Appendix K1

Water System Analysis

DEXTER WILSON ENGINEERING, INC.

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WATER SYSTEM ANALYSIS
FOR THE
SUNRISE PROJECT
IN THE CITY OF SAN MARCOS

September 12, 2019

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Job No. 930-010

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September 12, 2019 930-010

The Sunrise Gardens Project Owner, LLC
c/o Consultants Collaborative Inc.
160 Industrial Street, Suite 200
San Marcos, CA 92078

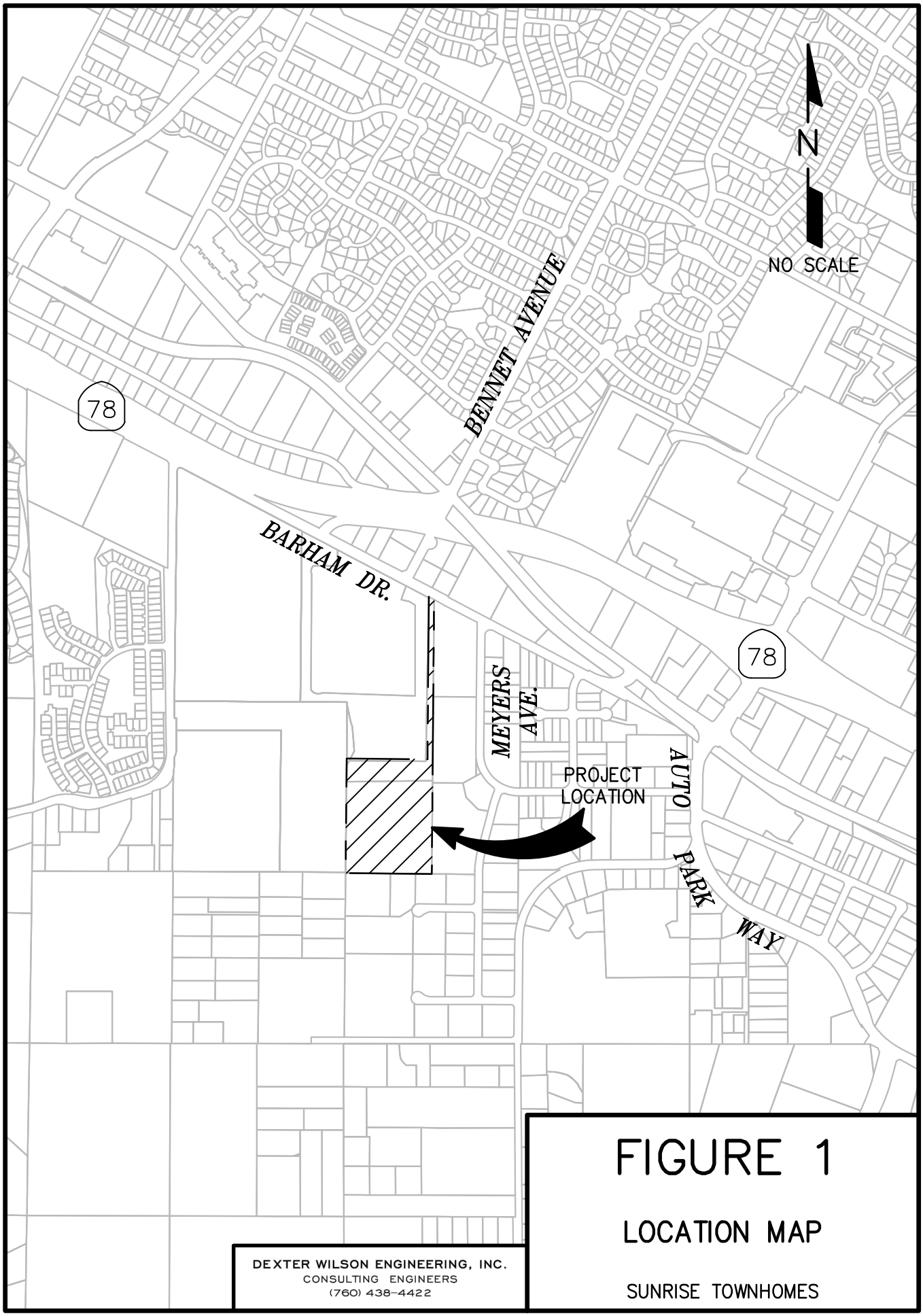
Attention: Matt Simmons

Subject: Water System Analysis for the Sunrise Project in the City of San Marcos

Introduction

The Sunrise project is located in the City of San Marcos near the intersection of Meyers Avenue and Barham Drive. Figure 1 provides a location map for the project. The project is proposing to develop a total of 192 residential townhome units and a small pool/recreation building. Pad elevations for the buildings within the project range from approximately 759 feet to 800 feet.

The project will receive water service from the Rincon Del Diablo Municipal Water District (RDDMWD), but will consist of a private domestic and fire protection system that serve the project. The purpose of this letter report is to provide recommendations for the water system which will provide service to the Sunrise project.



\\ARTIC\DWG\930010\FIGURE-1_VIC MAP.DWG 04-03-19 10:55:34 LAYOUT: LAYOUT

FIGURE 1

LOCATION MAP

SUNRISE TOWNHOMES

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Private Water System Design Criteria

The water system for the Sunrise project will consist of two separate systems; one will be for private domestic water and the other will be for private fire protection service. The domestic water system is sized in accordance with the 2016 California Plumbing Code.

The fire protection component of the water system is designed based on the required fire flow for the project as stipulated by the City of San Marcos Fire Department. The private fire protection system is designed to provide a minimum residual pressure greater than 20 psi at any location within the private water system under a fire flow demand of 1,500 gpm.

Existing Water System

The project is within the City of San Marcos and will obtain water service from the RDDMWD. Water service to the project will be from the ID-1 South Pressure Zone. This zone is fed by reservoirs with a high water line of 958.5 feet. This results in maximum static water pressures on the project of 69 to 86 psi at the building pads. Existing water lines in the vicinity of the project include an 8-inch water line in Meyers Avenue and a 10-inch line in Barham Drive.

Water Service Overview

Water service to the project will be from connections to the existing 8-inch water line in Meyers Avenue and 10-inch waterline in Barham Drive. A fire service with backflow preventer and domestic service with meter and backflow preventer will be provided at each connection to the public system. The range of pad elevations on the project, 759 feet to 800 feet, fits within this pressure zone, but pumps for the domestic building services will need to be evaluated due to the supply reservoir not always being full and in consideration of losses through the master meter, backflow preventer, and due to the proposed multi-story buildings.

Fire sprinkler laterals to each building will be supplied from the private fire line that supplies onsite fire hydrants. The domestic service lines will serve the residential townhomes and pool/recreation area.

Private Domestic Water System

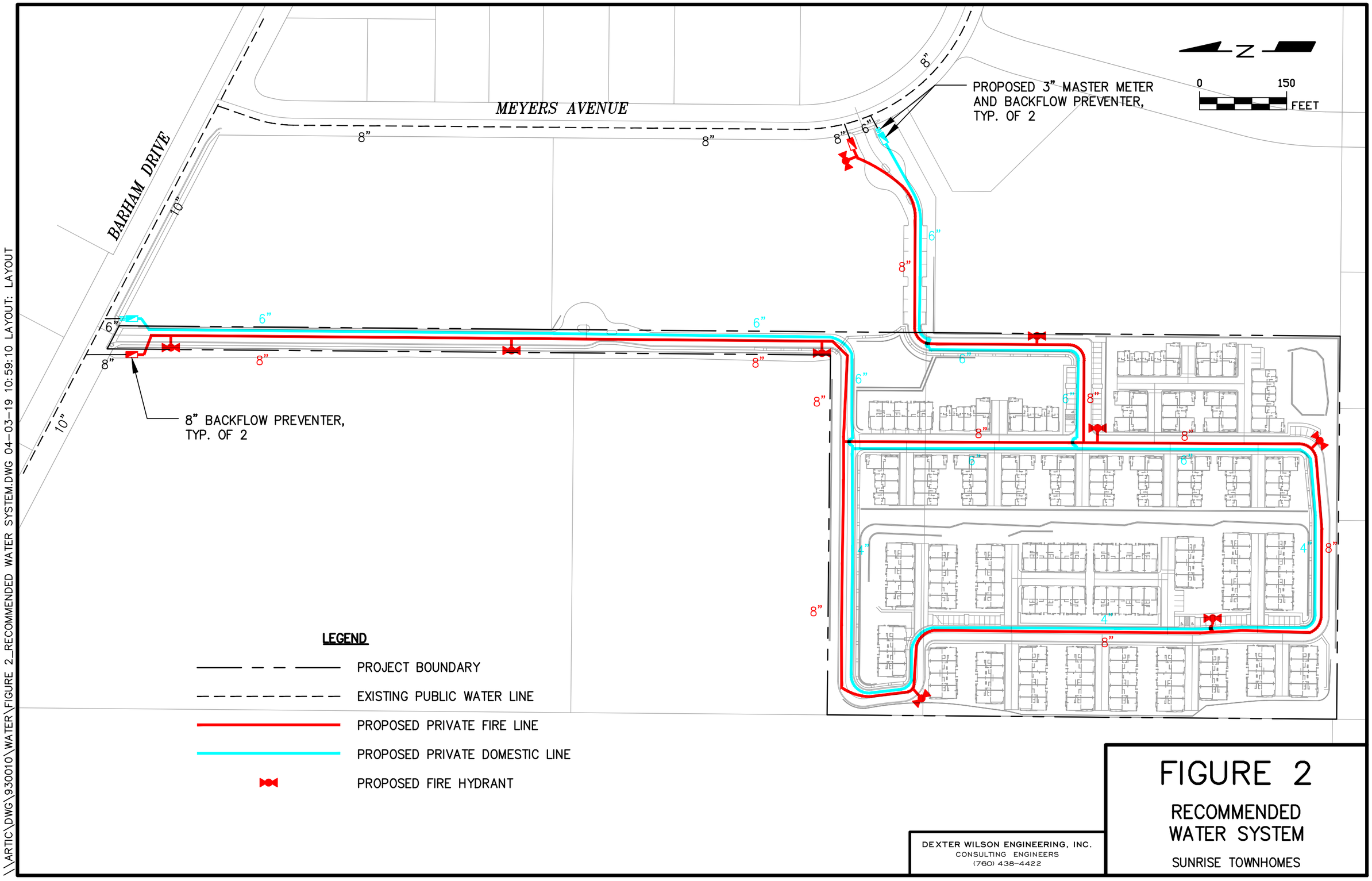
The project's private domestic water system will be connected to the existing 8-inch water line in Meyers Avenue and to the 10-inch water line in Barham Drive. A 6-inch diameter service lateral connection with a 3-inch master meter and a 3-inch reduced pressure principle backflow preventer assembly is recommended at each connection. The domestic water system after the meter will be a private system and will be the responsibility of the project association. Internal to the project, each building will be connected to the private domestic water main by building service laterals. The sizing of the project's domestic water meter and private backbone domestic water system are presented in the following sections.

Water Fixture Unit Calculation. Water Fixture Units are determined for each dwelling unit type proposed within the project based on the project architectural plans. Table 1 summarizes the total water supply fixture units for the project.

TABLE 1 SUNRISE PROJECT WATER FIXTURE UNIT SUMMARY			
Description	**Quantity**	**WFU Each**	**Total WFU**
2 Story Townhomes			
Plan 1	42 units	24.5	1,029
Plan 2	16 units	24.5	392
Plan 3	42 units	24.5	1,029
3 Story Townhomes			
Plan 1	22 units	20.5	451
Plan 2	22 units	28.5	627
Plan 3	16 units	26.5	424
Plan 4	32 units	30	960
Pool/Rec Building			
---	1	10	10
TOTAL			**4,922**

Using Chart A103.1 from the 2016 California Plumbing Code, 4,922 water fixture units extrapolates to a peak demand of 591 gallons per minute (gpm).

Domestic Water System Pipe Sizing. The private domestic water system piping for the project has been sized in accordance with the California Plumbing Code and the Installation Standard for PVC Cold Water Building Supply and Yard Piping (IAPMO IS 8-95). The Installation Standard requires that the maximum pipeline velocity be limited to eight feet per second (8 fps). To comply with this requirement, the maximum flowrate and water fixture units for different pipe sizes were calculated based on Chart A-2 from the 2016 California Plumbing Code. Figure 2 presents a graphic of the recommended private domestic water line sizes throughout the project.



\\ARTIC\DWG\930010\WATER\FIGURE 2_RECOMMENDED WATER SYSTEM.DWG 04-03-19 10:59:10 LAYOUT: LAYOUT

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FIGURE 2

RECOMMENDED WATER SYSTEM

SUNRISE TOWNHOMES

Meter Sizing. The meter size for the project was determined based on the total number of fixture units that will be served by the meter. Based on a peak water demand of 591 gpm, two 3-inch meters are recommended. The capacity of a 3-inch meter can range based on manufacturer and meter type, but capacities of 320 gpm to 400 gpm for a 3-inch meter are typical. Thus, two 3-inch meters have adequate capacity to meet the peak demands of the project.

Private Fire Protection System Pipe Sizing

All fire hydrants along the driveways and within the project will be connected to a private fire protection water system which will be independent of the domestic water system loop. The private fire protection system will include two connections to the existing public water system. Each of the two private fire protection system connections to the public main shall include a backflow preventer in accordance with District standards. An 8-inch service and backflow preventer is proposed at both locations with 8-inch looped piping in the driveways and onsite. Figure 2 shows the proposed private fire system.

To confirm the ability of the private water system to meet a 1,500 gpm fire flow with a minimum residual pressure of 20 psi at the onsite hydrants, a computer hydraulic model was setup. An analysis using the KYPIPE computer software developed by the University of Kentucky determined residual pressures throughout the private fire protection system. This computer software utilizes the Hazen-Williams equation for determining headloss in pipes. The Hazen-Williams "C" value used for all pipe sizes in analysis is 130.

The available hydraulic grade line in the vicinity of the project was obtained from the fire flow calculations prepared by the RDDMWD September 12, 2017. These calculations provide a residual pressure of 20 psi in the public system near the project site based on a fire flow demand of 3,950 gpm. Appendix A includes a copy of the letter provided by the RDDMWD. The available hydraulic gradeline was determined to be approximately 890 feet at the fire flow of 1,500 gpm based on an interpolation of the calculations provided by RDDMWD.

This gradeline was used as the input available hydraulic gradeline at the points of connection to the public system. The pressure losses through the reduced pressure principle detector check backflow preventer assemblies were modeled as minor losses using a "k" value large enough to result in the expected pressure loss through these devices. The manufacturer's literature includes charts which show pressure loss through the backflow preventer as a function of flow. These charts were used to approximate the pressure losses which were reflected in the computer modeling and show up as minor losses calculated in feet.

Appendix B presents the computer modeling results for the private fire protection system and Exhibit A provides a computer model node and pipe diagram. The fire flow requirement of 1,500 gpm was modeled at two fire hydrant locations. For the fire flow scenario modeled, the fire flow requirement is being met with greater than 20 psi residual pressure at all locations within the project. Minimum pressures within the system are just over the 20 psi minimum under the fire flow scenarios modeled.

The required fire flow of 1,500 gpm can be delivered to the project through the proposed public lines in the area. The onsite private fire protection system will be connected to the public water system at two locations as shown in Figure 2 with 8-inch looped piping within the site. Each of the two private fire protection system connections to the public water system will include an 8-inch reduced pressure principle backflow preventer assembly in accordance with the RDDMWD requirements.

Conclusions and Recommendations

The following summarizes the conclusions and recommendations based on the findings in this study.

1. The project can receive water service by making connections to the RDDMWD system and providing private domestic water and fire protection for the site. Figure 2 graphically shows the proposed water system improvements.

2. Domestic water service can be provided by constructing two 6-inch services to the RDDMWD water system. Each service will feed a 3-inch master meter and backflow preventer and then increase back to 6-inch. Onsite domestic piping consists of 4-inch and 6-inch.

3. The RDDMWD system provides adequate static pressures to the site, but the project architect will need to evaluate the need for building pumps to boost domestic pressures. The potential need for pumps is due to losses through the master meter, backflow preventer, piping system, and elevation losses due to multi-story buildings.

4. The private fire system is proposed to consist of two 8-inch connections to the existing system with a backflow preventer at each connection. The private fire system will supply fire hydrants and building fire sprinklers and is adequate as 8-inch piping.

5. Because the system just barely meets the 20 psi minimum residual pressure requirement during a fire flow event, care should be taken during final engineering of the project to make sure that backflow preventers with relatively low headloss characteristics are selected.

Thank you for the opportunity to assist you with the water system planning for this project. If you have any questions regarding the information presented in this report, please do not hesitate to call.

Dexter Wilson Engineering, Inc.

Stephen M. Nielsen, P.E.

SMN:pjs

Attachments

APPENDIX A

FIRE FLOW ANALYSIS

No. 4

FIRE FLOW AVAILABILITY FORM
FOR
RINCON DEL DIABLO MUNICIPAL WATER DISTRICT

SECTION A: TO BE COMPLETED BY CUSTOMER

PROJECT NAME: Sunrise Orix SR#: _____ (Assigned upon plan submittal)

PROJECT ADDRESS: _____ CITY: Escondido

PHONE: ( ) _____ FAX NUMBER: ( ) _____

Largest Building (ft.^{2}): _____ Sprinkled? _____ Construction Type: _____

SECTION B: TO BE COMPLETED BY LOCAL WATER COMPANY OR CONSULTANT. CUSTOMER TO PROVIDE RESULTS TO CITY FD.

Water Purveyor: Rincon del Diablo Municipal Water District

Location of test (reference map required): south of Barham Dr west of Meyer Ave

TEST INFORMATION IS VALID FOR 6 MONTHS FROM DATE PERFORMED

Flow Test Results	
Static pressure: _____ **PSI**	Hydrant Number (if applicable): NA
Elevation of test: 653 Feet	Main Diameter: 8 INCH
Pitot Tube Reading: _____ **PSI**	**Corresponding Flow:** _____ **GPM**
Total Flow: 3,950 **GPM**	**Residual Pressure** 20 **PSI**
At peak demand, this water system is capable of providing a fire flow discharge @ 20 psi in the vicinity of 3,950 gpm SPLIT between the existing 8-inch and 10-inch mains (looped system). The maximum allowable fire flow for this site off the existing 8-inch only is 3,200 **gpm**, and 3,850 gpm off the existing 10-inch.	

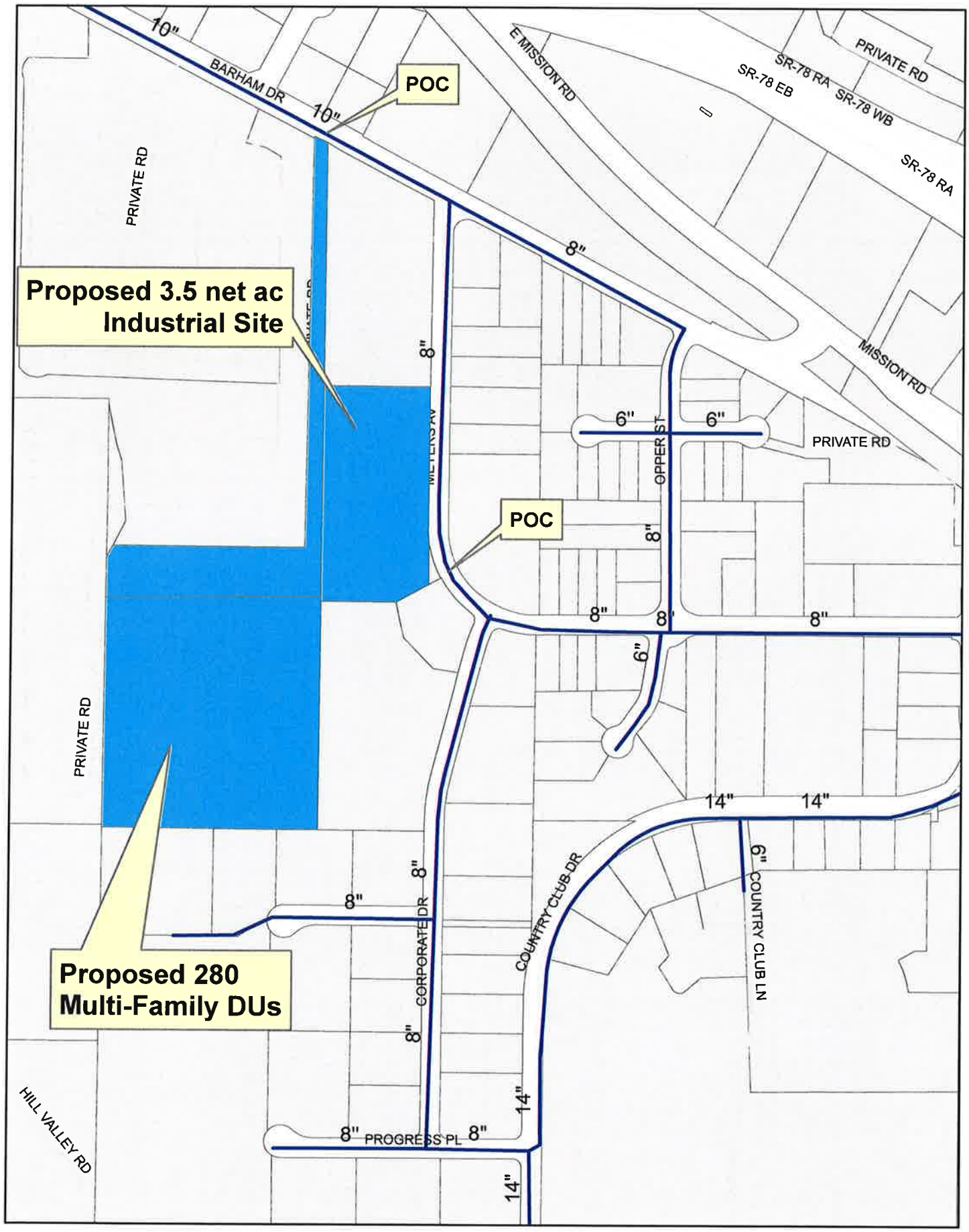
[1] Test to be performed as close as possible to the time the most conservative flows and pressures are expected.

Note: If the water availability information was obtained in a manner other than a flow test (i.e. computer modeling), fill out the information above as applicable and check here: x

Name: Jennifer R. Mael, P.E. Eng. Lic. No. (if applicable): C69606

Signature: _____

Title/Org: Project Manager Date: 09/12/2017



Sunrise Orix - Fire Flow Analysis

APPENDIX B

PRIVATE FIRE SYSTEM COMPUTER MODELING

FLOWRATE IS EXPRESSED IN GPM AND PRESSURE IN PSIG

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE NO.	NODE NOS.		LENGTH (FEET)	DIAMETER (INCHES)	ROUGHNESS	MINOR LOSS K	FIXED GRADE
1	0	2	100.0	8.0	130.0	60.00	890.00
3	2	4	1220.0	8.0	130.0	.00	
5	4	6	175.0	8.0	130.0	.00	
7	6	8	420.0	8.0	130.0	.00	
9	8	10	125.0	8.0	130.0	.00	
11	10	12	600.0	8.0	130.0	.00	
13	12	14	190.0	8.0	130.0	.00	
15	14	16	320.0	8.0	130.0	.00	
17	16	18	370.0	8.0	130.0	.00	
19	6	18	440.0	8.0	130.0	.00	
21	20	18	465.0	8.0	130.0	.00	
23	22	20	465.0	8.0	130.0	.00	
25	0	22	50.0	8.0	130.0	50.00	890.00

JUNCTION NUMBER	DEMAND	ELEVATION	CONNECTING PIPES		
2	.00	700.00	1	3	
4	.00	740.00	3	5	
6	.00	755.00	5	7	19
8	.00	790.00	7	9	
10	1500.00	795.00	9	11	
12	.00	800.00	11	13	
14	.00	796.00	13	15	
16	.00	772.00	15	17	
18	.00	765.00	17	19	21
20	.00	745.00	21	23	
22	.00	710.00	23	25	

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

THIS SYSTEM HAS 13 PIPES WITH 11 JUNCTIONS , 1 LOOPS AND 2 FGNS

THE RESULTS ARE OBTAINED AFTER 4 TRIALS WITH AN ACCURACY = .00007

SUNRISE TOWNHOMES PRIVATE FIRE SYSTEM ANALYSIS

1500 GPM FIRE FLOW AT NODE 10

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	2	699.61	.94	.00	18.57	4.47	9.43
3	2	4	699.61	11.50	.00	.00	4.47	9.43
5	4	6	699.61	1.65	.00	.00	4.47	9.43
7	6	8	935.94	6.79	.00	.00	5.97	16.16
9	8	10	935.94	2.02	.00	.00	5.97	16.16
11	10	12	-564.06	-3.80	.00	.00	-3.60	-6.33
13	12	14	-564.06	-1.20	.00	.00	-3.60	-6.33
15	14	16	-564.06	-2.02	.00	.00	-3.60	-6.33
17	16	18	-564.06	-2.34	.00	.00	-3.60	-6.33
19	6	18	-236.32	-.56	.00	.00	-1.51	-1.26
21	20	18	800.39	5.62	.00	.00	5.11	12.09
23	22	20	800.39	5.62	.00	.00	5.11	12.09
25	0	22	800.39	.60	.00	20.26	5.11	12.09

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2	.00	870.48	700.00	73.88
4	.00	858.98	740.00	51.56
6	.00	857.33	755.00	44.34
8	.00	850.55	790.00	26.24
10	1500.00	848.53	795.00	23.19
12	.00	852.32	800.00	22.67
14	.00	853.52	796.00	24.93
16	.00	855.55	772.00	36.20
18	.00	857.89	765.00	40.25
20	.00	863.51	745.00	51.36
22	.00	869.14	710.00	68.96

THE NET SYSTEM DEMAND = 1500.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
1	699.61
25	800.39

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1500.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND
10	.00
12	1500.00

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00126

1500 GPM FIRE FLOW AT NODE 12

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	2	696.31	.93	.00	18.40	4.44	9.34
3	2	4	696.31	11.40	.00	.00	4.44	9.34
5	4	6	696.31	1.64	.00	.00	4.44	9.34
7	6	8	696.79	3.93	.00	.00	4.45	9.36
9	8	10	696.79	1.17	.00	.00	4.45	9.36
11	10	12	696.79	5.61	.00	.00	4.45	9.36
13	12	14	-803.21	-2.31	.00	.00	-5.13	-12.17
15	14	16	-803.21	-3.90	.00	.00	-5.13	-12.17
17	16	18	-803.21	-4.50	.00	.00	-5.13	-12.17
19	6	18	-.47	.00	.00	.00	.00	.00
21	20	18	803.69	5.67	.00	.00	5.13	12.19
23	22	20	803.69	5.67	.00	.00	5.13	12.19
25	0	22	803.69	.61	.00	20.43	5.13	12.19

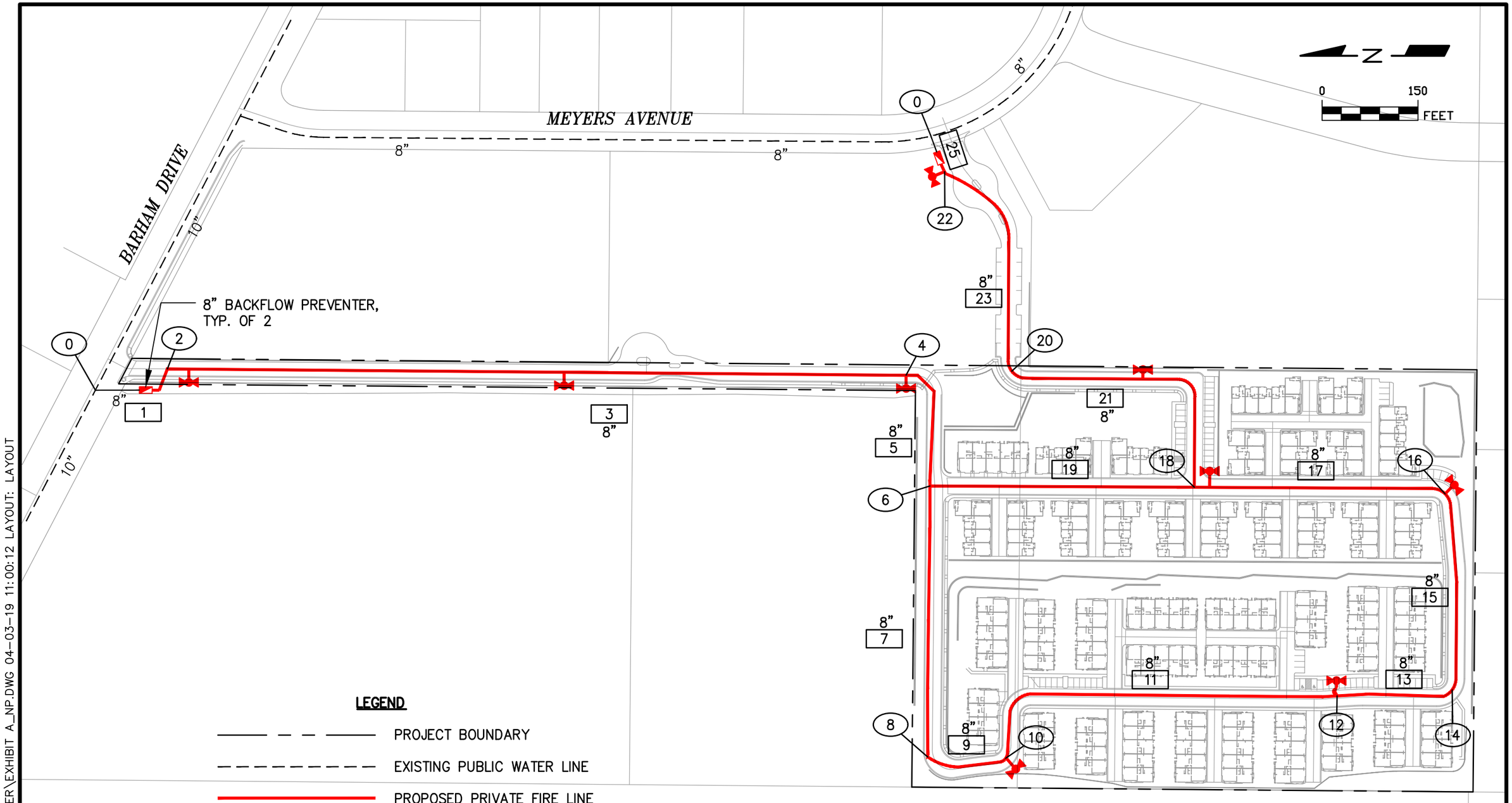
JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2	.00	870.67	700.00	73.96
4	.00	859.27	740.00	51.68
6	.00	857.63	755.00	44.47
8	.00	853.70	790.00	27.60
10	.00	852.53	795.00	24.93
12	1500.00	846.92	800.00	20.33
14	.00	849.23	796.00	23.07
16	.00	853.13	772.00	35.15
18	.00	857.63	765.00	40.14
20	.00	863.30	745.00	51.26
22	.00	868.97	710.00	68.88

THE NET SYSTEM DEMAND = 1500.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
1	696.31
25	803.69

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1500.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00



LEGEND

——— – – ———	PROJECT BOUNDARY
– – – – – – – –	EXISTING PUBLIC WATER LINE
———	PROPOSED PRIVATE FIRE LINE
⋈	PROPOSED FIRE HYDRANT
3	NODE NUMBER
8	PIPE NUMBER

EXHIBIT A

NODE AND PIPE DIAGRAM

SUNRISE TOWNHOMES

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