

PRELIMINARY WATER INVESTIGATION

ARTISAN SCOTTSDALE

SWC Indian School Rd. & Marshall Way
Scottsdale, AZ 85251

PRELIMINARY Basis of Design Report

- ACCEPTED
 ACCEPTED AS NOTED
 REVISE AND RESUBMIT



Disclaimer: If accepted; the preliminary approval is granted under the condition that a final basis of design report will also be submitted for city review and approval (typically during the DR or PP case). The final report shall incorporate further water or sewer design and analysis requirements as defined in the city design standards and policy manual and address those items noted in the preliminary review comments (both separate and included herein). The final report shall be submitted and approved prior to the plan review submission.

For questions or clarifications contact the Water Resources Planning and Engineering Department at 480-312-5685.

BY Idillon DATE 7/13/2021

Address comments below and herein within the final submitted BOD during DR phase. Conform to noted stipulations:

- 1.) **Stipulation:** Align and offset water and sewer lines as marked up on the utility plan within this BOD. A 20ft alley with corresponding property boundaries shall be assumed. From north to south provide pipe centerline spacing of 6ft, 7ft, 7ft within 20ft alley boundary.
- 2.) **Stipulation:** DS&PM 6-1.402 As shown on utility plan in BOD provide 2 off-site connections in distribution system between existing mains.
- 3.) **Stipulation:** Install approximately 410ft of new 8-inch DI pipe per City standards within the alley.
- 4.) **Stipulation:** Per DS&PM 6-1.403 provide a flushing pipe per MAG Standard Detail No. 390, Type "B" to the new 8" alley line. Provide MAG detail 319 box and cover.
- 5.) **Stipulation:** Reinstate and replace existing service lines along the alley. If lines are not 1-inch minimum they must be reinstated as 1-inch per City requirements (or per existing size if larger than 1-inch).
- 6.) **Stipulation:** A section of the existing 4" pipe east of Marshall Way cannot be removed. There are 2X2" meters on this segment that serve water site 179. Install insertion valve on 4" to west of meters to keep meters active. Restrain pipe as necessary and remove pipe up to insertion valve. Cap with restrained cap or plug.
- 7.) **Stipulation:** Construction of new public water and sewer lines shall be coordinated and planned such that there is a minimum reasonable amount of disruption to water/sewer services to other parcels. Reasonable shall be defined by the City given the relevant details.
- 8.) **Stipulation:** The existing 4-inch water main in the alley shall be removed as it is noted on the BOD utility plan and shall not be abandoned in place. Removal distance approximately 615ft from Goldwater to east side of Marshall Way (remove up to meters east of Marshall Way, refer to utility plan comments).
- 9.) Address applicable comments indicated on utility plan herein

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Project Number: 200708

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Revised Submission: June 18, 2021

Case No.: 3-ZN-2021 Plan Check No.: TBD





Table of Contents

1. INTRODUCTION	1
1.1 SUMMARY OF PROPOSED DEVELOPMENT:	1
1.2 REPORT INTENT:.....	1
1.3 SITE AND LEGAL DESCRIPTION:	1
2. DESIGN DOCUMENTATION.....	1
2.1 DESIGN COMPLIANCE:.....	1
2.2 PROCEDURES, POLICIES AND METHODOLOGIES:	1
2.3 SOFTWARE ACKNOWLEDGEMENT:	1
3. EXISTING CONDITIONS.....	1
3.1 ZONING & LAND USE:.....	1
3.2 EXISTING TOPOGRAPHY, VEGETATION AND LANDFORM FEATURES:	2
3.3 EXISTING WATER MAIN:	2
3.4 CERTIFIED FLOW TEST RESULTS OF EXISTING WATER SYSTEM:.....	2
4. PROPOSED CONDITIONS	3
4.1 SITE PLAN:.....	3
4.2 PROPOSED WATER SYSTEM:	3
4.3 WATER REQUIREMENTS:	3
4.4 MAINTENANCE RESPONSIBILITIES:.....	3
5. WATER SYSTEM COMPUTATIONS.....	3
5.1 WATER DEMANDS:.....	3
5.2 SOFTWARE MODELING:.....	4
5.3 MINIMUM PRESSURE REQUIREMENTS:.....	4
5.4 WATER SYSTEM ANALYSIS:	5
6. SUMMARY	5
6.1 SUMMARY OF PROPOSED WATER IMPROVEMENTS:.....	5
6.2 PROJECT SCHEDULE:.....	6
7 SUPPORTING MAPS	6
7.1 SITE UTILITY PLAN	6
8 REFERENCES	6

LIST OF TABLES:

TABLE 1	-	COS Demand Criteria by Demand Type
TABLE 2	-	Water Demand Calculations
TABLE 3	-	WaterCAD® Analysis Results

LIST OF FIGURES:

FIGURE 1	-	Vicinity Map
FIGURE 2	-	Aerial
FIGURE 3	-	FIRMETTE
FIGURE 4	-	Water QS Map 16-44

APPENDIX:

APPENDIX I	-	Flow Test
APPENDIX II	-	WaterCAD Modeling Analysis
APPENDIX III	-	Utility Plan
APPENDIX IV	-	IFC and NFPA References

1. INTRODUCTION

1.1 SUMMARY OF PROPOSED DEVELOPMENT:

The proposed development consists of a multifamily residential use with commercial amenities located south of Indian School Road and west of Marshall Way Road in Scottsdale Arizona. The lot area is approximately 35,696 sf (0.82 acres) per the A.L.T.A. Survey performed by AW Land Surveying, LLC , 08/10/2020The two proposed buildings will have a maximum of five floors and include 83 residential units and approximately 7,500 square feet of retail and amenities.

1.2 REPORT INTENT:

This report is being prepared to evaluate the existing and proposed water demands compliant to the City's 2017 Design Standards and Policies Manual and the projects impact to the local area's water distribution system.

1.3 SITE AND LEGAL DESCRIPTION:

The project property consists of six land parcels north and south of the existing 14' alley located in the NE ¼ of Section 27, Township 2 North, Range 4 East of the Gila and Salt River Base and Meridian, Maricopa County.

- Assessor Parcel Numbers: 130-12-033B, 130-12-031B, 130-12-032B, 130-12-045,130-12-046B, 130-12-047A

existing alley alley
varies in width

Refer to **FIGURE 1** for a vicinity map of the project's location with respect to major cross streets.

2. DESIGN DOCUMENTATION

2.1 DESIGN COMPLIANCE:

The proposed water system is designed to meet the criteria of the City of Scottsdale ("the City") Water Resources Department, the Arizona Department of Environmental Quality ("ADEQ"), and Maricopa County Environmental Services Department ("MCESD").

2.2 PROCEDURES, POLICIES AND METHODOLOGIES:

The general methodology used to design this public water infrastructure consists of modeling a network of water distribution mains to meet the City's pressure, head loss, and water demand requirements during daily demands and fire events. The connection to the water system is modeled as a reservoir and pump. The pump will simulate the pressure drop and the available flow from the existing water system as depicted by the fire flow test.

2.3 SOFTWARE ACKNOWLEDGEMENT:

Bentley WaterCAD® Version 8i is the computer modeling tool used in this water study.

3. EXISTING CONDITIONS

3.1 ZONING & LAND USE:

The overall project parcel is zoned C-2. Land uses consist of existing parking area.

3.2 EXISTING TOPOGRAPHY, VEGETATION AND LANDFORM FEATURES:

The site has approximately four feet of fall from Indian School Road to 1st Avenue in a south east direction. The site is covered with paved parking, and decomposed granite parking with only minor landscaping. Refer to **FIGURE 2** for an aerial of the overall project existing conditions.

FIRM Map Number 04013C2235L dated October 16, 2013, indicates this site is designated as Zone "X". As such, it is defined as areas outside of the 0.2% annual chance of flooding. A small portion of the northwest corner is designated as Zone "X" shaded, it is defined as areas determined to be an area of 0.2% annual chance flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance. Refer to **FIGURE 3** for an excerpt from the FIRM.

3.3 EXISTING WATER MAIN:

Water: City of Scottsdale (QS 16-44)

- The site is located within COS Water Pressure Zone 1N/1S.
- An existing 24" ductile iron (DIP) water distribution main fronts the site, approx. 10 ft south of the Indian School Road center line and serves the area north of Indian School Road in Zone 1A.
- An existing 4" water line runs along the existing 14' alley and bisects the site.
- An existing 12" DIP water main fronts the site along 1st Avenue.
- Fire hydrants exist north of the project across Indian School Road and southeast and southwest, across Marshall Way and 1st Avenue, respectively.
- An existing water meter to the south parcels is indicated on the City's quarter-section map.
- An existing 36" DIP water transmission line fronts the site, approx. 45 ft north of the Indian School Road center line and serves Pressure Zone 1N/1S to the south of Indian School Road.
- There is existing 8" and 12" Zone 1N/1S waterlines running parallel along Goldwater Blvd. The 12" turns 90° to run west-east, approx. 104 ft, along the frontage of the parcel at the SEC of Indian School Road and turns 90° once more to connect to the existing 36" DIP along Indian School Road

Refer to **FIGURE 4** for COS Water QS Map 16-44 showing water line locations.

3.4 CERTIFIED FLOW TEST RESULTS OF EXISTING WATER SYSTEM:

Certified fire hydrant flow testing was performed on July 16, 2020, by Arizona Flow Testing LLC at 7:40 a.m. The fire flow raw test data recorded a static pressure of 78.0 psi and residual pressure of 64.0 psi at 2,314 gpm. The AFES "derated" data adjusted the static pressure to 70.2 psi, a residual pressure of 56.2 psi and a 4,611 gpm flow at 20 psi. The water model uses the adjusted data. The actual flow test documentation is included in the **APPENDIX I**.

4. PROPOSED CONDITIONS

4.1 SITE PLAN:

The property is proposed to be re-developed as residential apartment use with supporting commercial. Development will include the reconstruction of existing drive entrances from Marshall Way and 1st Avenue.

4.2 PROPOSED WATER SYSTEM:

Underground parking for the two buildings is proposed to cross over the existing alley and necessitate a partial alley abandonment. The existing 4" water line within the alley will be removed between Goldwater Blvd and Marshall Way and replaced with a new 8" DIP from Goldwater Boulevard east to the west side of the development ending with a flushing device at the west side of the building. Metered services and fire lines in the alley serving adjacent properties will be reconnected in like size (or 1" minimum) to the new 8" water line. A reach of 8" DIP will be installed from Marshall Way to the east side of the building terminating at a new fire hydrant for the development. New domestic water service connections for the development will be provided off the existing 12" DIP in 1st Avenue. Building fire line connections will be provided off both the new 8" alley water line and the existing 12" water line in 1st Avenue. Metered irrigation services will be off the new Indian School Road line and the existing 1st Avenue line. Refer to **APPENDIX III** for the Preliminary Water Exhibit.

good

4.3 WATER REQUIREMENTS:

The City's design standards govern the domestic and fire flow demands per Chapter 6 of the City of Scottsdale's Design Standards & Policies Manual ("DS&PM"), dated January 2017. The north building will have a maximum five stories to a maximum 66-foot height; the south building will have a maximum four stories to a maximum 51-foot height. The gross floor area is 117,089 square feet. Per **APPENDIX IV** the rated fire flow is 8,000 gallons per minute for Type V-B construction and with a 75% reduction for the automated fire sprinkler system results in a required fire flow of 2,000 gpm.

4.4 MAINTENANCE RESPONSIBILITIES:

Off-site water lines and meters for the proposed development will be public, located within City of Scottsdale right-of-way or public easements. All existing offsite water lines are also located within public rights-of-ways and/or easements. All metered services will be installed with reduced pressure principle backflow preventers owned and maintained by the property owner.

5. WATER SYSTEM COMPUTATIONS

5.1 WATER DEMANDS:

The proposed development at the site consists of residential apartment units and commercial/amenities use. The associated DS+PM demands along with the peaking factors are shown in Table 1 below. A summary of the total water demands for the site are presented below in Table 2.

Table 1: COS DESIGN CRITERIA BY DEMAND TYPE

Land Use	Average Day Demand (gpm)	Unit	Peaking Factors	
			Max Day	Peak Hour
High Density Residential	0.27	per unit	2	3.5
Retail amenities	1.11E-03	per sq. ft.	2	3.5

Table 2: ONSITE WATER DEMAND CALCULATIONS PER DS+PM

Land Use	Unit Count or Area (sq ft)	Unit	ADD per Unit (gpm)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
High Density Residential (North)	53	Units	0.27	14.3	28.6	50.1
High Density Residential (South)	30	Units	0.27	8.1	16.2	28.4
Retail amenities	7,600	Sq. Ft.	1.11E-03	8.4	16.9	29.5
Totals				30.8	61.7	108.0

The domestic water demands can be supplied by a 2" nutating disc, positive displacement meter rated at 160 gpm per DS+PM Figure 6.1-4 Design Meter Capacities. The final design report will evaluate internal fixture unit demand and losses through the meter and backflow preventing device, adjusting the meter size if necessary.

yes but this table includes a 1.5 factor so that the meter is operating at most within the AWWA high-normal flow rate for the meter. At 108gpm peak hour it is right on the edge. If fixture rate per IPC is higher a 3" meter would be required. Provide fixture count and design flow in final BOD.

5.2 SOFTWARE MODELING:

Bentley WaterCAD® Version 8i is the computer modeling tool used in this study.

Network analysis input parameters included the following:

1. Pipe diameters (inches)
2. Pipe lengths (feet)
3. Pipes invert elevations (feet – MSL)
4. A reservoir and a pump to model the fire flow test performed.
5. System demands (gpm)
6. Fire flows (gpm)
7. Model piping is ductile iron pipe using Hazen-Williams frictional losses (C = 130)

Output parameters included but were not limited to:

1. Pressure (psig)
2. Flow rates (gpm)
3. Velocities (fps)
4. Head loss (feet)

5.3 MINIMUM PRESSURE REQUIREMENTS:

The following system pressure requirements are in accordance with the City's design standards:

- Average day, maximum day and peak hour flow demands:
 - Minimum pressure = 50 psig
 - Maximum pressure = 120 psig
- Maximum day plus coincident fire flow demand:

- Minimum pressure = 30 psig
- Maximum pressure = 120 psig
- Daily scenario head loss shall not exceed 10 feet per 1,000 feet length of pipe.

Refer to **APPENDIX II** for computer modeling results.

5.4 WATER SYSTEM ANALYSIS:

Water modeling including the proposed 8" water line along the alley and the existing local pipe network shows available pressure and flow to provide domestic and fire service to the proposed building. A summary of the modeling results is presented below in Table 3. Detailed WaterCAD® results are presented in **APPENDIX II**. The following table represents flow and pressure available at ground level. Any required building pumps will be specified and detailed on the MPE drawing set. Provisions of NFPA 1 allow the aggregate fire flow capacity of hydrants adjacent to the building to equal the required fire flow. For modeling, the 2,000 gpm fire flow requirement is split between the new hydrant at Indian School Road and the existing hydrant at 1st Avenue.

Table 3 - WaterCAD® Analysis Results

Demand Scenario	Water Demand (GPM)	Pressure (PSIG)				Velocity (ft/s)	Pipe ID
		Min.	Node	Max.	Node		
Average Day	31	69	J-2	73	J-18	0.13	P-25
Maximum Day	62	69	J-2	73	J-18	0.27	P-25
Peak Hour	108	69	J-2	73	J-18	0.47	P-25
MDD + Fire Flow	2062*	55	J-12	61	J-18	8.93	P-25

* 2000 gpm fire flow split equally between J-12 and J-20

These results indicate that the proposed water system meets the City's criteria for daily water usage and fire flow events.

good

6. SUMMARY

6.1 SUMMARY OF PROPOSED WATER IMPROVEMENTS:

- The proposed water main is designed in accordance with City of Scottsdale's design standards and policies².
 - Minimum 50 psi @ peak hour required; 69 psi provided. Minimum 30 psi @ max+ fire flow required; 55 psi provided.
 - The system along with the proposed fire hydrants support the minimum 2000 gpm plus 62 gpm max day flow.
- The results shown in the modeling summary above indicate that the proposed water system meets the City's criteria for daily water usage and fire flow.

- Pressure regulating valves will be installed on all building services and backflow prevention devices on all metered services.

6.2 PROJECT SCHEDULE:

The infrastructure and buildings are proposed to be constructed in a single phase.

7 SUPPORTING MAPS

7.1 SITE UTILITY PLAN

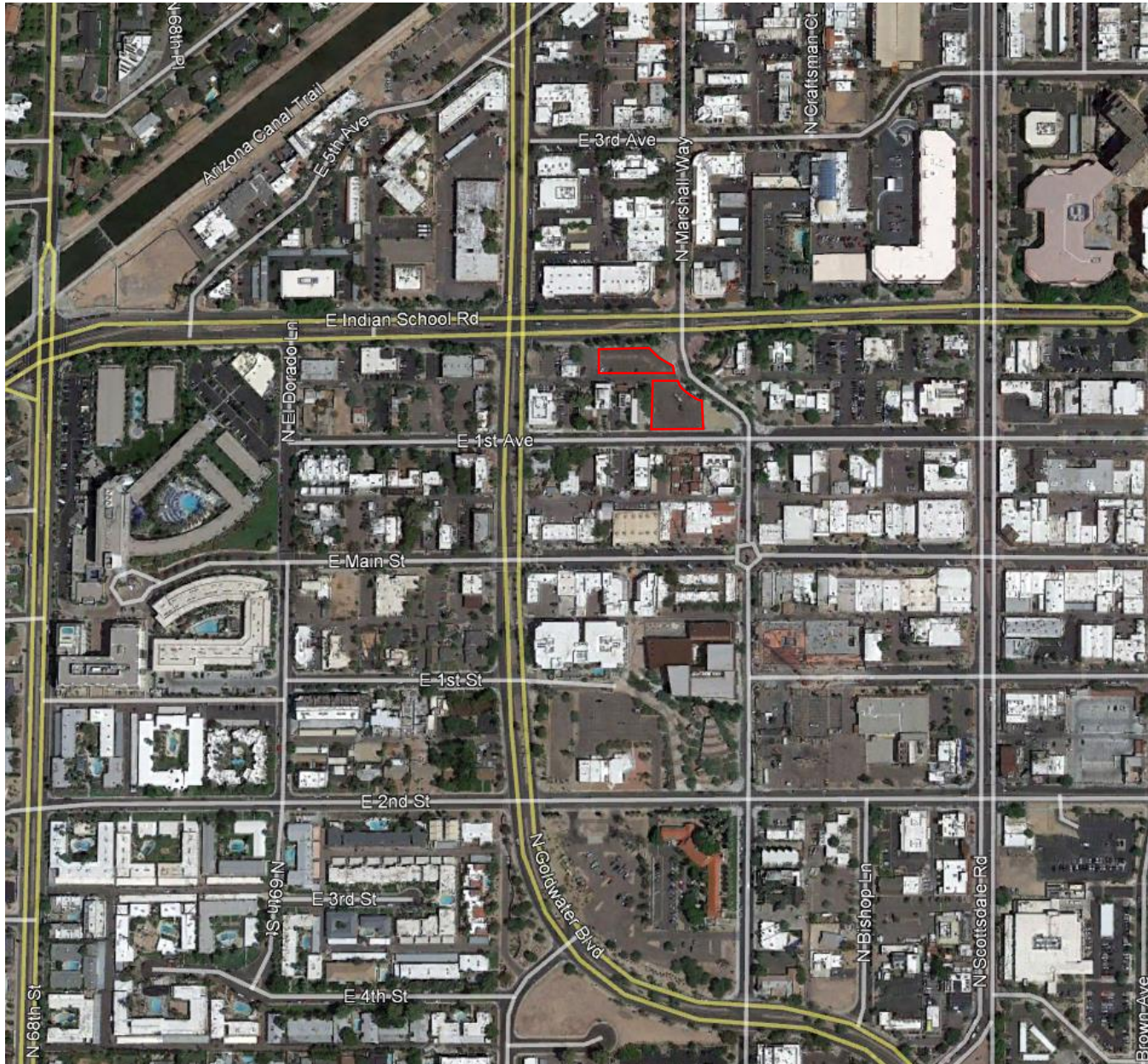
Refer to the Site Plan / Utility Plan in **APPENDIX III**.

8 REFERENCES

1. *COS QS Water Plan number 16-44*
2. *City of Scottsdale Design Standards & Policies Manual, 2017 (Chapter 6 – Water)*

FIGURES –

- 1. Aerial Map*
- 2. Vicinity Map*
- 3. FEMA FIRM Map*
- 4. Water Q-S 16-44*



8280 E. Gelding Dr., Suite 101
Scottsdale, AZ 85260

FIGURE 1
VICINITY MAP



FIGURE 2
AERIAL MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Arizona State Plane Central zone (FIPSZONE 0202). The **horizontal datum** was NAD 83 HARN, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. Map users wishing to obtain flood elevations referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29) may use the following Maricopa County website application: <http://www.fcd.maricopa.gov/Maps/gismaps/apps/gdacs/application/index.cfm>

This web tool allows users to obtain point-specific datum conversion values by zooming in and hovering over a VERTCON checkbox on the layers menu on the left side of the screen. The VERTCON grid referenced in this web application was also used to convert existing flood elevations from NGVD 29 to NAVD 88.

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

Base map information shown on this FIRM was derived from multiple sources. Aerial imagery was provided in digital format by the Maricopa County Department of Public Works, Flood Control District. The imagery is dated October 2009 to November 2009. Additional National Agricultural Imagery Program (NAIP) imagery was provided by the Arizona State Land Department (ALRIS) and is dated 2007. The coordinate system used for the production of the digital FIRM is State Plane Arizona Central NAD83 HARN, International Feet.

The **profile baseline** depicted on this map represents the hydraulic modeling baselines that match flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

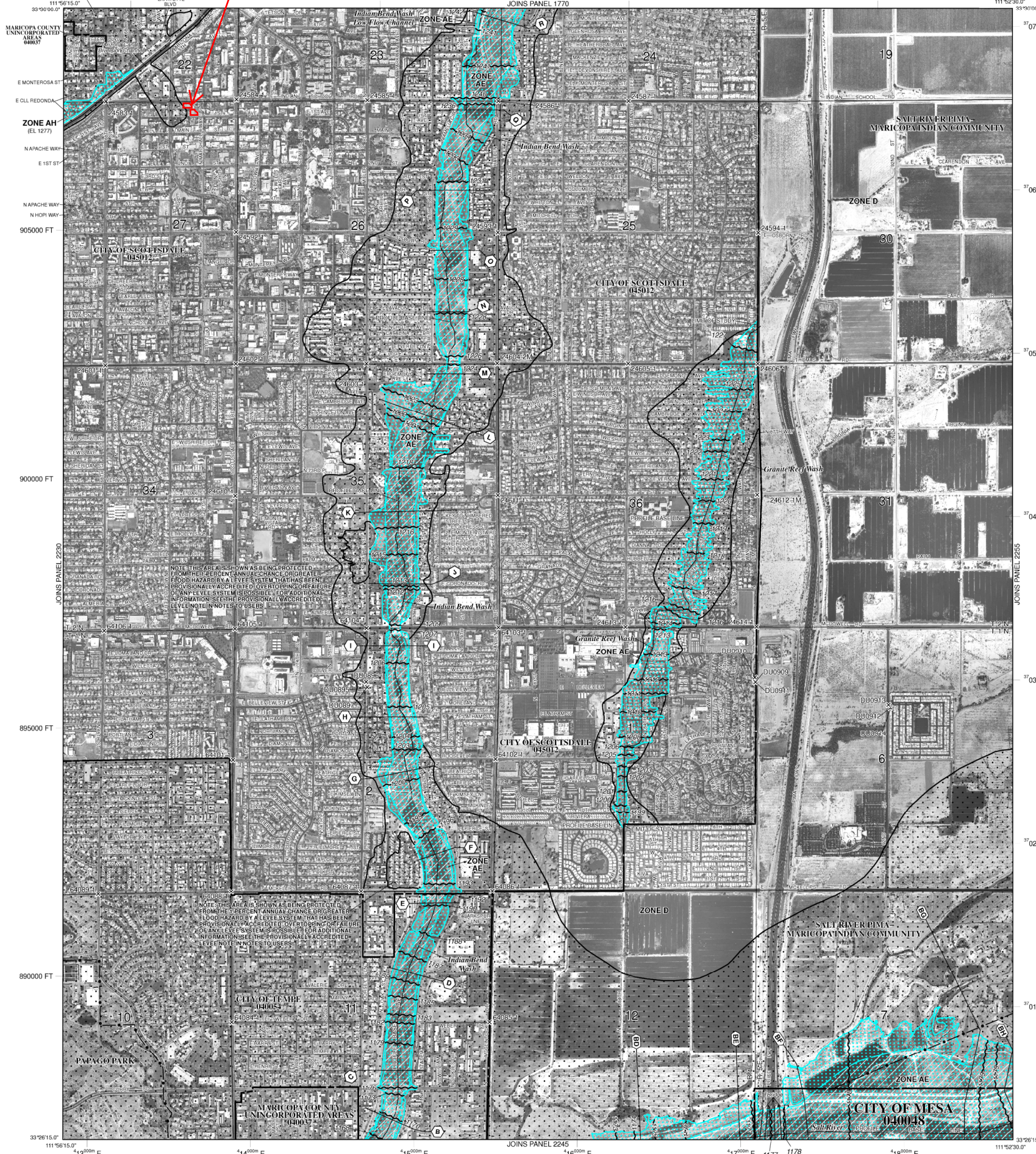
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM, visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/>.

Provisionally Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by June 25, 2011. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/nfip/index.shtm>.

PROJECT SITE



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
OTHER AREAS
ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)
 CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
 0.2% annual chance floodplain boundary
 Floodway boundary
 Zone D boundary
 CBRS and OPA boundary
 Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 Base Flood Elevation line and value; elevation in feet* (EL 887)
 Base Flood Elevation value where uniform within zone; elevation in feet*
 * Referenced to the North American Vertical Datum of 1988 (NAVD 88)

⊙ Cross section line
 ⊙ Transsect line
 ⊙ Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid ticks, zone 12
 5000-foot grid ticks; Arizona State Plane coordinate system, central zone (FIPSZONE 0202), Transverse Mercator

DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
 M1.5 River Mile

MAP REPOSITORIES
 Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
 April 15, 1988
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
 July 15, 2006
 September 30, 2006

October 16, 2013 - to advance suffix, to add floodway, to change base flood elevations, to change floodway, to update corporate limits, to add roads and road names, to incorporate previously issued letters of map revision, to add base flood elevation, and to add special flood hazard areas.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
 500 1000 2000 FEET
 300 0 300 600 METERS

NFIP **PANEL 2235L**

FIRM FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2235 OF 4425
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

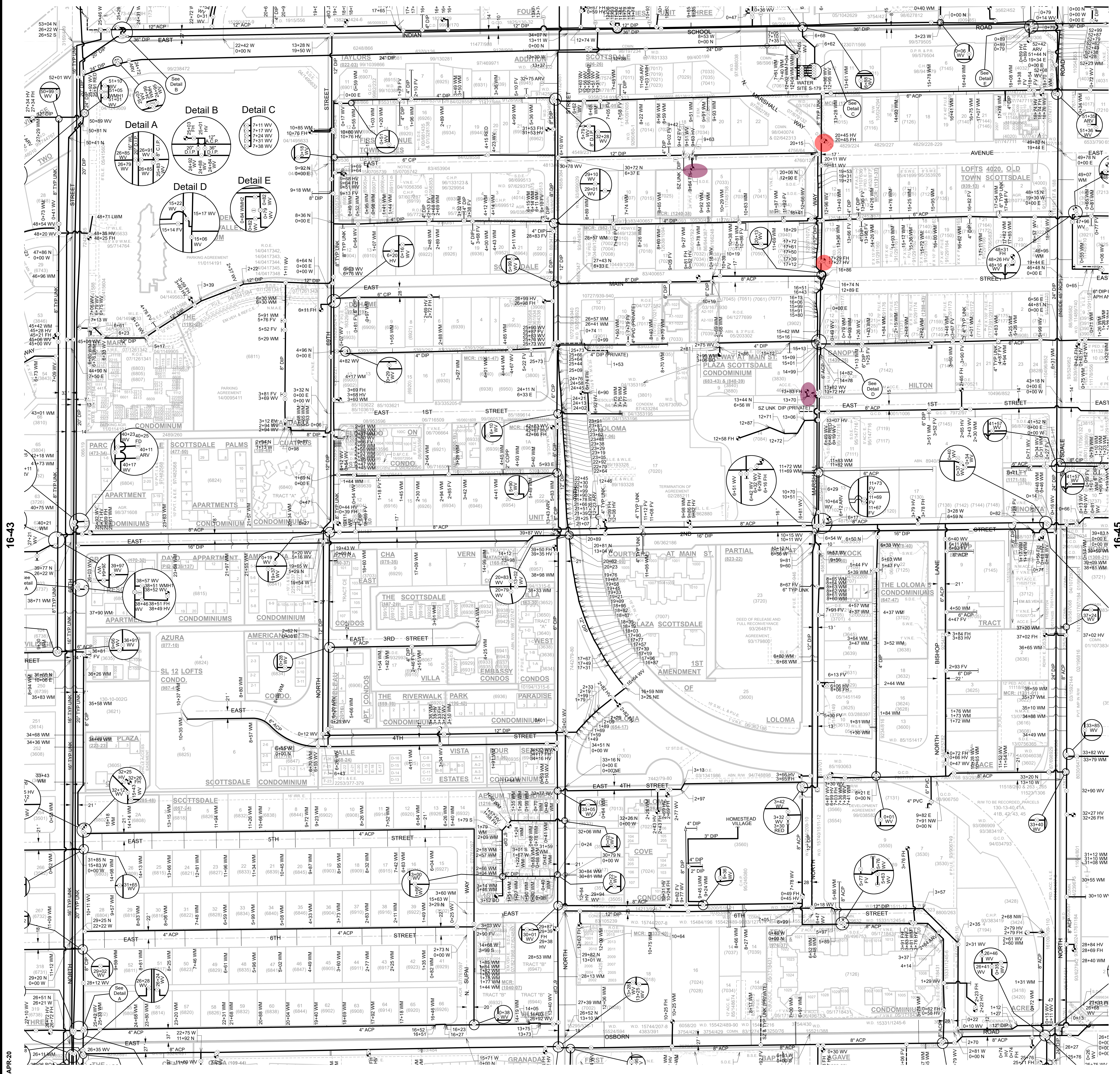
COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2235	L
MESA, CITY OF	040048	2235	L
SCOTTSDALE, CITY OF	040112	2235	L
TEMPE, CITY OF	040054	2235	L

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 04013C2235L
MAP REVISED OCTOBER 16, 2013

Federal Emergency Management Agency

FIGURE 3
FEMA FIRM



GENERAL NOTES:

- THIS IS A COMPUTER GENERATED DRAWING. FOR ANY REVISIONS PLEASE CONTACT THE CITY OF SCOTTSDALE GIS DEPARTMENT AT (480) 312-7792.
- THE SECTION LINE BEARING AND DISTANCES ARE BASED ON THE CITY OF SCOTTSDALE GPS SURVEY OF SEPTEMBER, 1991. BEARINGS ARE NAD 83 GRID AND DISTANCES ARE FLATTENED TO GROUND. WHERE NO CORNER WAS FOUND THE DIMENSIONS ARE GIVEN TO CALCULATED SECTION CORNERS AND ARE NOTED AS 'CALCULATED' ON THE MAP.

LEGEND:

- Air Release Valve
- Non-potable Air Release Valve
- Blowoff
- Cap
- Cathodic Protection
- Fill Drain
- Fire Hydrant
- Non-GPS Point
- Pressure Reducing Valve
- Pump
- Reducer
- Sample Station
- Water Manhole
- Non-Potable Manhole
- Well
- Valve
- Non-potable Valve
- Vault
- Water Main
- Non-Potable Main
- Fire / Private Main
- Non-Scottsdale Main

VICINITY MAP

NORTH

SCALE: 1" = 100'

0 50 100 200

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

WATER
QUARTER SECTION MAP
16-44
 NE 1/4 SEC. 27 T2N R4E

FIGURE 4

CITY OF SCOTTSDALE
 SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS
 3629 North Drinkwater Boulevard
 Scottsdale, Arizona 85251

NOTICE

THIS DOCUMENT IS PROVIDED FOR GENERAL INFORMATION PURPOSES ONLY. THE CITY OF SCOTTSDALE DOES NOT WARRANT ITS ACCURACY, COMPLETENESS OR SUITABILITY FOR ANY PARTICULAR PURPOSE. IT SHOULD NOT BE RELIED UPON WITHOUT FIELD VERIFICATION.

THE CITY OF SCOTTSDALE

26-APR-20



“LEED®ing and Developing Smart Projects”

APPENDIX I

FLOW TEST

8280 E. Gelding Dr., Suite 101
Scottsdale, AZ 85260

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name: Indian School & Marshall Way
Project Address: 7041 East Indian School Road, Scottsdale, Arizona 85251
Client Project No.: Not Provided
Arizona Flow Testing Project No.: 20260
Flow Test Permit No.: C62626
Date and time flow test conducted: July 16, 2020 at 7:40 AM
Data is current and reliable until: January 16, 2021
Conducted by: Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Witnessed by: Ray Padilla – City of Scottsdale-Inspector (602-541-0586)

Raw Test Data

Static Pressure: **78.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **64.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **29.0 PSI**
(Measured in pounds per square inch)

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

Coefficient of Diffuser: .9

Flowing GPM: **2,314 GPM**
(Measured in gallons per minute)

GPM @ 20 PSI: **4,985 GPM**

Data with 10% Safety Factor

Static Pressure: **70.2 PSI**
(Measured in pounds per square inch)

Residual Pressure: **56.2 PSI**
(Measured in pounds per square inch)

Distance between hydrants: Approx. 320 Feet

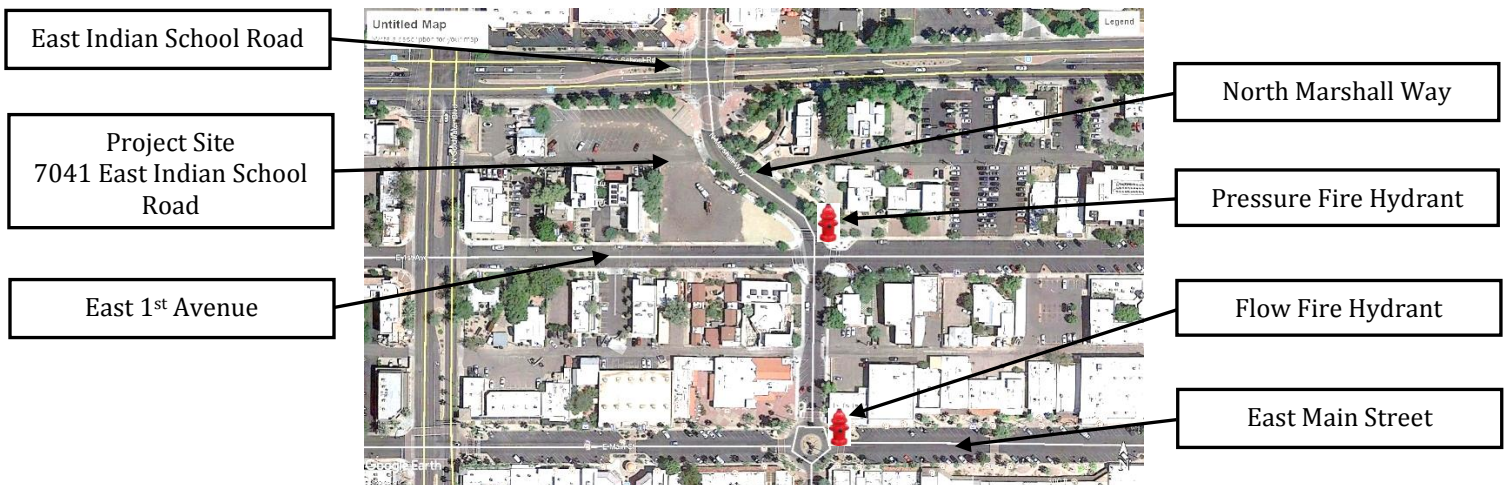
Main size: Not Provided

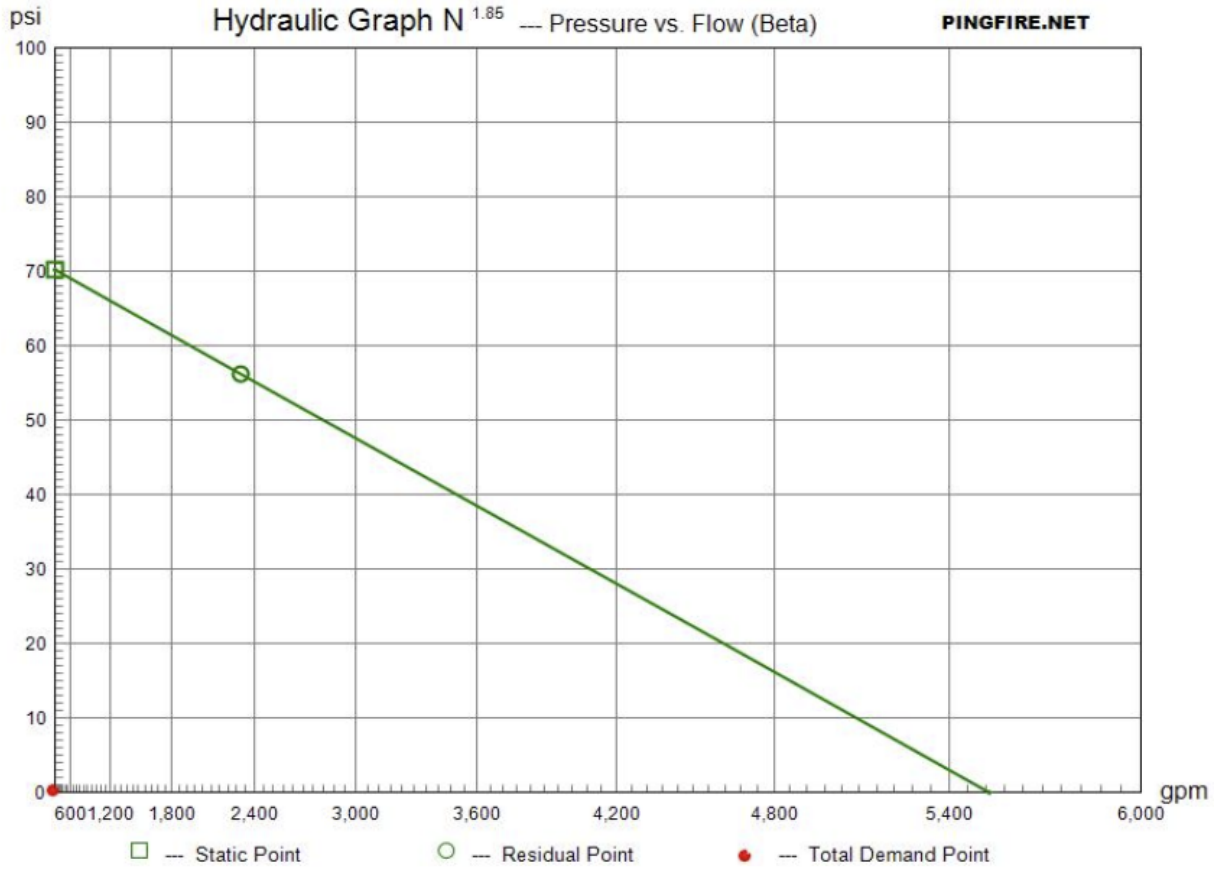
Flowing GPM: **2,314 GPM**

GPM @ 20 PSI: **4,611 GPM**

Flow Test Location

North ↑





Project Location:

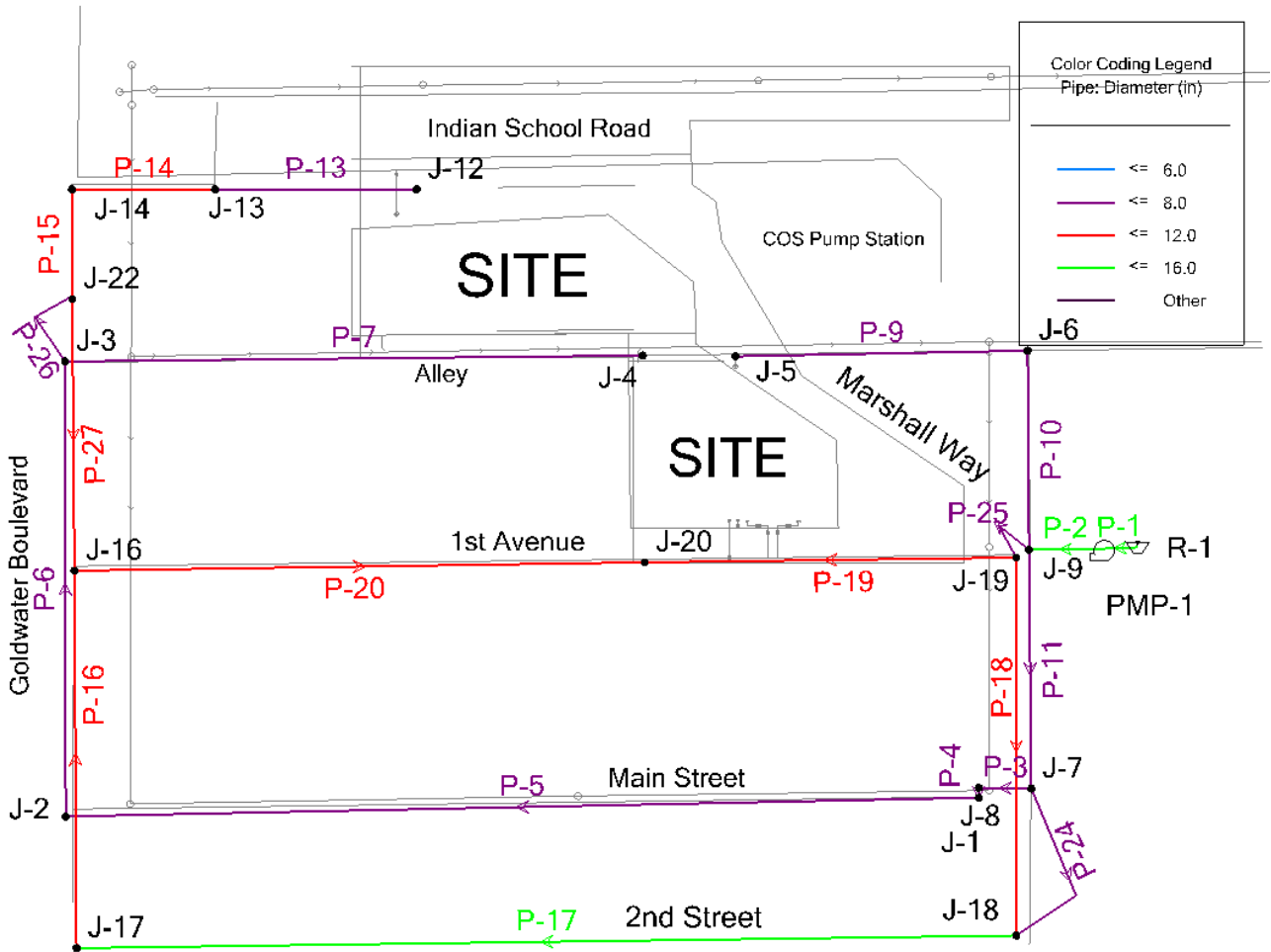
Flow Test: Hydrant Elev.= ft., Static Pressure= psi, Residual Pressure= psi, Flow= gpm

APPENDIX I

FH Flow Test

APPENDIX II

WaterCAD Modeling



APPENDIX II

Water Model

WaterCAD Model.wtg
Active Scenario: ADD
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	60.00	0	223.35	71
J-2	63.00	0	223.35	69
J-3	64.83	0	223.35	69
J-4	63.55	0	223.35	69
J-5	63.50	0	223.35	69
J-6	61.79	0	223.35	70
J-7	60.04	0	223.35	71
J-8	60.00	0	223.35	71
J-9	60.95	0	223.35	70
J-12	64.20	0	223.35	69
J-13	64.30	0	223.35	69
J-14	64.40	0	223.35	69
J-16	61.30	0	223.35	70
J-17	56.00	0	223.35	72
J-18	55.00	0	223.35	73
J-19	60.70	0	223.35	70
J-20	61.20	31	223.35	70
J-22	63.51	0	223.35	69

WaterCAD Model.wtg
Active Scenario: ADD
FlexTable: Pipe Table

Label	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Length (ft)	Velocity (ft/s)	Pressure Loss (psi)
P-1	16.0	Ductile Iron	130.0	31	26	0.05	0.0
P-2	16.0	Ductile Iron	130.0	31	53	0.05	0.0
P-3	8.0	Ductile Iron	130.0	3	38	0.02	0.0
P-4	8.0	Ductile Iron	130.0	3	7	0.02	0.0
P-5	8.0	Ductile Iron	130.0	3	666	0.02	0.0
P-6	8.0	Ductile Iron	130.0	3	332	0.02	0.0
P-7	8.0	Asbestos Cement	130.0	0	421	0.00	0.0
P-9	8.0	Asbestos Cement	130.0	0	213	0.00	0.0
P-10	8.0	Ductile Iron	130.0	0	145	0.00	0.0
P-11	8.0	Ductile Iron	130.0	10	174	0.06	0.0
P-13	8.0	Ductile Iron	130.0	0	147	0.00	0.0
P-14	12.0	Ductile Iron	130.0	0	104	0.00	0.0
P-15	12.0	Ductile Iron	130.0	0	80	0.00	0.0
P-16	12.0	Ductile Iron	130.0	-9	275	0.02	0.0
P-17	16.0	Ductile Iron	130.0	-9	685	0.01	0.0
P-18	12.0	Ductile Iron	130.0	-2	276	0.01	0.0
P-19	12.0	Ductile Iron	130.0	19	271	0.05	0.0
P-20	12.0	Ductile Iron	130.0	-12	416	0.03	0.0
P-24	8.0	Ductile Iron	130.0	7	137	0.04	0.0
P-25	8.0	Ductile Iron	130.0	-21	56	0.13	0.0
P-26	8.0	Ductile Iron	130.0	3	71	0.02	0.0
P-27	12.0	Ductile Iron	130.0	3	198	0.01	0.0

WaterCAD Model.wtg
Active Scenario: ADD
FlexTable: Pump Table

Label	Elevation (ft)	Pump Status	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	61.00	On	61.20	223.35	31	162.15

WaterCAD Model.wtg
Active Scenario: ADD
FlexTable: Reservoir Table

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	61.20	31	61.20

WaterCAD Model.wtg
Active Scenario: MD
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	60.00	0	223.32	71
J-2	63.00	0	223.32	69
J-3	64.83	0	223.32	69
J-4	63.55	0	223.32	69
J-5	63.50	0	223.32	69
J-6	61.79	0	223.32	70
J-7	60.04	0	223.32	71
J-8	60.00	0	223.32	71
J-9	60.95	0	223.32	70
J-12	64.20	0	223.32	69
J-13	64.30	0	223.32	69
J-14	64.40	0	223.32	69
J-16	61.30	0	223.32	70
J-17	56.00	0	223.32	72
J-18	55.00	0	223.32	73
J-19	60.70	0	223.32	70
J-20	61.20	61	223.32	70
J-22	63.51	0	223.32	69

WaterCAD Model.wtg
Active Scenario: MD
FlexTable: Pipe Table

Label	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Length (ft)	Velocity (ft/s)	Pressure Loss (psi)
P-1	16.0	Ductile Iron	130.0	61	26	0.10	0.0
P-2	16.0	Ductile Iron	130.0	61	53	0.10	0.0
P-3	8.0	Ductile Iron	130.0	6	38	0.04	0.0
P-4	8.0	Ductile Iron	130.0	6	7	0.04	0.0
P-5	8.0	Ductile Iron	130.0	6	666	0.04	0.0
P-6	8.0	Ductile Iron	130.0	6	332	0.04	0.0
P-7	8.0	Asbestos Cement	130.0	0	421	0.00	0.0
P-9	8.0	Asbestos Cement	130.0	0	213	0.00	0.0
P-10	8.0	Ductile Iron	130.0	0	145	0.00	0.0
P-11	8.0	Ductile Iron	130.0	19	174	0.12	0.0
P-13	8.0	Ductile Iron	130.0	0	147	0.00	0.0
P-14	12.0	Ductile Iron	130.0	0	104	0.00	0.0
P-15	12.0	Ductile Iron	130.0	0	80	0.00	0.0
P-16	12.0	Ductile Iron	130.0	-17	275	0.05	0.0
P-17	16.0	Ductile Iron	130.0	-17	685	0.03	0.0
P-18	12.0	Ductile Iron	130.0	-4	276	0.01	0.0
P-19	12.0	Ductile Iron	130.0	38	271	0.11	0.0
P-20	12.0	Ductile Iron	130.0	-23	416	0.07	0.0
P-24	8.0	Ductile Iron	130.0	13	137	0.09	0.0
P-25	8.0	Ductile Iron	130.0	-42	56	0.27	0.0
P-26	8.0	Ductile Iron	130.0	6	71	0.04	0.0
P-27	12.0	Ductile Iron	130.0	6	198	0.02	0.0

WaterCAD Model.wtg

Active Scenario: MD

FlexTable: Pump Table

Label	Elevation (ft)	Pump Status	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	61.00	On	61.20	223.32	61	162.12

WaterCAD Model.wtg
Active Scenario: MD
FlexTable: Reservoir Table

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	61.20	61	61.20

WaterCAD Model.wtg
Active Scenario: PH
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	60.00	0	223.24	71
J-2	63.00	0	223.24	69
J-3	64.83	0	223.24	69
J-4	63.55	0	223.24	69
J-5	63.50	0	223.25	69
J-6	61.79	0	223.25	70
J-7	60.04	0	223.24	71
J-8	60.00	0	223.24	71
J-9	60.95	0	223.25	70
J-12	64.20	0	223.24	69
J-13	64.30	0	223.24	69
J-14	64.40	0	223.24	69
J-16	61.30	0	223.24	70
J-17	56.00	0	223.24	72
J-18	55.00	0	223.24	73
J-19	60.70	0	223.24	70
J-20	61.20	107	223.24	70
J-22	63.51	0	223.24	69

WaterCAD Model.wtg
Active Scenario: PH
FlexTable: Pipe Table

Label	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Length (ft)	Velocity (ft/s)	Pressure Loss (psi)
P-1	16.0	Ductile Iron	130.0	107	26	0.17	0.0
P-2	16.0	Ductile Iron	130.0	107	53	0.17	0.0
P-3	8.0	Ductile Iron	130.0	10	38	0.06	0.0
P-4	8.0	Ductile Iron	130.0	10	7	0.06	0.0
P-5	8.0	Ductile Iron	130.0	10	666	0.06	0.0
P-6	8.0	Ductile Iron	130.0	10	332	0.06	0.0
P-7	8.0	Asbestos Cement	130.0	0	421	0.00	0.0
P-9	8.0	Asbestos Cement	130.0	0	213	0.00	0.0
P-10	8.0	Ductile Iron	130.0	0	145	0.00	0.0
P-11	8.0	Ductile Iron	130.0	33	174	0.21	0.0
P-13	8.0	Ductile Iron	130.0	0	147	0.00	0.0
P-14	12.0	Ductile Iron	130.0	0	104	0.00	0.0
P-15	12.0	Ductile Iron	130.0	0	80	0.00	0.0
P-16	12.0	Ductile Iron	130.0	-30	275	0.09	0.0
P-17	16.0	Ductile Iron	130.0	-30	685	0.05	0.0
P-18	12.0	Ductile Iron	130.0	-7	276	0.02	0.0
P-19	12.0	Ductile Iron	130.0	67	271	0.19	0.0
P-20	12.0	Ductile Iron	130.0	-40	416	0.11	0.0
P-24	8.0	Ductile Iron	130.0	23	137	0.15	0.0
P-25	8.0	Ductile Iron	130.0	-74	56	0.47	0.0
P-26	8.0	Ductile Iron	130.0	10	71	0.06	0.0
P-27	12.0	Ductile Iron	130.0	10	198	0.03	0.0

WaterCAD Model.wtg

Active Scenario: PH

FlexTable: Pump Table

Label	Elevation (ft)	Pump Status	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	61.00	On	61.20	223.25	107	162.05

WaterCAD Model.wtg
Active Scenario: PH
FlexTable: Reservoir Table

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	61.20	107	61.20

WaterCAD Model.wtg
Active Scenario: MD+Split FF
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	60.00	0	195.50	59
J-2	63.00	0	194.62	57
J-3	64.83	0	194.18	56
J-4	63.55	0	194.18	57
J-5	63.50	0	197.05	58
J-6	61.79	0	197.05	59
J-7	60.04	0	195.56	59
J-8	60.00	0	195.51	59
J-9	60.95	0	197.05	59
J-12	64.20	1,000	190.93	55
J-13	64.30	0	193.62	56
J-14	64.40	0	193.88	56
J-16	61.30	0	194.38	58
J-17	56.00	0	194.80	60
J-18	55.00	0	195.06	61
J-19	60.70	0	195.15	58
J-20	61.20	1,062	194.38	58
J-22	63.51	0	194.08	56

WaterCAD Model.wtg
Active Scenario: MD+Split FF
FlexTable: Pipe Table

Label	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Length (ft)	Velocity (ft/s)	Pressure Loss (psi)
P-1	16.0	Ductile Iron	130.0	2,062	26	3.29	0.0
P-2	16.0	Ductile Iron	130.0	2,062	53	3.29	0.1
P-3	8.0	Ductile Iron	130.0	243	38	1.55	0.0
P-4	8.0	Ductile Iron	130.0	243	7	1.55	0.0
P-5	8.0	Ductile Iron	130.0	243	666	1.55	0.4
P-6	8.0	Ductile Iron	130.0	243	332	1.55	0.2
P-7	8.0	Asbestos Cement	130.0	0	421	0.00	0.0
P-9	8.0	Asbestos Cement	130.0	0	213	0.00	0.0
P-10	8.0	Ductile Iron	130.0	0	145	0.00	0.0
P-11	8.0	Ductile Iron	130.0	663	174	4.23	0.6
P-13	8.0	Ductile Iron	130.0	-1,000	147	6.38	1.2
P-14	12.0	Ductile Iron	130.0	-1,000	104	2.84	0.1
P-15	12.0	Ductile Iron	130.0	-1,000	80	2.84	0.1
P-16	12.0	Ductile Iron	130.0	-758	275	2.15	0.2
P-17	16.0	Ductile Iron	130.0	-758	685	1.21	0.1
P-18	12.0	Ductile Iron	130.0	-337	276	0.96	0.0
P-19	12.0	Ductile Iron	130.0	1,061	271	3.01	0.3
P-20	12.0	Ductile Iron	130.0	-1	416	0.00	0.0
P-24	8.0	Ductile Iron	130.0	421	137	2.69	0.2
P-25	8.0	Ductile Iron	130.0	-1,399	56	8.93	0.8
P-26	8.0	Ductile Iron	130.0	243	71	1.55	0.0
P-27	12.0	Ductile Iron	130.0	-757	198	2.15	0.1

WaterCAD Model.wtg
Active Scenario: MD+Split FF
FlexTable: Pump Table

Label	Elevation (ft)	Pump Status	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	61.00	On	61.14	197.18	2,062	136.04

WaterCAD Model.wtg
Active Scenario: MD+Split FF
FlexTable: Reservoir Table

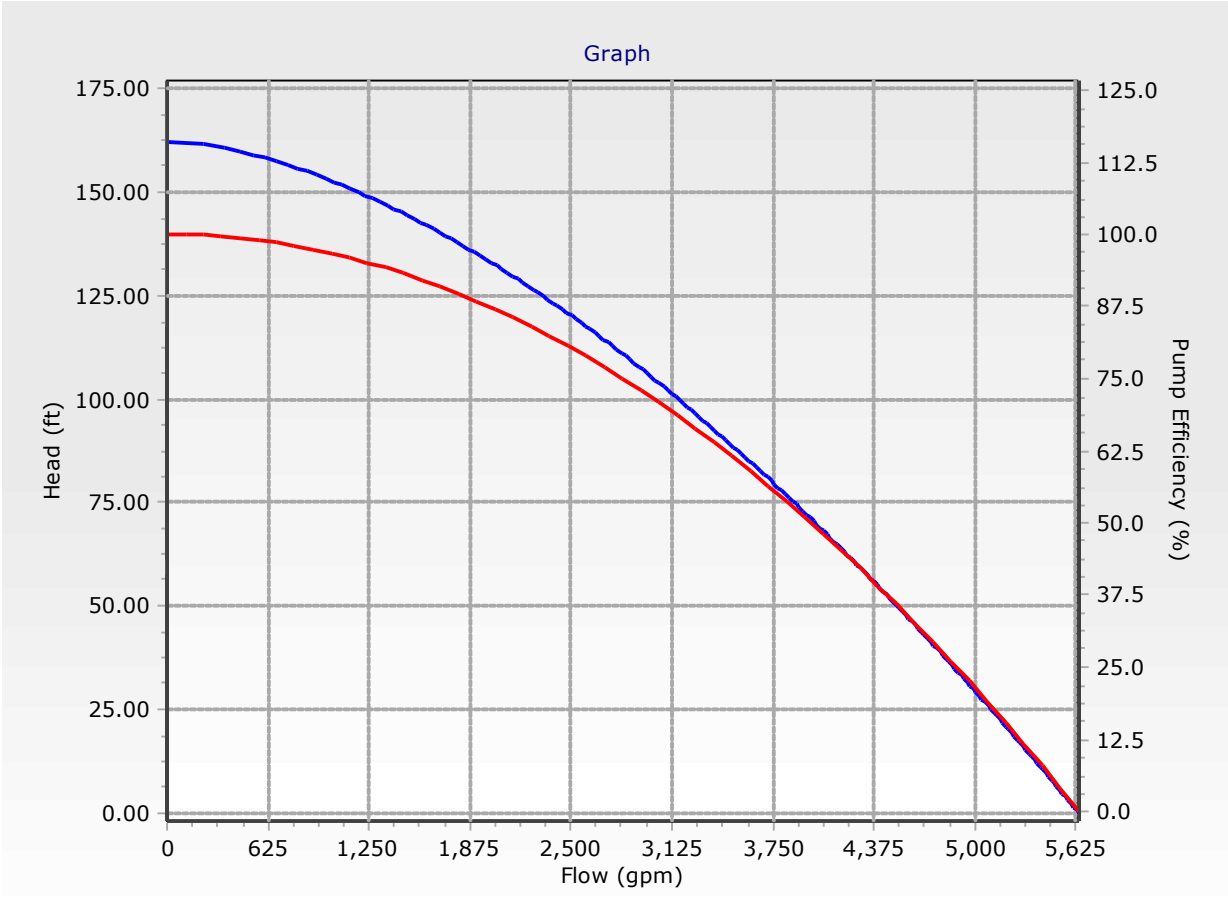
Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	61.20	2,062	61.20

Pump Definition Detailed Report: PUMP CURVE

Active Scenario: MD+FF

Element Details			
ID	59	Notes	
Label	PUMP CURVE		
Pump Definition Type			
Pump Definition Type	Standard (3 Point)	Design Head	129.82 ft
Shutoff Flow	0 gpm	Maximum Operating Flow	4,611 gpm
Shutoff Head	162.16 ft	Maximum Operating Head	46.20 ft
Design Flow	2,134 gpm		
Pump Efficiency Type			
Pump Efficiency Type	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0 gpm		
Transient (Physical)			
Inertia (Pump and Motor)	0.000 lb·ft ²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True

Pump Definition Detailed Report: PUMP CURVE
Active Scenario: MD+FF



APPENDIX III

PRELIMINARY UTILITY EXHIBIT

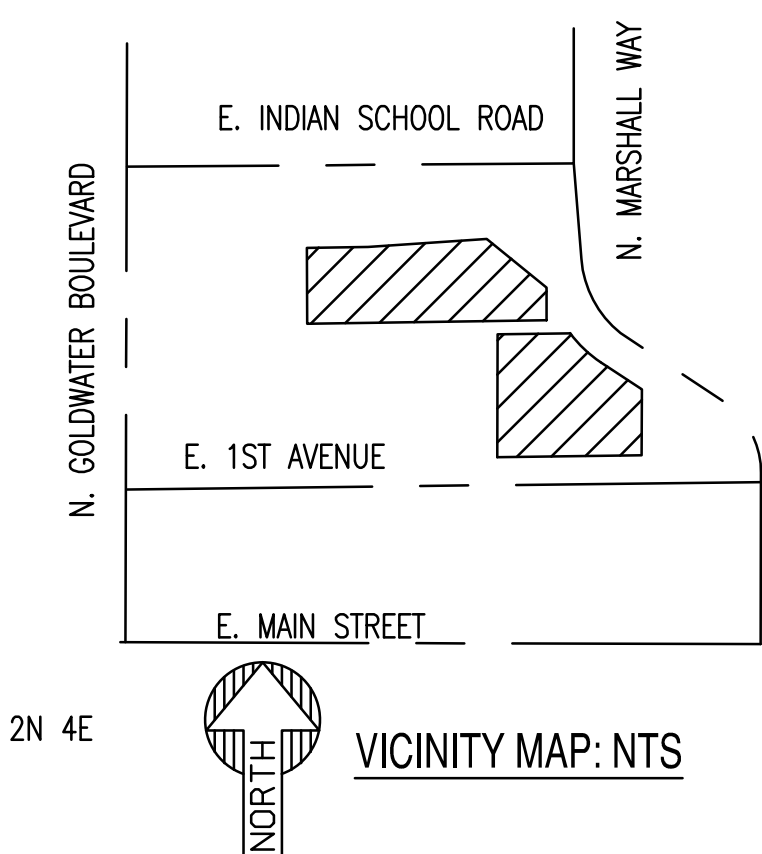
CIVIL ENGINEER:
 SEG
 8280 E. GELDING DR, SUITE #101
 SCOTTSDALE, AZ 85260
 480-588-7226
 ATTN: ALI FAKIH

DEVELOPER:
 JACKSON DEARBORN
 404 S. WELLS ST. SUITE 400
 CHICAGO, IL 60607
 312-878-7362
 ATTN: RYAN TOBIAS

ARCHITECT:
 SWABACK PLLC
 7550 E. McDONALD DR. SUITE A
 SCOTTSDALE, AZ 85250
 480-367-2100
 ATTN: JEFFREY DENZAK

OWNER:
 BENEFICIARY TRUST
 810 W. HOWE ST.
 TEMPE AZ 85281
 480-367-2100
 ATTN: BENJAMIN FUNKE

ARTISAN SCOTTSDALE
 SWC INDIAN SCHOOL RD & MARSHALL WAY
 SCOTTSDALE, AZ 85251
 PRELIMINARY UTILITY EXHIBIT



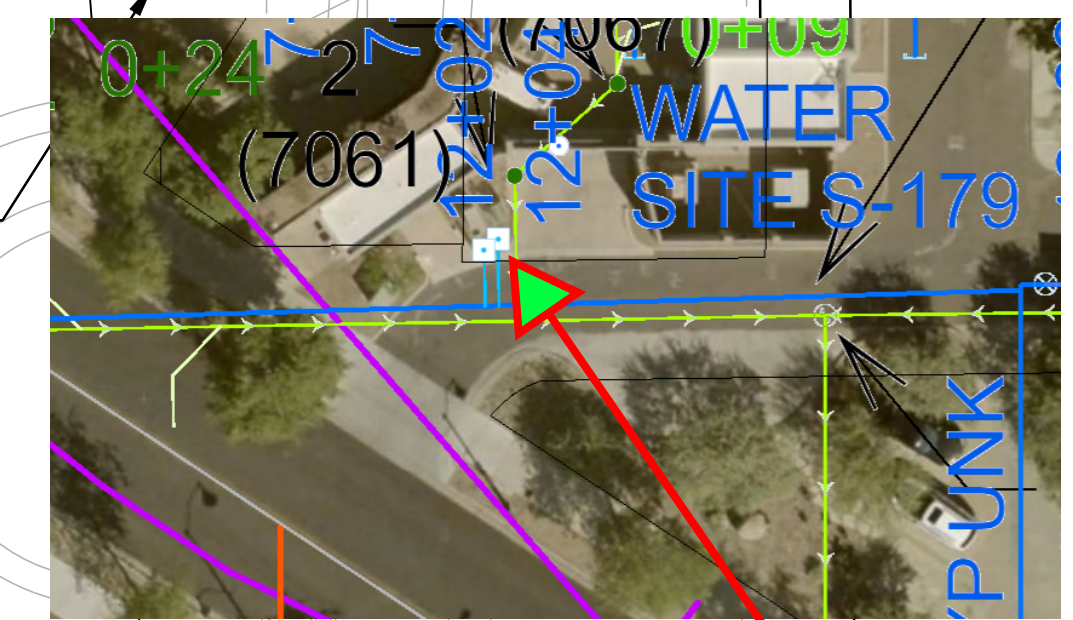
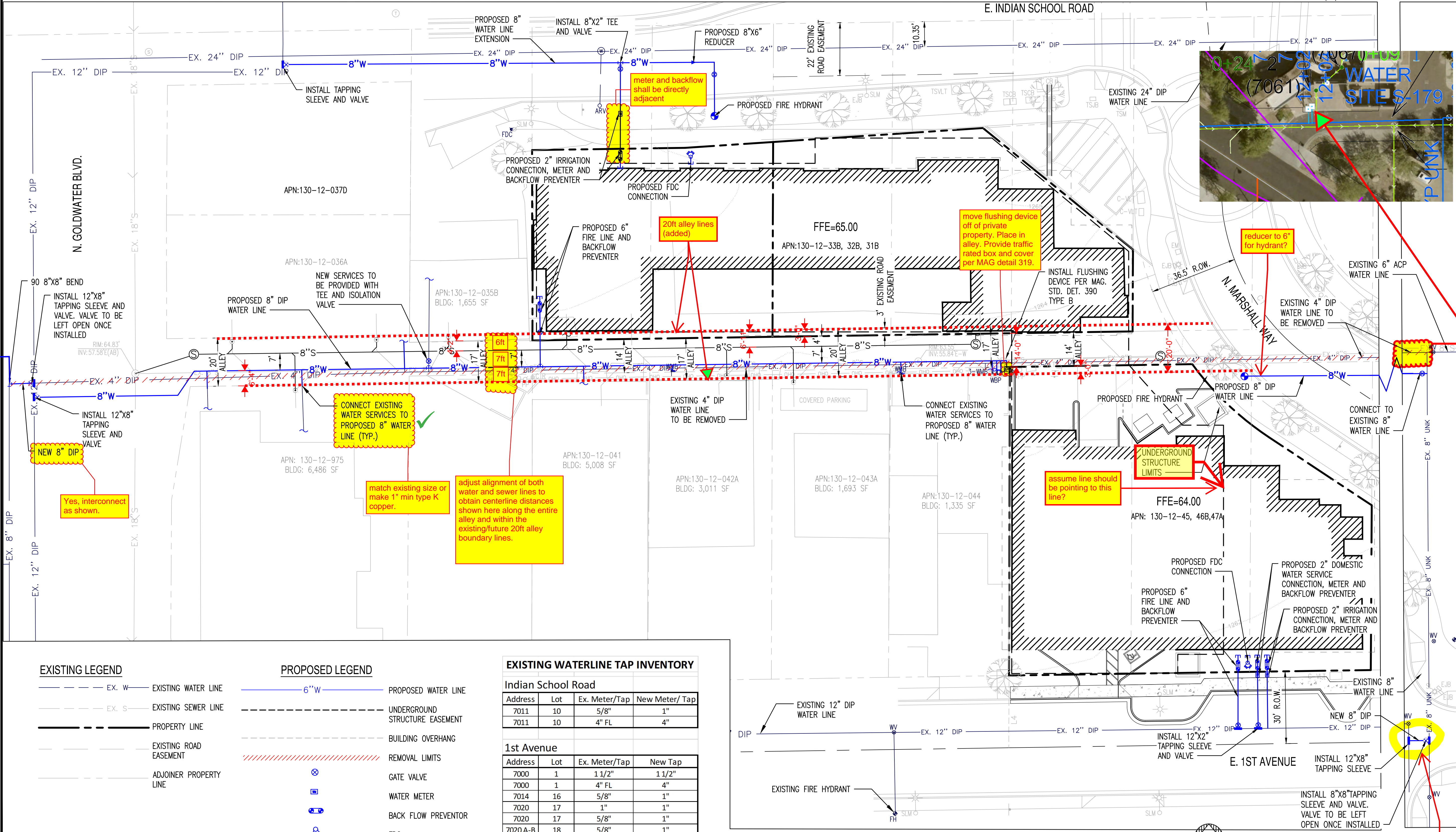
**PRELIMINARY
 NOT FOR
 CONSTRUCTION**

**SUSTAINABILITY
 ENGINEERING
 GROUP**



8280 E. GELDING DRIVE SUITE 101, SCOTTSDALE, ARIZONA 85260
 WWW.AZSEG.COM TEL: 480.588.7226 FAX: 480.259.3534

LOCATION: Z:\SHARED\PROJECTS\JACKSON DEARBORN PARTNERS-SWABACK\MARSHAL WAY-SCOTTSDALE-200708\11 CAD (SEG)\11.2 ENTITLEMENT-PLANNING\200708 UTILITY PLANDWG
 DATE: 6/17/2021
 SAVED BY: LAPTOP02



show existing line, tee, and iso valve

meter and backflow shall be directly adjacent

20ft alley lines (added)

move flushing device off of private property. Place in alley. Provide traffic rated box and cover per MAG detail 319.

reducer to 6" for hydrant?

Section of 4" pipe cannot be removed. There are 2X2" meters on this segment that serve water site 179. Install insertion valve on 4" to west of meters to keep meters active. Restrain pipe as necessary and remove pipe up to insertion valve. Cap with restrained cap.

NEW 8" DIP

Yes, interconnect as shown.

CONNECT EXISTING WATER SERVICES TO PROPOSED 8" WATER LINE (TYP.)

match existing size or make 1" min type K copper.

adjust alignment of both water and sewer lines to obtain centerline distances shown here along the entire alley and within the existing/future 20ft alley boundary lines.

assume line should be pointing to this line?

UNDERGROUND STRUCTURE LIMITS

Yes, interconnect as shown

EXISTING LEGEND

- EX. W — EXISTING WATER LINE
- EX. S — EXISTING SEWER LINE
- — PROPERTY LINE
- — EXISTING ROAD EASEMENT
- — ADJOINER PROPERTY LINE

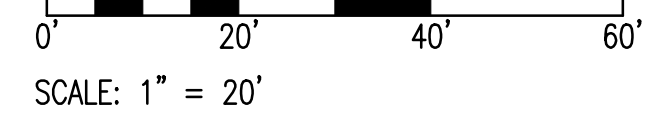
PROPOSED LEGEND

- 6"W — PROPOSED WATER LINE
- — UNDERGROUND STRUCTURE EASEMENT
- — BUILDING OVERHANG
- ////// — REMOVAL LIMITS
- ⊗ — GATE VALVE
- ⊠ — WATER METER
- ⊡ — BACK FLOW PREVENTOR
- ⊕ — FDC
- ⊙ — FIRE HYDRANT
- ⊞ — FLUSHING DEVICE

EXISTING WATERLINE TAP INVENTORY

Indian School Road			
Address	Lot	Ex. Meter/Tap	New Meter/Tap
7011	10	5/8"	1"
7011	10	4" FL	4"

1st Avenue			
Address	Lot	Ex. Meter/Tap	New Tap
7000	1	1 1/2"	1 1/2"
7000	1	4" FL	4"
7014	16	5/8"	1"
7020	17	1"	1"
7020	17	5/8"	1"
7020 A-B	18	5/8"	1"
7034	19	4" FL	4"
7034	19	1 1/2"	1 1/2"
7034	19	1"	1"



PROJECT: ARTISAN SCOTTSDALE
 LOCATION: SWC INDIAN SCHOOL RD & MARSHALL WAY SCOTTSDALE, AZ 85251
 DRAWN: LP 06/09/2021
 DESIGNED: LP 06/09/2021
 QC: SC 06/17/2021
 SA: AF
 DATE: 06/18/2021
 ISSUED FOR: REZONING
 REVISION NO.: DATE:
 JOB NO.: 200708
 SHEET TITLE: PRELIMINARY UTILITY EXHIBIT (WATER PLAN)
 PAGE NO.: 1 OF 2
 SHEET NO.: C4.10

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APPENDIX IV

IFC and NFPA References

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* without openings, constructed in

accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings* having a fire-flow calculation area that does not exceed 3,600 square feet (344.5 m²) shall be 1,000 gallons per minute (3785.4 L/min) for 1 hour. Fire-flow and flow duration for *dwellings* having a fire-flow calculation area in excess of 3,600 square feet (344.5 m²) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire-flow of 50 percent, as *approved*, is allowed when the building is equipped with an *approved automatic sprinkler system*.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings* shall be as specified in Table B105.1.

Exception: A reduction in required fire-flow of up to 75 percent, as *approved*, is allowed when the building is provided with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

SECTION B106 REFERENCED STANDARDS

ICC	IBC—12	International Building Code	B104.2, Table B105.1
ICC	IWUIC—12	International Wildland-Urban Interface Code	B103.3
NFPA	1142—12	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

**TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS**

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

NFPA 1: Minimum Number of Fire Hydrants for Fire Flow #FireCodefridays

BY KRISTIN BIGDA

Section 18.5 of NFPA 1 provides requirements for fire hydrants, including location, distribution, minimum number, clearance, marking, and testing and maintenance.

Section 18.5 was revised in its entirety for the 2015 edition of the Code. Previous editions provided a performance-based requirement that the number and type of fire hydrants and connections to other approved water supplies be capable of delivering the required fire flow and be provided at approved locations. The former Annex E was deleted for the 2015 edition of the Code; in its place, Section 18.5 was revised by the addition of prescriptive, mandatory requirements for fire hydrant location and distribution based on the required fire flow determined in accordance with Section 18.4.

To determine the minimum number of fire hydrants for fire flow, the following provisions should be followed:

- The aggregate fire flow capacity of all fire hydrants within 1000 ft (305 m) of the building cannot be less than the required fire flow.
- Table 18.5.4.3 provides the maximum fire flow capacity for which a fire hydrant can be credited.

Table 18.5.4.3 Maximum Fire Hydrant Fire Flow Capacity

Distance to Building ^a		Maximum Capacity ^b	
(ft)	(m)	(gpm)	(L/min)
≤ 250	≤ 76	1500	5678
> 250 and ≤ 500	> 76 and ≤ 152	1000	3785
> 500 and ≤ 1000	> 152 and ≤ 305	750	2839

^aMeasured in accordance with 18.5.1.4 and 18.5.1.5.

^bMinimum 20 psi (139.9 kPa) residual pressure.