since the site will connect Zone 3 and Zone 2 a Pressure Reducing Valve (PRV) is proposed at the connection to the existing 10" water main at the wester property boundary. The PRV will be set to maintain 60 psi for the downstream pressure and has been included in the system water modeling.

Per Figure 6-1.2 Average Day Demands in the City of Scottsdale *Design Standards & Policies Manual* a demand of 1.44 gallons per minute per acre were used for proposed industrial site. The Maximum Day Demand is 2.0 times the ADD, and the Peak Hour Demand (PHD) is 3.5 times the ADD. See Appendix B for a summary of these calculations.

The proposed Building is 243,360 square feet and will be type V-B construction. Per the 2018 International Fire Code, the minimum base fire flow rate for a building of this size and construction type is 8,000 gallons per minute (GPM). Because this building will be protected by an approved sprinkler system, per NFPA 13, the required fire flow may be reduced by half, but not below 1,500 GPM. A fire flow of 4,000 GPM is used for the site analysis. Per City of Scottsdale, pressure requirements, minimum acceptable design pressures are 30 psi at the hydrant under design fire flow requirements and minimum residual pressure 50 psi at highest finished floor for domestic demand. The required and the calculated fire flows are tabulated below.

Since the proposed public water main will be replacing the existing private 10" main connection to Thunderbird/Redfield Road it was requested the system was designed to accommodate the domestic and fire flows for the adjacent site. Since the adjacent property is an existing development with limited information the building sizes/quantities and land area for each use was estimated from aerial photos using the roof perimeter. The building uses include existing single family residential homes, church buildings, church educational facilities and the athletic fields. See the Water Exhibit in Appendix A.

Per Figure 6-1.2 Average Day Demands in the City of Scottsdale *Design Standards & Policies Manual* a demand of 0.69 gallons per minute per dwelling unit was used for the existing residences, 1.88 gallons per minute per acre for the existing institutional church and educational buildings and 2.49 gallons per minute per acre for the athletic fields park area. The Maximum Day Demand is 2.0 times the ADD, and the Peak Hour Demand (PHD) is 3.5 times the ADD. See Appendix B for a summary of these calculations.

The largest existing residential building is estimated to be 4,500 square feet and the largest institutional building is estimated to be 20,100 square feet and to be conservative they are assumed at type V-B construction. Per the 2018 International Fire Code, the minimum base fire flow rate for the residential is 1,750 GPM and 3,750 GPM for the institutional buildings. It is assumed the existing residences are not sprinklered so the base fire flow remains at 1,750 GPM. The institutional buildings are assumed to be sprinklered and therefore the required fire flow may be reduced by half, but not below 1,500 GPM. A fire flow of 1,875 GPM is used for the institutional buildings. These existing fire flows are below the 4,000 GPM required for the new industrial buildings and therefore the overall site is being analyzed for the higher 4,000 gpm.

The existing church site design flows have been modeled at the existing connection point for the adjacent church property to the south. Per City of Scottsdale, pressure requirements, minimum acceptable design pressures are 30 psi at the hydrant under design fire flow requirements and minimum residual pressure 50 psi at highest finished floor for domestic demand. The required and the calculated fire flows are shown in Appendix B.

A fire flow test was completed on March 10th, 2022 by Arizona Flow Testing, LLC within the Zone 3 Pressure Zone. A second fire flow test was also completed on July 29th, 2022 by Arizona Flow Testing, LLC within the Zone 2 Pressure Zone. This test data was used to model the proposed system using WaterCad, a pipe network analysis program by Haestad Methods. A reservoir and pump were added to the model near the flow test locations to simulate pressure versus flow curve. Both hydrant tests were adjusted per the City of Scottsdale requirements. Note that the pipes PX-1, PX-2, PX-3 and PX-4 connecting the pumps and reservoirs are not a part of the system and are oversized to 120-inches to minimize system losses. Pipes and junctions were added to the network model matching the pipe sizes, materials, and elevations of the proposed and existing system.

The fire flow model was set up such that 1,000 gpm is taken from each of the four most remote hydrants totaling the required 4,000 gpm. The lowest resultant pressure based upon the required fire flow and the max day demand was calculated to be 40.41 psi, at J-7. This is above the 30-psi fire flow minimum pressure. The resultant pressure for the peak flow is 55.59 psi and is greater than the minimum peak flow pressure of 50 psi. Results and data from the WaterCAD are shown in Appendix B.

4.0 CONCLUSIONS

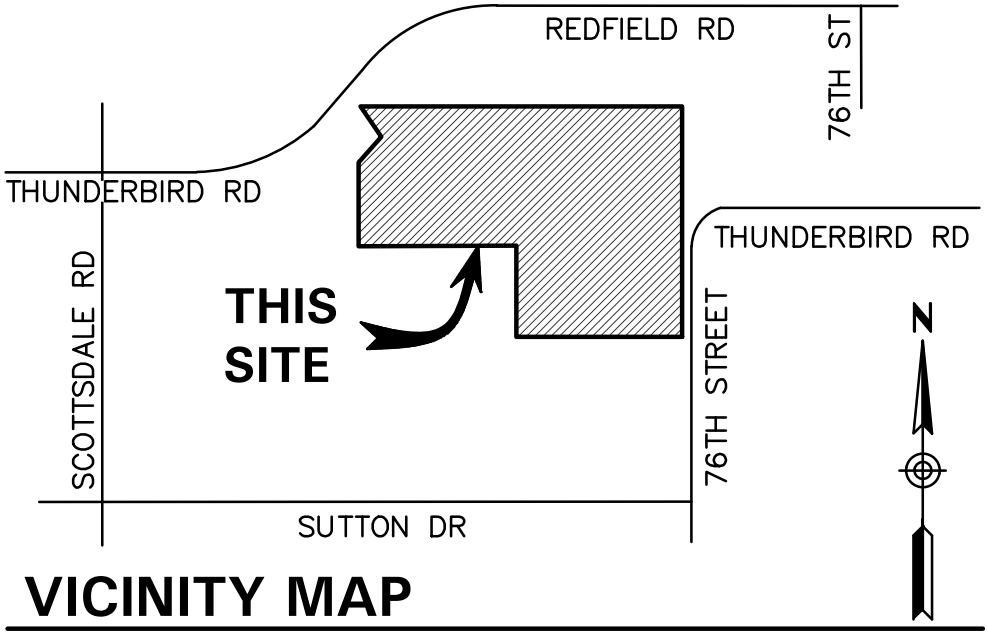
Based on the results of this study, it can be concluded that:

- The existing public water system is adequate to support this development and the existing adjacent church site to the south.
- The pressure drops between Water Zones 2 and 3 will be maintained by the proposed Pressure Reducing Valve.

5.0 REFERENCES

1) City of Scottsdale Design Standard & Policies Manual, January 2018.

APPENDIX A
FIGURES



VICINITY MAP

VICINITY MAP
FIGURE 1

WATER EXHIBIT

FOR

SCOTTSDALE AND THUNDERBIRD

SEC OF SCOTTSDALE AND THUNDERBIRD

SCOTTSDALE, ARIZONA

NO.	DATE	REVISION	BY

PURPOSE:
2ND CONCEPTUAL SUBMITTAL

DESIGN BY: WG
DRAWN BY: DC
CHECKED BY: LT

HUNTER ENGINEERING
CIVIL AND SURVEY
10450 NORTH 74TH STREET,
SUITE 200
SCOTTSDALE, AZ 85258
T 480 991 3985
F 480 991 3986

Registered Professional Engineer
CERTIFICATE NO.
42104
LARRY M.
TALBOTT
7/20/22
STATE OF ARIZONA, U.S.A.

FOR
SCOTTSDALE AND THUNDERBIRD
SEC OF SCOTTSDALE AND THUNDERBIRD
SCOTTSDALE, ARIZONA

CONTACT ARIZONA 811 AT LEAST 2 FULL WORKING DAYS BEFORE YOU BEGIN EXCAVATION
ARIZONA811
CALL 811 OR CLICK ARIZONA811.COM

THESE PLANS ARE NOT APPROVED FOR CONSTRUCTION WITHOUT AN APPROVED SIGNATURE FROM THE GOVERNING MUNICIPALITY.

PROJECT NAME:
SCOTTSDALE AND THUNDERBIRD

HE NO.: LGEC308
SCALE: ?"=??'

SHEET:
1

14-DR-2022
11/4/22

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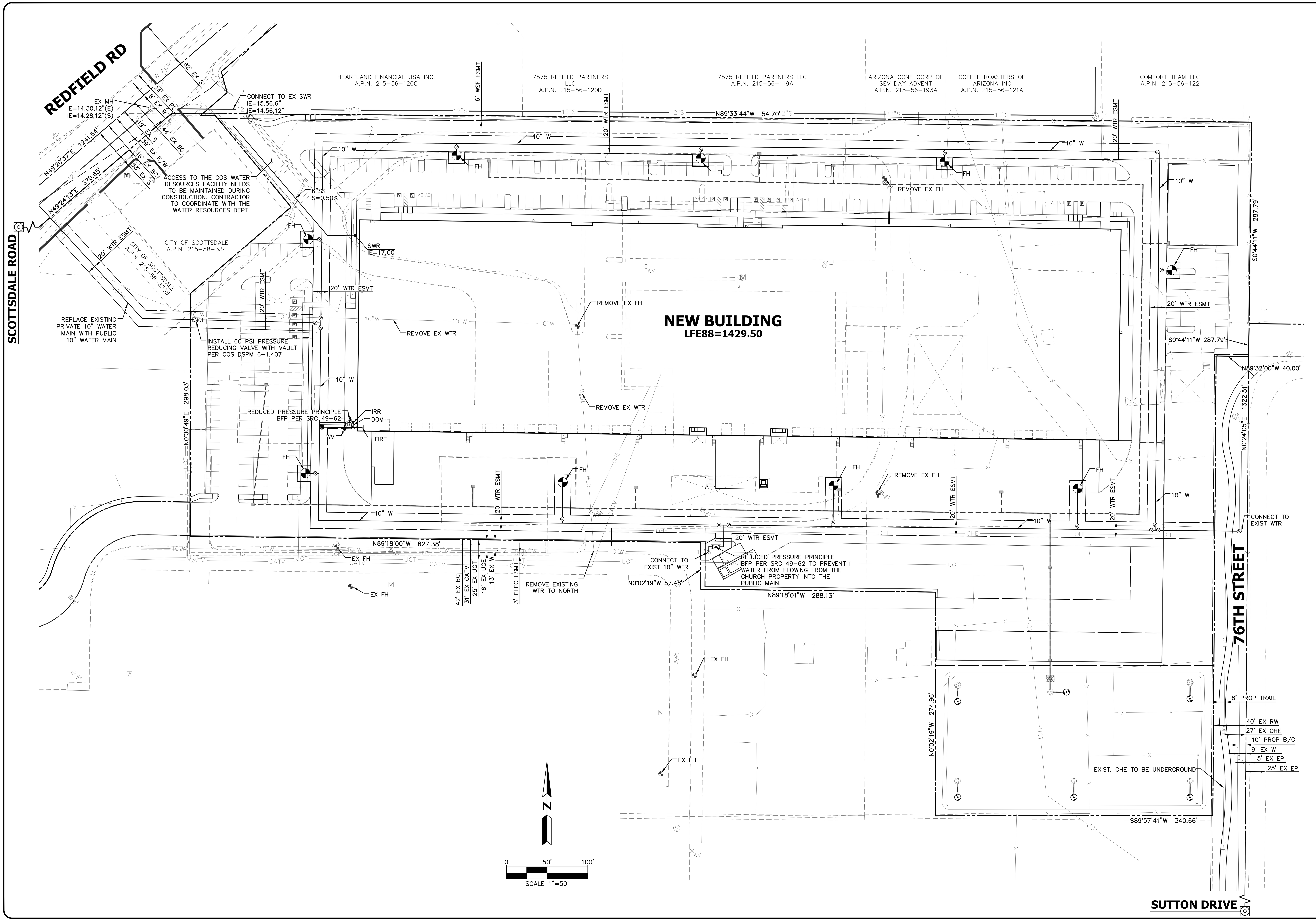

REDFIELD RD
SCOTTSDALE ROAD
76TH STREET
SUTTON DRIVE
HEARTLAND FINANCIAL USA INC.
A.P.N. 215-56-120C
7575 REFIELD PARTNERS LLC
A.P.N. 215-56-120D
7575 REFIELD PARTNERS LLC
A.P.N. 215-56-119A
ARIZONA CONF CORP OF SEV DAY ADVENT
A.P.N. 215-56-193A
COFFEE ROASTERS OF ARIZONA INC
A.P.N. 215-56-121A
COMFORT TEAM LLC
A.P.N. 215-56-122
CITY OF SCOTTSDALE
A.P.N. 215-58-334
CITY OF SCOTTSDALE
A.P.N. 215-58-333B
EX MH
IE=14.30,12"(E)
IE=14.28,12"(S)
CONNECT TO EX SWR
IE=15.56,6"
IE=14.56,12"
ACCESS TO THE COS WATER RESOURCES FACILITY NEEDS TO BE MAINTAINED DURING CONSTRUCTION. CONTRACTOR TO COORDINATE WITH THE WATER RESOURCES DEPT.
6"SS
S=0.50%
SWR
IE=17.00
REPLACE EXISTING PRIVATE 10" WATER MAIN WITH PUBLIC 10" WATER MAIN
INSTALL 60 PSI PRESSURE REDUCING VALVE WITH VAULT PER COS DSPM 6-1.407
REDUCED PRESSURE PRINCIPLE BFP PER SRC 49-62
IRR
DOM
WM
FIRE
NEW BUILDING
LFE88=1429.50
REMOVE EX FH
REMOVE EX WTR
REMOVE EX FH
REMOVE EX WTR
REMOVE EX FH
20' WTR ESMT
6' WSF ESMT
10" W
FH
N89°33'44"W 54.70'
S0°44'11"W 287.79'
N89°32'00"W 40.00'
N0°24'05"E 1322.51'
N0°00'49"E 298.03'
N49°20'37"E 1241.54'
N49°24'13"E 370.85'
N89°18'00"W 627.38'
N0°02'19"W 57.48'
N89°18'01"W 288.13'
N0°02'19"W 274.96'
S89°57'41"W 340.66'
62' EX S
24' EX BC
8' EX W
19' EX S
44' EX BC
39' EX R/W
46' EX BC
53' EX S
20' WTR ESMT
CONNECT TO EXIST 10" WTR
REDUCED PRESSURE PRINCIPLE BFP PER SRC 49-62 TO PREVENT WATER FROM FLOWING FROM THE CHURCH PROPERTY INTO THE PUBLIC MAIN.
EX FH
42' EX BC
31' EX CATV
25' EX UGT
16' EX UGE
13' EX W
3' ELEC ESMT
REMOVE EXISTING WTR TO NORTH
CONNECT TO EXIST WTR
8' PROP TRAIL
40' EX RW
27' EX OHE
10' PROP B/C
9' EX W
5' EX EP
.25' EX EP
EXIST. OHE TO BE UNDERGROUND
N
0 50' 100'
SCALE 1"=50'

NO.	DATE	REVISION	BY

PURPOSE:
3RD CONCEPTUAL SUBMITTAL

DESIGN BY: WG
DRAWN BY: DC
CHECKED BY: LT

HUNTER
ENGINEERING
CIVIL AND SURVEY
10450 NORTH 74TH STREET, SUITE 200
SCOTTSDALE, AZ 85258
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Registered Professional Engineer
CERTIFICATE NO. 42104
LARRY M. TALBOTT
ARIZONA U.S.A.

CONCEPTUAL UTILITY PLAN FOR SCOTTSDALE AND THUNDERBIRD SEC OF SCOTTSDALE AND THUNDERBIRD SCOTTSDALE, ARIZONA

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PROJECT NAME: SCOTTSDALE AND THUNDERBIRD

HE NO.: LGEC308
SCALE: 1"=50'

SHEET: C3

14-DR-2022
11/4/22

APPENDIX B
CALCULATIONS AND DATA SHEET

Project: Scottsdale and Thunderbird
Project Number: LGEC308
City: Scottsdale
Date: 8/1/2022

SITE DOMESTIC DEMAND SUMMARY

Site	Site Use	Site Area (ac)	Average Day Demand (gpm) Gross Bldg Area (sf) per Table 6-1.2 Average Day Water Demands		Average Day Demand (ADD) (gpm)	Max Day Demand (MDD) (ADD*2.0) (gpm)	Peak Hour Demand (PHD) (ADD*3.5) (gpm)
Building A	Industrial	18.00	1.44	per ac	25.9	51.8	90.7

SITE FIRE FLOW SUMMARY

Building	Construction Type	Building Area (sf)	Minimum Required Fire Flow for Buildings Table B105.1 2006 International Fire Code		Min Fire Flow w/ 50% Sprinkler Reduction
Building A	V-B	243,360	8,000	gpm	4,000

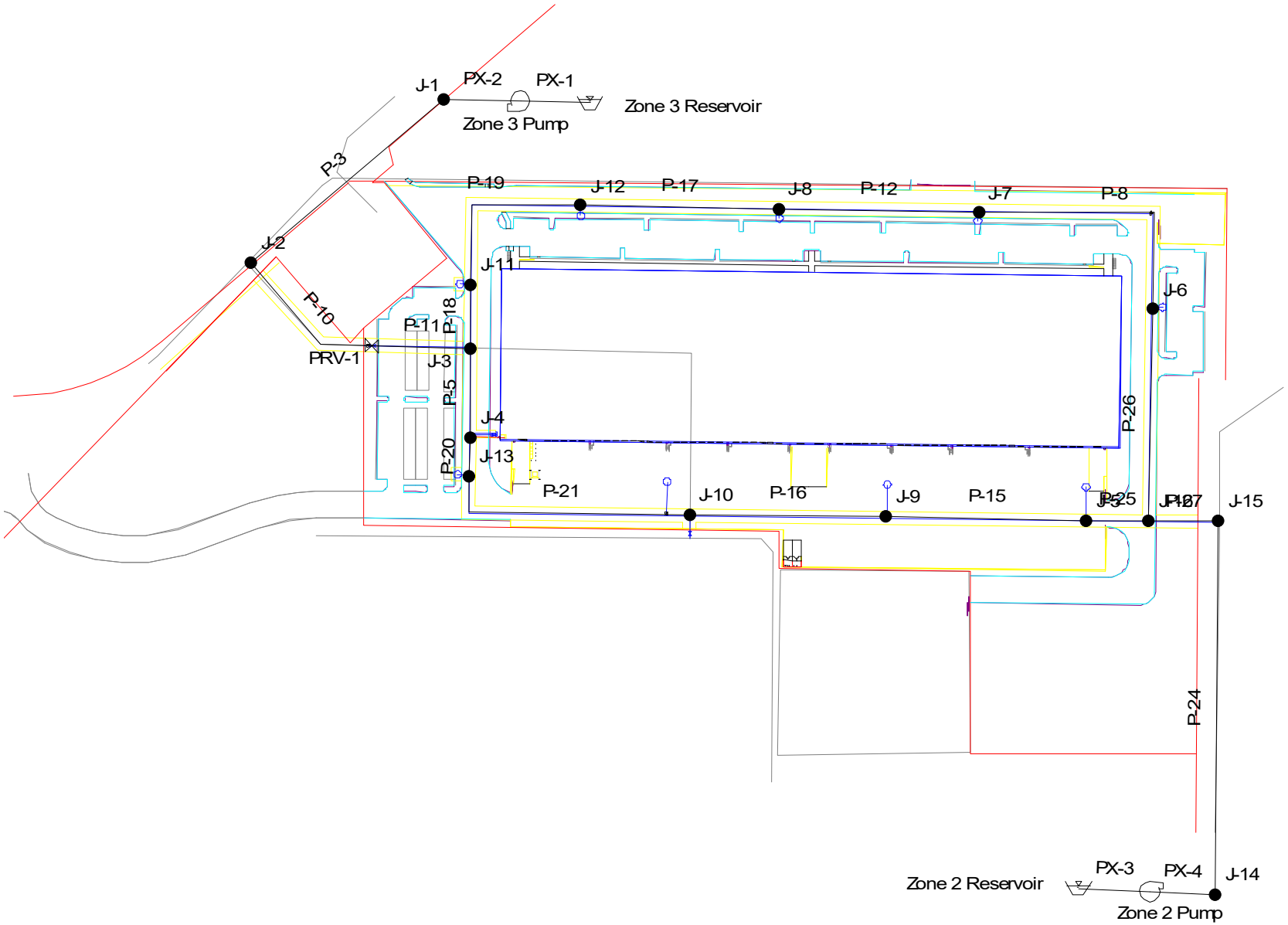
SEVENTH DAY ADVENTIST DOMESTIC DEMAND SUMMARY

Site	Site Use	Dwelling Units (DU)	Average Day Demand (gpm) Dwelling Unit (DU) per Table 6-1.2 Average Day Water Demands		Average Day Demand (ADD) (gpm)	Max Day Demand (MDD) (ADD*2.0) (gpm)	Peak Hour Demand (PHD) (ADD*3.5) (gpm)
Residential	< 2 DU/AC	21.00	0.69	per DU	14.5	29.0	50.7
Site	**Site Use**	**Site Area (ac)**	**Average Day Demand (gpm) Site Area (ac) per Table 6-1.2 Average Day Water Demands**		**Average Day Demand (ADD) (gpm)**	**Max Day Demand (MDD) (ADD*2.0) (gpm)**	**Peak Hour Demand (PHD) (ADD*3.5) (gpm)**
Church and School	Institutional	18.00	1.88	per ac	33.8	67.7	118.4
Site	**Site Use**	**Site Area (ac)**	**Average Day Demand (gpd) Landscape Area (ac) per Table 6-1.2 Average Day Water Demands**		**Average Day Demand (ADD) (gpm)**	**Max Day Demand (MDD) (ADD*2.0) (gpm)**	**Peak Hour Demand (PHD) (ADD*3.5) (gpm)**
Sports Fields	Landscaping	10.00	2.49	per ac	24.9	49.8	87.2
Total					73.23	146.46	256.31

SEVENTH DAY ADVENTIST SITE FIRE FLOW SUMMARY

Building	Construction Type	Building Area (sf)	Minimum Required Fire Flow for Buildings Table B105.1 2006 International Fire Code		Min Fire Flow w/ 50% Sprinkler Reduction	Min Fire Flow No Sprinkler Reduction
Residential	V-B	4,500	1,750	gpm		1,750
Institutional	V-B	20,100	3,750	gpm	1,875	

Scenario: Peak



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11/4/22

Scenario: Peak
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Discharge (gpm)	Hazen-Williams C	Pressure Pipe Headloss (ft)	Velocity (ft/s)
PX-1	1.00	120.0	Ductile Iron	196.59	130.0	0.00	0.01
PX-2	1.00	120.0	Ductile Iron	187.28	130.0	0.00	0.01
P-3	900.00	12.0	Asbestos Ceme	165.73	140.0	0.00	0.47
P-5	135.00	10.0	Ductile Iron	210.48	130.0	0.00	0.86
P-8	411.00	10.0	Ductile Iron	50.85	130.0	0.00	0.21
P-10	239.00	10.0	Ductile Iron	165.73	130.0	0.00	0.68
P-11	149.00	10.0	Ductile Iron	159.63	130.0	0.00	0.65
P-12	302.00	10.0	Ductile Iron	50.85	130.0	0.00	0.21
P-15	301.00	10.0	Ductile Iron	-155.69	130.0	0.00	0.64
P-16	297.00	10.0	Ductile Iron	-155.69	130.0	0.00	0.64
P-18	97.00	10.0	Ductile Iron	50.85	130.0	0.00	0.21
P-17	300.00	10.0	Ductile Iron	50.85	130.0	0.00	0.21
P-19	285.00	10.0	Ductile Iron	50.85	130.0	0.00	0.21
P-20	57.00	10.0	Ductile Iron	119.78	130.0	0.00	0.49
P-21	387.00	10.0	Ductile Iron	119.78	130.0	0.00	0.49
PX-3	1.00	120.0	Ductile Iron	196.59	130.0	0.00	0.01
PX-4	1.00	120.0	Ductile Iron	186.65	130.0	0.00	0.01
P-24	140.00	8.0	Ductile Iron	206.54	130.0	0.00	1.32
P-25	95.00	10.0	Ductile Iron	-155.69	130.0	0.00	0.64
P-26	319.00	10.0	Ductile Iron	50.85	130.0	0.00	0.21
P-27	105.00	10.0	Ductile Iron	206.54	130.0	0.00	0.84

Scenario: Peak
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	0.00	52.14
J-2	31.00	0.00	53.87
J-3	28.00	0.00	55.16
J-4	27.00	90.70	55.59
J-5	25.50	0.00	56.33
J-6	27.50	0.00	55.46
J-7	28.00	0.00	55.22
J-8	28.00	0.00	55.20
J-9	25.00	0.00	56.50
J-10	26.20	256.31	55.93
J-11	28.35	0.00	55.02
J-12	30.00	0.00	54.32
J-13	26.00	0.00	56.02
J-14	18.00	0.00	60.90
J-15	27.50	0.00	55.52
J-16	27.66	0.00	55.41

>50psi OK

14-DR-2022
11/4/22

Scenario: Fire
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	0.00	58.33
J-2	31.00	0.00	53.04
J-3	28.00	0.00	45.90
J-4	27.00	51.80	46.03
J-5	25.50	0.00	44.92
J-6	27.50	1,000.00	41.37
J-7	28.00	1,000.00	40.41
J-8	28.00	1,000.00	40.45
J-9	25.00	0.00	45.57
J-10	26.20	146.46	45.47
J-11	28.35	0.00	44.65
J-12	30.00	1,000.00	40.69
J-13	26.00	0.00	46.35
J-14	18.00	0.00	58.96
J-15	27.50	0.00	44.24
J-16	27.66	0.00	43.84

>30psi OK

Detailed Report for PRV: PRV-1

Scenario Summary	
Scenario	Peak
Active Topology Alternative	Base-Active Topology
Physical Alternative	Base-Physical
Demand Alternative	Base-Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary			
Demand	<None>	Roughness	<None>

Geometric Summary					
X	698,569.55	ft	Upstream Pipe	P-10	
Y	949,956.69	ft	Downstream Pipe	P-11	
Elevation	28.00	ft	Diameter	10.0	in
Minor Loss Coefficient	0.00				

Initial Status					
Initial Valve Status	Active		Initial Pressure	60.00	psi
Initial HGL	166.63	ft			

Calculated Results Summary

Time (hr)	Control Status	From HGL (ft)	To HGL (ft)	Discharge (gpm)	Velocity (ft/s)	Headloss (ft)	Calculated Pressure Setting (psi)
0.00	Inactive	1,799,520.00	1,799,520.00	162.23	0.66	0.00	60.00

Detailed Report for Pump: Zone 2 Pump

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Peak
Active Topology Alternative	Base-Active Topology
Physical Alternative	Base-Physical
Demand Alternative	Base-Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary			
Demand	<None>	Roughness	<None>

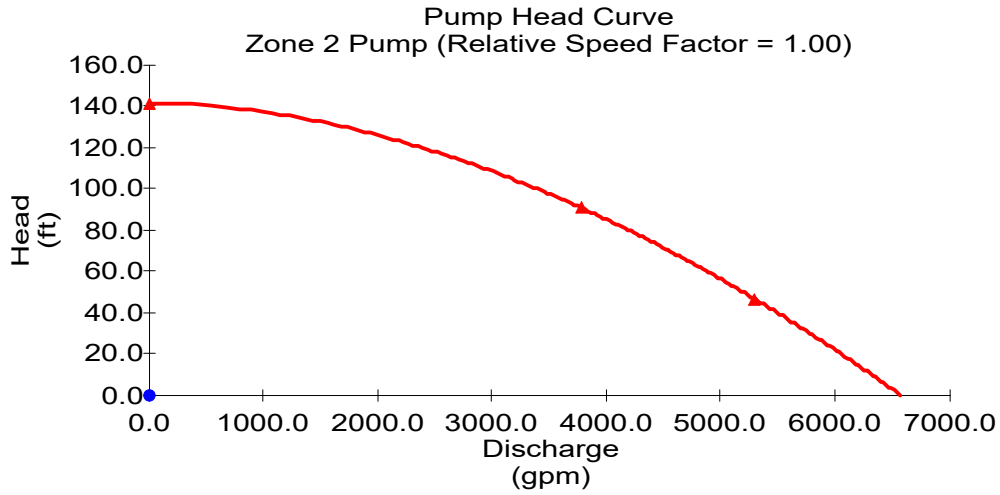
Geometric Summary			
X	699,743.42 ft	Upstream Pipe	PX-3
Y	949,132.88 ft	Downstream Pipe	PX-4
Elevation	18.00 ft		

Pump Definition Summary	
Pump Definition	Zone 2

Initial Status			
Initial Pump Status	On	Initial Relative Speed Facto	1.00

Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
0.00	Pump cannot deliver head ((	18.00	),799,520.00	0.00	0.00	1.00	0.00



14-DR-2022
11/4/22

Detailed Report for Reservoir: Zone 2 Reservoir

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Peak
Active Topology Alternative	Base-Active Topology
Physical Alternative	Base-Physical
Demand Alternative	Base-Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary			
Demand	<None>	Roughness	<None>

Geometric Summary			
X	699,635.74 ft	Elevation	18.00 ft
Y	949,137.49 ft	Zone	Zone

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Inflow (gpm)	Outflow (gpm)
0.00	18.00	196.59	196.59

Scenario: Static Zone 2
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	0.00	53.81
J-2	31.00	0.00	55.54
J-3	28.00	0.00	56.84
J-4	27.00	0.00	57.27
J-5	25.50	0.00	57.92
J-6	27.50	0.00	57.05
J-7	28.00	0.00	56.84
J-8	28.00	0.00	56.84
J-9	25.00	0.00	58.14
J-10	26.20	0.00	57.62
J-11	28.35	0.00	56.69
J-12	30.00	0.00	55.97
J-13	26.00	0.00	57.70
J-14	18.00	0.00	61.16
J-15	27.50	0.00	57.05
J-16	27.66	0.00	56.98

= 61.2psi Matches Reduced Hydrant Test

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Scenario: Residual Zone 2
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	0.00	31.82
J-2	31.00	0.00	33.55
J-3	28.00	0.00	34.85
J-4	27.00	0.00	35.28
J-5	25.50	0.00	35.93
J-6	27.50	0.00	35.07
J-7	28.00	0.00	34.85
J-8	28.00	0.00	34.85
J-9	25.00	0.00	36.15
J-10	26.20	0.00	35.63
J-11	28.35	0.00	34.70
J-12	30.00	0.00	33.98
J-13	26.00	0.00	35.72
J-14	18.00	3,780.00	39.18
J-15	27.50	0.00	35.07
J-16	27.66	0.00	35.00

= 39.2psi Matches Reduced Hydrant Test

Scenario: Max Zone 2
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	0.00	12.63
J-2	31.00	0.00	14.36
J-3	28.00	0.00	15.66
J-4	27.00	0.00	16.09
J-5	25.50	0.00	16.74
J-6	27.50	0.00	15.88
J-7	28.00	0.00	15.66
J-8	28.00	0.00	15.66
J-9	25.00	0.00	16.96
J-10	26.20	0.00	16.44
J-11	28.35	0.00	15.51
J-12	30.00	0.00	14.80
J-13	26.00	0.00	16.53
J-14	18.00	5,304.00	19.99
J-15	27.50	0.00	15.88
J-16	27.66	0.00	15.81

= 20psi Matches Reduced Hydrant Test

Detailed Report for Pump: Zone 3 Pump

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Peak
Active Topology Alternative	Base-Active Topology
Physical Alternative	Base-Physical
Demand Alternative	Base-Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary			
Demand	<None>	Roughness	<None>

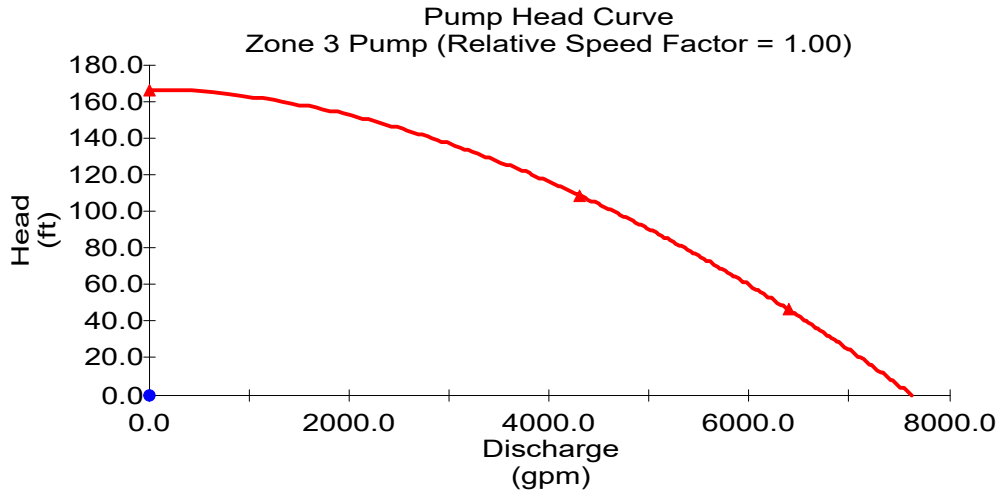
Geometric Summary				
X	698,792.99	ft	Upstream Pipe	PX-1
Y	950,326.35	ft	Downstream Pipe	PX-2
Elevation	35.00	ft		

Pump Definition Summary	
Pump Definition	Default Pump Definition

Initial Status			
Initial Pump Status	On	Initial Relative Speed Facto	1.00

Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
0.00	Pump cannot deliver head ((	35.00	),799,520.00	0.00	0.00	1.00	0.00



14-DR-2022
11/4/22

Detailed Report for Reservoir: Zone 3 Reservoir

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Peak
Active Topology Alternative	Base-Active Topology
Physical Alternative	Base-Physical
Demand Alternative	Base-Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary			
Demand	<None>	Roughness	<None>

Geometric Summary			
X	698,898.24 ft	Elevation	35.00 ft
Y	950,323.76 ft	Zone	Zone

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Inflow (gpm)	Outflow (gpm)
0.00	35.00	196.59	196.59

Scenario: Static Zone 3
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	0.00	71.96
J-2	31.00	0.00	73.69
J-3	28.00	0.00	74.99
J-4	27.00	0.00	75.42
J-5	25.50	0.00	76.07
J-6	27.50	0.00	75.20
J-7	28.00	0.00	74.99
J-8	28.00	0.00	74.99
J-9	25.00	0.00	76.29
J-10	26.20	0.00	75.77
J-11	28.35	0.00	74.84
J-12	30.00	0.00	74.12
J-13	26.00	0.00	75.85
J-14	18.00	0.00	79.31
J-15	27.50	0.00	75.20
J-16	27.66	0.00	75.13

= 72psi Matches Reduced Hydrant Test

Scenario: Residual Zone 3
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	4,308.00	46.97
J-2	31.00	0.00	48.70
J-3	28.00	0.00	50.00
J-4	27.00	0.00	50.43
J-5	25.50	0.00	51.08
J-6	27.50	0.00	50.22
J-7	28.00	0.00	50.00
J-8	28.00	0.00	50.00
J-9	25.00	0.00	51.30
J-10	26.20	0.00	50.78
J-11	28.35	0.00	49.85
J-12	30.00	0.00	49.14
J-13	26.00	0.00	50.87
J-14	18.00	0.00	54.33
J-15	27.50	0.00	50.22
J-16	27.66	0.00	50.15

= 47psi Matches Reduced Hydrant Test

Scenario: Max Flow Zone 3
Steady State Analysis
Junction Report

Label	Elevation (ft)	Base Flow (gpm)	Pressure (psi)
J-1	35.00	6,396.00	19.99
J-2	31.00	0.00	21.72
J-3	28.00	0.00	23.02
J-4	27.00	0.00	23.45
J-5	25.50	0.00	24.10
J-6	27.50	0.00	23.23
J-7	28.00	0.00	23.02
J-8	28.00	0.00	23.02
J-9	25.00	0.00	24.32
J-10	26.20	0.00	23.80
J-11	28.35	0.00	22.87
J-12	30.00	0.00	22.15
J-13	26.00	0.00	23.88
J-14	18.00	0.00	27.34
J-15	27.50	0.00	23.23
J-16	27.66	0.00	23.16

= 20psi Matches Reduced Hydrant Test

APPENDIX C
FIRE HYDRANT FLOW TEST

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	Scottsdale and Thunderbird
Project Address:	Scottsdale Road and Sutton Drive, Scottsdale, Arizona, 85254
Client Project No.:	Not Provided
Arizona Flow Testing Project No.:	22527
Flow Test Permit No.:	C69610
Date and time flow test conducted:	July 29, 2022 at 7:00 AM
Data is current and reliable until:	January 29, 2023
Conducted by:	Floyd Vaughan-Az Flow Testing, LLC (480-250-8154)
Witnessed by:	Chris Mendez – City of Scottsdale-Inspector (602-9028-9046)

Raw Test Data

Static Pressure: **68.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **46.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **16.0 PSI Hyd A**
23.0 PSI Hyd B
(Measured in pounds per square inch)
+

Diffuser Orifice Diameter: Two 4-inch Pollard Diffuser
(Measured in inches)

Coefficient of Diffuser: 0.9

Flowing GPM: **3,780 GPM**
(Measured in gallons per minute)
1,719 GPM +2,061 GPM = 3,780 GPM

GPM @ 20 PSI: **5,759 GPM**

Data with 10% Safety Factor

Static Pressure: **61.2 PSI**
(Measured in pounds per square inch)

Residual Pressure: **39.2 PSI**
(Measured in pounds per square inch)

Distance between hydrants: See Below

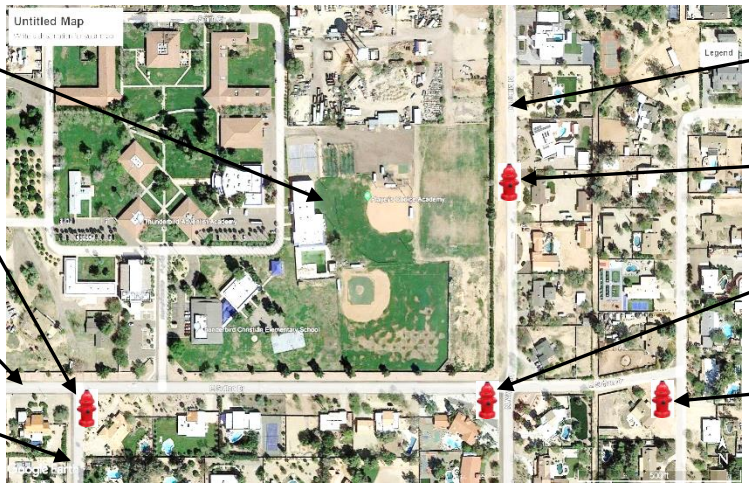
Main size: Not Provided

Flowing GPM: **3,780 GPM**

GPM @ 20 PSI**:** **5,304 GPM**

Flow Test Location

North



Project Site
Scottsdale Road and Sutton Drive

Flow Fire Hydrant A
(Approx. 1,260 feet from pressure hydrant)

East Sutton Drive

North 74th Street

North Miller Road

Fire Hydrant
(No Flow)

Pressure Fire Hydrant

Flow Fire Hydrant B
(Approx. 540 feet from pressure hydrant)

14-DR-2022
11/4/22

WATER FLOW TEST REPORT

Project: **Scottsdale and Thunderbird**
Project Number: LGEC308

Zone 2 Original Hydrant Test

TOTAL FLOW DURING TEST: **3780** GPM

STATIC READING: 68 PSI RESIDUAL: 46 PSI

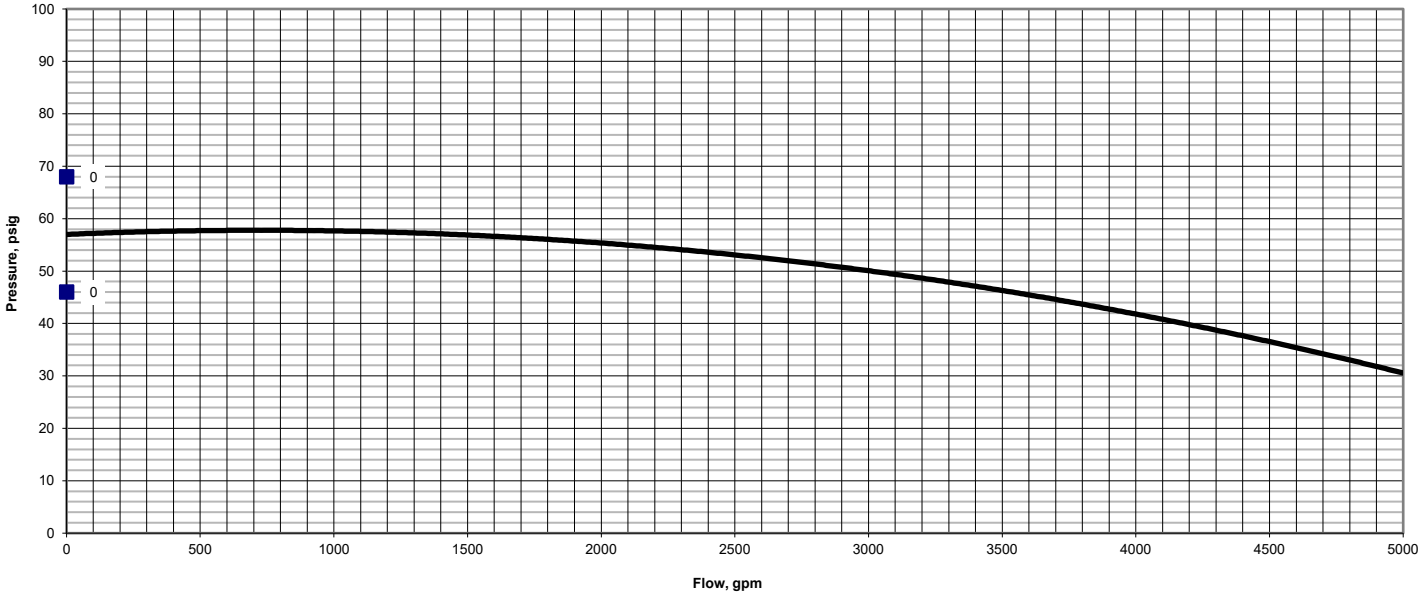
RESULTS: AT 20 RESIDUAL **5760** GPM AT 0 PSI **6952** GPM

REMARKS:

	Shutoff Head	Design	Max Operating
	68 psi	46 psi	20 psi
psi X 2.31 = ft	157.08 ft	106.26 ft	46.2 ft
		3780 flow	6952 flow

14-DR-2022
11/4/22

ZONE 2 ORIGINAL HYDRANT TEST - WATER FLOW TEST CHART



14-DR-2022

11/4/22

WATER FLOW TEST REPORT

Project: **Scottsdale and Thunderbird**
Project Number: LGEC308

Zone 2 Original Hydrant Test

TOTAL FLOW DURING TEST: **3780** GPM

STATIC READING: 61.2 PSI RESIDUAL: 39.2 PSI

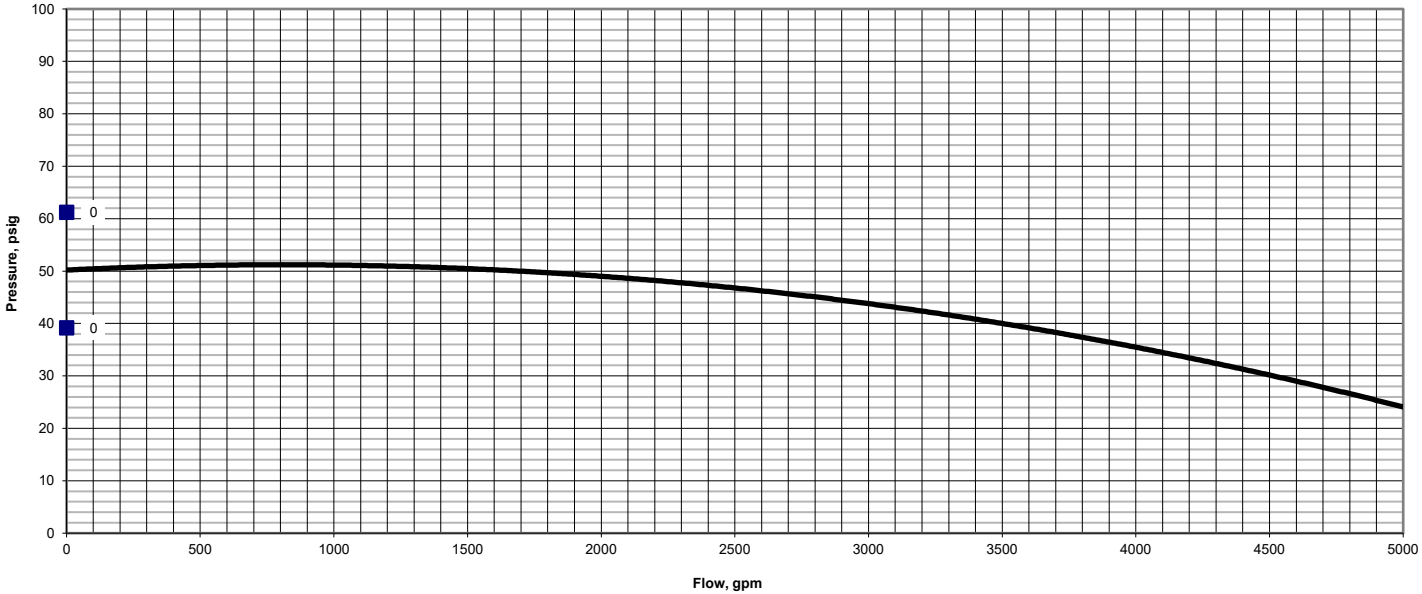
RESULTS: AT 20 RESIDUAL **5304** GPM AT 0 PSI **6568** GPM

REMARKS:

	Shutoff Head	Design	Max Operating
	61.2 psi	39.2 psi	20 psi
psi X 2.31 = ft	141.372 ft	90.552 ft	46.2 ft
		3780 flow	6568 flow

14-DR-2022
11/4/22

ZONE 2 REDUCED HYDRANT TEST - WATER FLOW TEST CHART



14-DR-2022

11/4/22

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	Thunderbird & Scottsdale
Project Address:	7575 East Redfield Road, Scottsdale, Arizona 85260
Arizona Flow Testing Project No.:	22148
Client Project No.:	Not Provided
Flow Test Permit No.:	C68095
Date and time flow test conducted:	March 10, 2022 at 7:00 AM
Data is current and reliable until:	September 10, 2022
Conducted by:	Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Coordinated by:	Aaron Roby – City of Scottsdale-Inspector (480-407-7022)

Raw Test Data

Static Pressure: **100.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **75.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **30.0 PSI Hyd A**
27.0 PSI Hyd B
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One 4-inch Pollard Diffuser
(Measured in inches) One 4-Inch Hose Monster

Coefficient of Diffuser: 0.9 & .7875

Flowing GPM**:** **4,308 GPM**
(Measured in gallons per minute)
2,354 GPM + 1,954 GPM = 4,308

GPM @ 20 PSI: **8,072 GPM**

Data with 28PSI Safety Factor

Static Pressure: **72.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **47.0 PSI**
(Measured in pounds per square inch)

Scottsdale requires a maximum Static Pressure of 72 PSI for AFES Design.

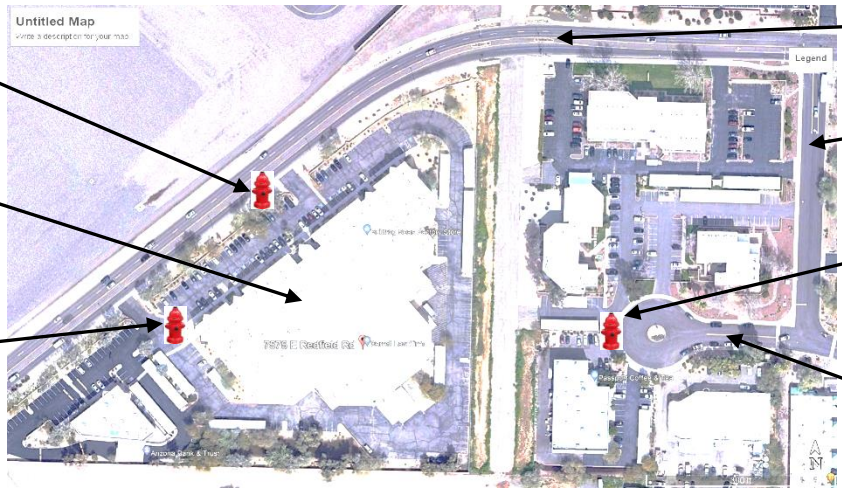
Distance between hydrants: Approx.: See Below

Main size: Not Provided

Flowing GPM: **4,308 GPM**

GPM @ 20 PSI**:** **6,396 GPM**

Flow Test Location **North**



Pressure Fire Hydrant

Project Site
7575 East Redfield Road

Flow Fire Hydrant B
(Approx. 340 Feet from Pressure Hydrant)

East Redfield Road

North 76th Street

Flow Fire Hydrant A
(Approx. 1,220 Feet from Pressure Hydrant)

East Gray Road

14-DR-2022
11/4/22

WATER FLOW TEST REPORT

Project: **Scottsdale and Thunderbird**
Project Number: LGEC308

Zone 3 Original Hydrant Test

TOTAL FLOW DURING TEST: **4308** GPM

STATIC READING: 100 PSI RESIDUAL: 75 PSI

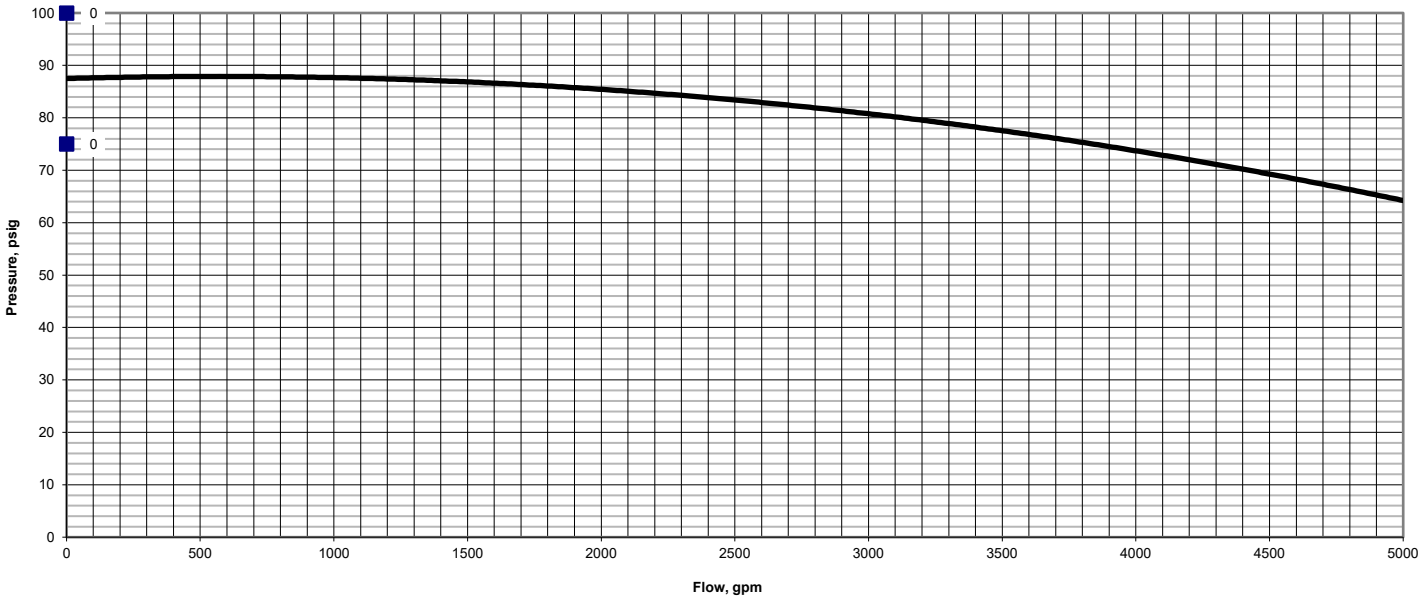
RESULTS: AT 20 RESIDUAL **8073** GPM AT 0 PSI **9107** GPM

REMARKS:

	Shutoff Head	Design	Max Operating
	100 psi	75 psi	20 psi
psi X 2.31 = ft	231 ft	173.25 ft	46.2 ft
		4308 flow	9107 flow

14-DR-2022
11/4/22

ZONE 3 ORIGINAL HYDRANT TEST - WATER FLOW TEST CHART



14-DR-2022
11/4/22

WATER FLOW TEST REPORT

Project: **Scottsdale and Thunderbird**
Project Number: LGEC308

Zone 3 Reduced Hydrant Test

TOTAL FLOW DURING TEST: **4308** GPM

STATIC READING: 72 PSI RESIDUAL: 47 PSI

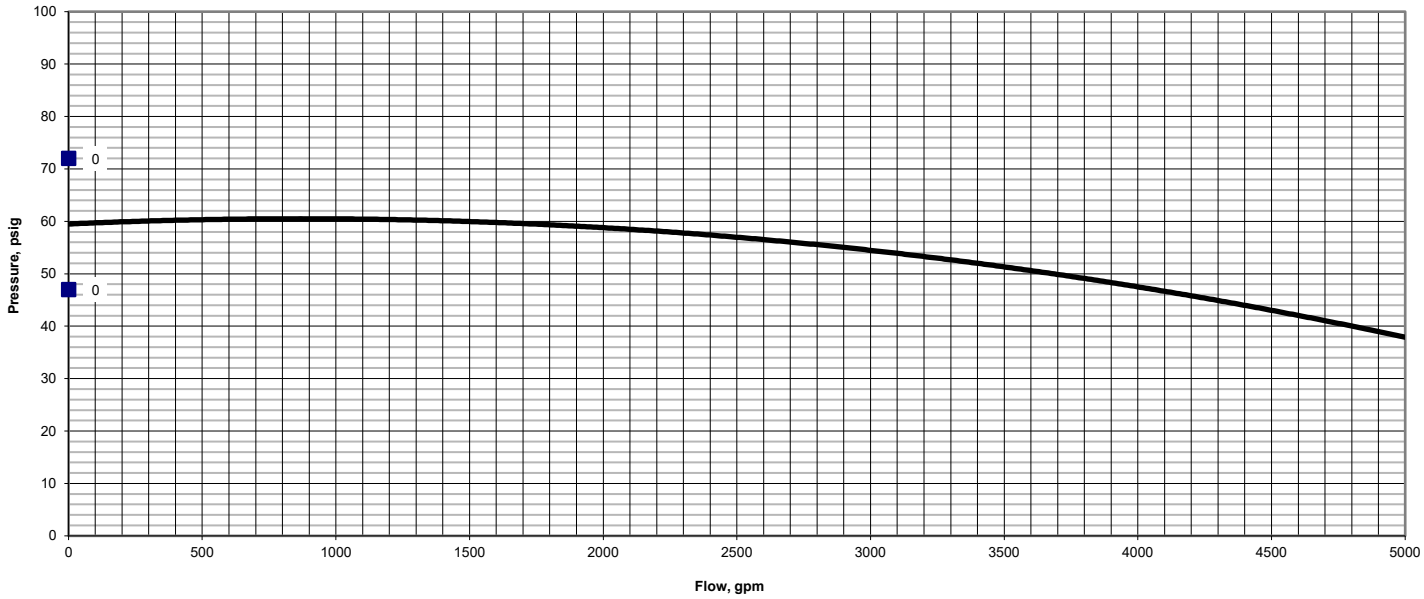
RESULTS: AT 20 RESIDUAL **6398** GPM AT 0 PSI **7627** GPM

REMARKS:

	Shutoff Head	Design	Max Operating
	72 psi	47 psi	20 psi
psi X 2.31 = ft	166.32 ft	108.57 ft	46.2 ft
		4308 flow	7627 flow

14-DR-2022
11/4/22

ZONE 3 REDUCED - WATER FLOW TEST CHART



14-DR-2022
11/4/22

APPENDIX D
REFERENCES

CITY OF SCOTTSDALE

DESIGN STANDARDS & POLICIES MANUAL

14-DR-2022
11/4/22

are met. The necessary process to develop the design system supply curve or grade line from the hydrant test results is described in Section 6-1.405.

3. Water demands shall generally be determined based on the unit demands in gallons per minute (gpm) listed in Figure 6-1.2, or as accepted or directed by the Water Resources Department, or as described within this chapter. The Water Resources Department reserves the right to require the use of potentially higher water demand peaking factors or directly apply demand flows for developments if deemed justified e.g. some restaurants or specialty developments.
4. Computer hydraulic modeling shall use H2ONET, WATERCAD, or EPANET software, or other Water Resource Department approved software.
5. In addition to network diagrams clearly present all inputs, details, and analysis output in organized tables.
6. Include all relevant hydraulic network diagrams listed for each of the following required hydraulic analysis scenarios:
   a. Model Scenario 1: Average day demand in gpm at all demand nodes. (Refer to Figure 6-1.2)
   b. Model Scenario 2: Peak hour demand in gpm at all demand nodes. (Refer to Figure 6-1.2 and Section 6-1.404 for peak hour demand)
   c. Model Scenario 3: Maximum day demand in gpm at all demand nodes with worst case fire flow (Refer to section 6-1.501 describing fire flow determination. Refer to Figure 6-1.2 and Section 6-1.404 for maximum day demand)
      Requirements:
      i. The determined fire flow must be applied to the single worst-case location in the proposed system where fire flow will be required. Typically, this is the furthest and/or highest point from the main water supply connection. If not clear what the worst-case fire flow demand point is, the fire flow shall be applied to each potential point in the model until the worst-case point is determined.
      ii. A minimum of 30 pounds per square inch (psi) must be maintained at the worst-case hydrant supply line tee/tap under this condition with a simultaneous minimum of 15 psi maintained at all domestic demand nodes (i.e., at the highest finished floor elevation and post service line and appurtenances) (Refer to scenario 4 for guidance on modeling the service line up to the demand nodes).
   d. Model Scenario 4: Maintain the minimum domestic service pressure at the worst case domestic demand node (location/elevation) under normal daily operating flow conditions termed henceforth as the *Initial Service Line Design Flow*.
      Notes: A minimum of 50 psi must be maintained at the highest proposed finished floor elevation to be served, for the worst hydraulic case domestic demand node, while applying the Initial Service Line Design Flow to the node. Typically, this will be the demand node with the lowest modeled pressure in the previous scenarios. The engineer shall define the service line

details, demand node location, and determine normal daily operating hydraulic conditions/criteria as follows:

i. Demand point location: the furthest, highest (i.e. worst case hydraulic metered node). If the service line distances and building heights are unknown, the demand node shall be located at the geometric center of the lot at elevation 12 feet above the planned finished floor elevation for single family residential. Otherwise a typical highest finished floor elevation for the development type shall be used.

ii. Initial Service Line Design Flow: 1) Estimate the average number of water fixtures served by the subject node; 2) Use the 2015 International Plumbing Code, Appendix E, Table E103.3(2)-total load values and Table E103.3(3) to determine the normal operating flow rate; 3) Add 10 gpm minimum to the normal operating flow to account for either a hose bib or a single irrigation sprinkler zone or estimate a higher applicable intermittent or constant base flow; 4) Apply a 1.5 safety factor to the resultant total flow rate to obtain the Initial Service Line Design Flow. Note that this flow also factors into meter sizing, refer to section 6-1.416 Service Lines and Meters.

iii. Determine the required service line and appurtenance sizing: If the sprinkler system and the domestic uses are metered through a shared meter use the greater of the resultant flow in step above, or the required fire sprinkler flow. Refer to the applicable Fire Code for sprinkler system flow and pressure requirements. Refer to section 6-1.404 Design Flows and Head Loss for design criteria on service lines.

iv. Model pressure losses between the service tap and the demand node: Determine the losses through the water meter and the pressure reducing valve for the resultant flow and sizing from the step above. A combined 10 psi or greater loss shall be used for meter and pressure reducing valve (PRV) in scenario 4. A 5 psi or greater loss shall be used for the meter and PRV in other modeled scenarios. The service pipe friction loss portion will be per its length and diameter as included in the model.

v. All other demand nodes in the network, other than the worst-case node shall be assigned their corresponding peak hour total use demand per Figure 6.1-2 and Section 6-1.404 during this scenario.

vi. No fire flows are to be applied for this scenario.

H. **Network Diagrams**

1. Network Diagram 1: Describe the Physical Modeled Network
   Refer to Sections 6-1.300, 6-1.400, and 6-1.500 and their related subsections for water network design requirements.
   Present all the nodes, valves, pipes, tanks, hydrants, and pumps within the network and present the following:
   a. Network components with IDs
   b. Existing distributions system pipelines (label as existing) and connection to the proposed system

c. Complete proposed water system, including:
d. Each/all individually metered service lines ending in a demand node
    i. Irrigation connections with demand nodes (show both dedicated metered lines and where shared with the domestic service line post-meter)
    ii. Fire sprinkler riser connections with demand nodes (typically dedicated connections are used for developments other than single family residential)
e. Elevations (ft.)
f. Pipe lengths (ft.)
g. Friction head loss coefficients used
h. Pipe/valve diameters (in)
i. Point of any changes in pipe diameter
j. Valve types and positions (open/closed/modulating)
k. Tanks: working volumes (gal), heights (ft.), diameters (ft.)
l. Pump curves (3-point min) or hydraulic grade line (HGL)
m. Note: Developments supplied from the city's water distribution system should be modeled as a pumped supply using a pump curve developed from the required hydrant test to simulate the dynamic flow vs. pressure supplied from the water distribution system. Alternatively, differing supply HGLs derived from the flow test results can be used for the different modeling scenarios.
n. Provide all valve, tank, pump, and system settings (levels, pressures/control set points, valve open/close/modulation rates and settings, valve coefficients, initial conditions, etc.)
o. Static system supply pressure (if supply is from system, develop pump curve or HGL from hydrant test)

Shows all numerical units or provide a legend that indicates the units used

2. Network Diagram 2: Describe the Specific Demand Scenario
    a. Label the figure with the title of specific modeling scenario
    b. Indicate the demand (gpm) being applied to each applicable node for the scenario
    c. Demand nodes shall include all applicable demands for the defined scenario including domestic use (indoor), irrigation (outdoor), fire sprinkler or hydrant, etc. If a node is a summation of more than one demand type describe this in a notes column in the associated tables
    d. Provide all valve, tank, pump, or system settings that are specific to the modeling scenario
    e. Shows all units or provide a legend that indicates the units used
3. Network Diagram 3: Present the Scenario Analysis Results

    Label the figure with the title of the specific modeling scenario and present the following output:
    a. Node pressures (psi or HGL elevation)
    b. Pipe flow (gpm)
    c. Flow direction arrows

d. Pipe flow velocity in feet per second (fps)
e. Each pipe segment's head loss rate (ft. /1,000ft or psi/ft.)
f. PRVs: Upstream and downstream pressures (psi or HGL elevation)
g. Tanks: Inflow and outflow (gpm)
h. Shows all units for the values presented or provide a legend on the diagram page that indicates the units used

AVERAGE DAY WATER DEMANDS [1]							
IN GALLONS PER DAY (GPD) [2]				IN GALLONS PER MINUTE (GPM) [2][3]			
Land Use	Inside Use	Outside Use	Total Use	Inside Use	Outside Use	Total Use	Units
Residential Demand per Dwelling Unit							
< 2 dwelling unit per acre (DU/ac)	208.9	276.7	485.6	0.30	0.39	0.69	per unit
2 – 2.9 DU/ac	193.7	276.7	470.4	0.27	0.39	0.66	per unit
3 – 7.9 DU/ac	175.9	72.3	248.2	0.25	0.11	0.36	per unit
8 – 11.9 DU/ac	155.3	72.3	227.6	0.22	0.11	0.33	per unit
12 – 22 DU/ac	155.3	72.3	227.6	0.22	0.11	0.33	per unit
High Density Condominium (condo)	155.3	30	185.3	0.22	0.05	0.27	per unit
Resort Hotel (includes site amenities)	401.7	44.6	446.3	0.56	0.07	0.63	per room
Service and Employment							
Restaurant	1.2	0.1	1.3	1.67E-03	1.39E-04	1.81E-03	per square foot (sq.ft.)
Commercial/ Retail	0.7	0.1	0.8	9.73E-04	1.39E-04	1.11E-03	per sq.ft.
Commercial High Rise	0.5	0.1	0.6	6.95E-04	1.39E-04	8.34E-04	per sq.ft.

AVERAGE DAY WATER DEMANDS [1]							
IN GALLONS PER DAY (GPD) [2]				IN GALLONS PER MINUTE (GPM) [2][3]			
Office	0.5	0.1	0.6	6.95E-04	1.39E-04	8.34E-04	per sq.ft.
Institutional	670	670	1340	0.94	0.94	1.88	per acre
Industrial	873	154	1027	1.22	0.22	1.44	per acre
Research and Development	1092	192	1284	1.52	0.27	1.79	per acre
Special Use Areas							
Natural Area Open Space	0	0	0	0.0	0.0	0.0	per acre
Developed Open Space – Parks	0	1786	1786	0.0	2.49	2.49	per acre
Developed Open Space – Golf Course	0	4285	4285	0.0	5.96	5.96	per acre

Notes:
(1) These values shall not be used directly for service line or water meter sizing.
(2) Gallon per day values are provided for reference only. The instantaneous gallon per minute flow rates presented are intended for use in the required hydraulic modeling scenarios. The gpm values assume a 12-hour active water use period per 24-hour day. In large or specialty developments or master plans the hydraulic analysis criteria and parameters should be discussed with the Water Resources Department. Seasonal peaking should also be considered. Upon review, the Water Resources Department reserves the right to designate flows to be used in hydraulic modeling scenarios that may be different from those presented here.
(3) The hydraulic modeling peaking factors used in select modeling scenarios are to be applied to the gpm values shown here. Max day and peak hour peaking factors can be found in Section 6-1.404.

FIGURE 6-1.2 AVERAGE DAY WATER DEMANDS