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WATER STUDY FOR THE
CARLSBAD VILLAGE MIXED USE PROJECT
IN THE CITY OF CARLSBAD

November 3, 2023

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11-3-23

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Job No. 1135-001

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November 3, 2023 1135-001

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Attention: Andrew Cerrina, Vice President

Subject: Water Study for the Carlsbad Village Mixed Use Project in the City of Carlsbad

Introduction

The Carlsbad Village Mixed Use project is located in the northwest portion of the City of Carlsbad. The project is located between Carlsbad Village Drive and Oak Avenue, west of Interstate 5. A vicinity map for the project is presented in Figure 1.

Project Description

The Carlsbad Village Mixed Use project proposes a mixed-use development consisting of 218 multi-family units, as well as approximately 13,800 square feet of commercial space (0.32 acres), on a 4.12 acre site. The proposed commercial uses would be contained in two, one-story buildings along Carlsbad Village Drive, and the residential units would be spread across two five story residential buildings. The site is currently occupied by a retail shopping center, as well as a surface parking lot that would be demolished during project construction. Water service to the project site is provided by the Carlsbad Municipal Water District.

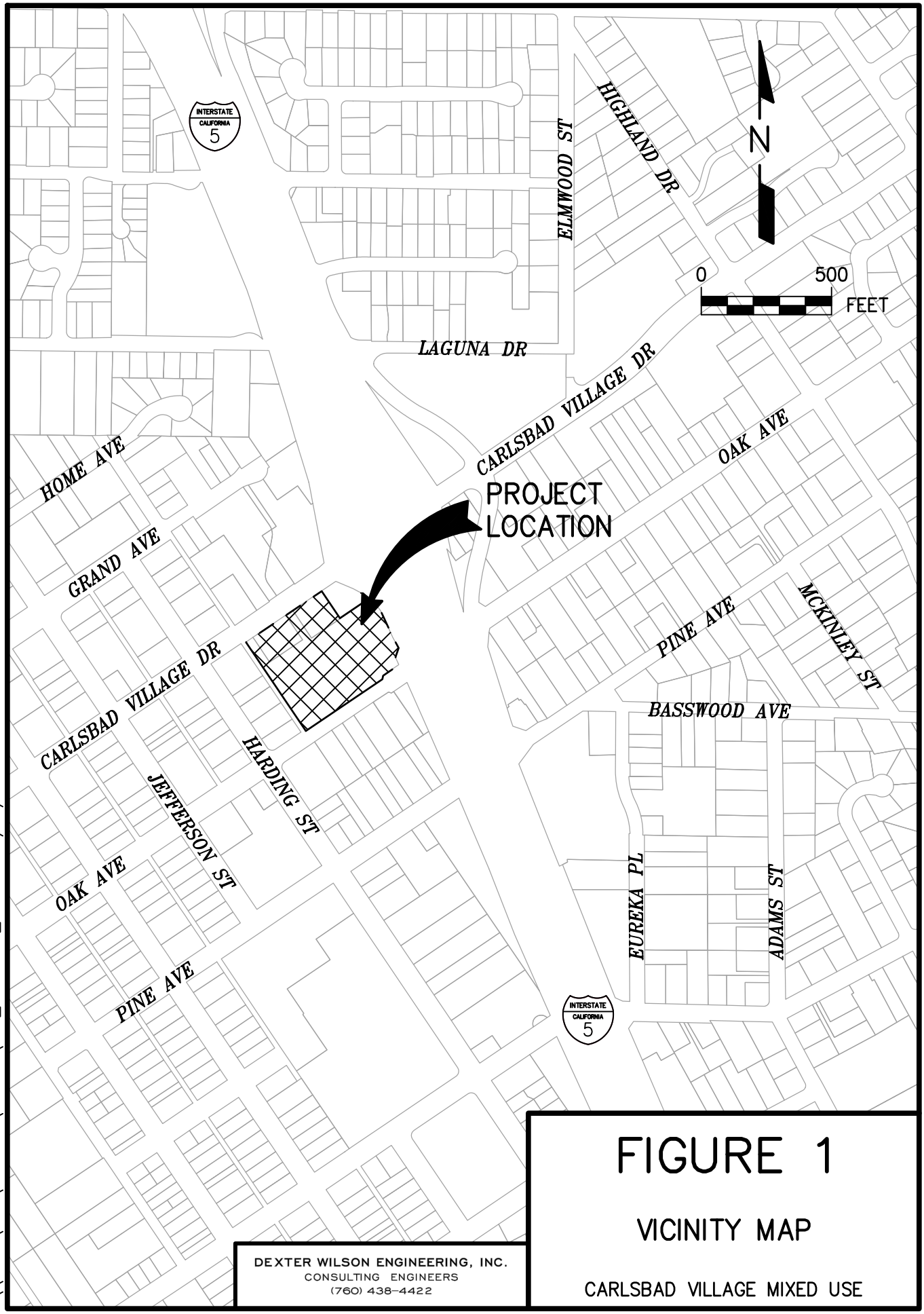

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FIGURE 1

VICINITY MAP

CARLSBAD VILLAGE MIXED USE

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Purpose of Study

The purpose of this study is to provide a fire flow analysis to verify that the required fire hydrant flow can be delivered to the Carlsbad Village Mixed Use site utilizing the existing public water system and that the project can be adequately served from existing infrastructure.

This report will provide recommendations for any immediate improvements to the existing public water system determined to be necessary for the public water system to deliver the required fire hydrant flow and pressure.

Water System Design Criteria

The design criteria used to analyze the public water system in the vicinity of the Carlsbad Village Mixed Use project are consistent with Volume 2 of the 2022 City of Carlsbad Engineering Standards: Potable and Recycled Water Standards (2022 Volume 2 Engineering Standards). Appendix A includes excerpts from the 2022 Volume 2 Engineering Standards pertinent to this report for reference.

The criteria include a minimum static pressure of 60 psi, a desired maximum static pressure of 125 psi, and a maximum static pressure allowed of 150 psi. Under Peak Hour Demand conditions, minimum residual pressure at any location must not be less than 40 psi. Under a Maximum Day Demand with Fire Flow, a minimum residual pressure of 20 psi must be maintained in the water system. Peaking factors used in analyzing demand scenarios were 1.6 for average day to maximum day demands, and 2.9 for average day to peak hour demands.

Projected Water Demand

The expected water demand for the Carlsbad Village Mixed Use project was estimated using water demand criteria from the 2022 Volume 2 Engineering Standards. Table 1 presents the estimated onsite water demand for the project.

TABLE 1
CARLSBAD VILLAGE MIXED USE
AVERAGE WATER DEMAND

Land Use	Quantity	Demand Factor[1]	Average Demand
Multi-Family Residential	218 DUs	185 gpd/DU	40,330 gpd
Commercial	0.32 acres	1,500 gpd/acre	480 gpd
TOTAL			**40,810 gpd**

1. Table 4-2 Design Criteria from CMWD Potable Water Master Plan, June 17, 2019.

Per Table 1, average day demand for the Carlsbad Village Mixed Use project is 40,810 gpd or 28.3 gpm. The maximum day demand is 65,296 gpd or 45.3 gpm (ADD x 1.6). The peak hour demand is 118,349 gpd or 82.2 gpm (ADD x 2.9).

Fire Flow Requirements

The fire flow requirement for the Carlsbad Village Mixed Use project was determined using the 2022 California Fire Code and the 2022 Volume 2 Engineering Standards.

2022 California Fire Code. The required fire hydrant flow for the project was determined using the 2022 California Fire Code and is based on building square footage and type of construction. The project's building square footages, types of construction, and fire hydrant flow requirement based on the 2022 California Fire Code are summarized in Table 2. Appendix B includes excerpts from the 2022 California Fire Code for reference.

TABLE 2
CARLSBAD VILLAGE MIXED USE
FIRE HYDRANT FLOW REQUIREMENTS BY UNIT

Building	Building Area, sqft.	Construction Type	Un-sprinklered Fire Flow Req., gpm	Reduced Fire Flow Req., gpm [1,2]
Commercial A	7,689	VA	1,500	1,500
Commercial B	5,798	VA	1,500	1,500
Residential C	123,031	IIIA	5,000	2,500
Residential D	124,332	IIIA	5,000	2,500
Parking Structure [3]	24,531	IA	1,750	1,500

1. A 50% reduction factor is applied per Table B105.1(2) and Table B105.2 of the 2022 California Fire Code. The City of Carlsbad allows a 50% maximum reduction.
2. Reduced fire flow requirement shall not be less than 1,500 gpm per Table B105.2 in the 2022 California Fire Code.
3. Building area shows area of largest floor per Section B104.3 of the 2022 California Fire Code.

Per Table 2, the fire flow requirement for the Carlsbad Village Mixed Use project is 2,500 gpm. The existing public water system was analyzed using a 2,500 gpm fire flow requirement for the project.

Existing Water System

The Carlsbad Village Mixed Use project is within the City of Carlsbad 255 Pressure Zone. There is an existing 8-inch 255 Pressure Zone public water line south of the project in Oak Avenue. North of the project in Carlsbad Village Drive there is an existing 6-inch 255 Pressure Zone public water line east of Harding Street that increases to an 8-inch water line east of the fire hydrant near the northeast corner of the project site. Figure 2 presents the existing public water system in the vicinity of the project.

Finish Floor elevations within the Carlsbad Village Mixed Use project site range between 66 feet and 70 feet. With service from the 255 Pressure Zone, this results in a maximum static pressure range of 80 psi and 81 psi within the development. When static pressures exceed 80 psi, the California Plumbing Code requires pressure regulating valves at each building supply.

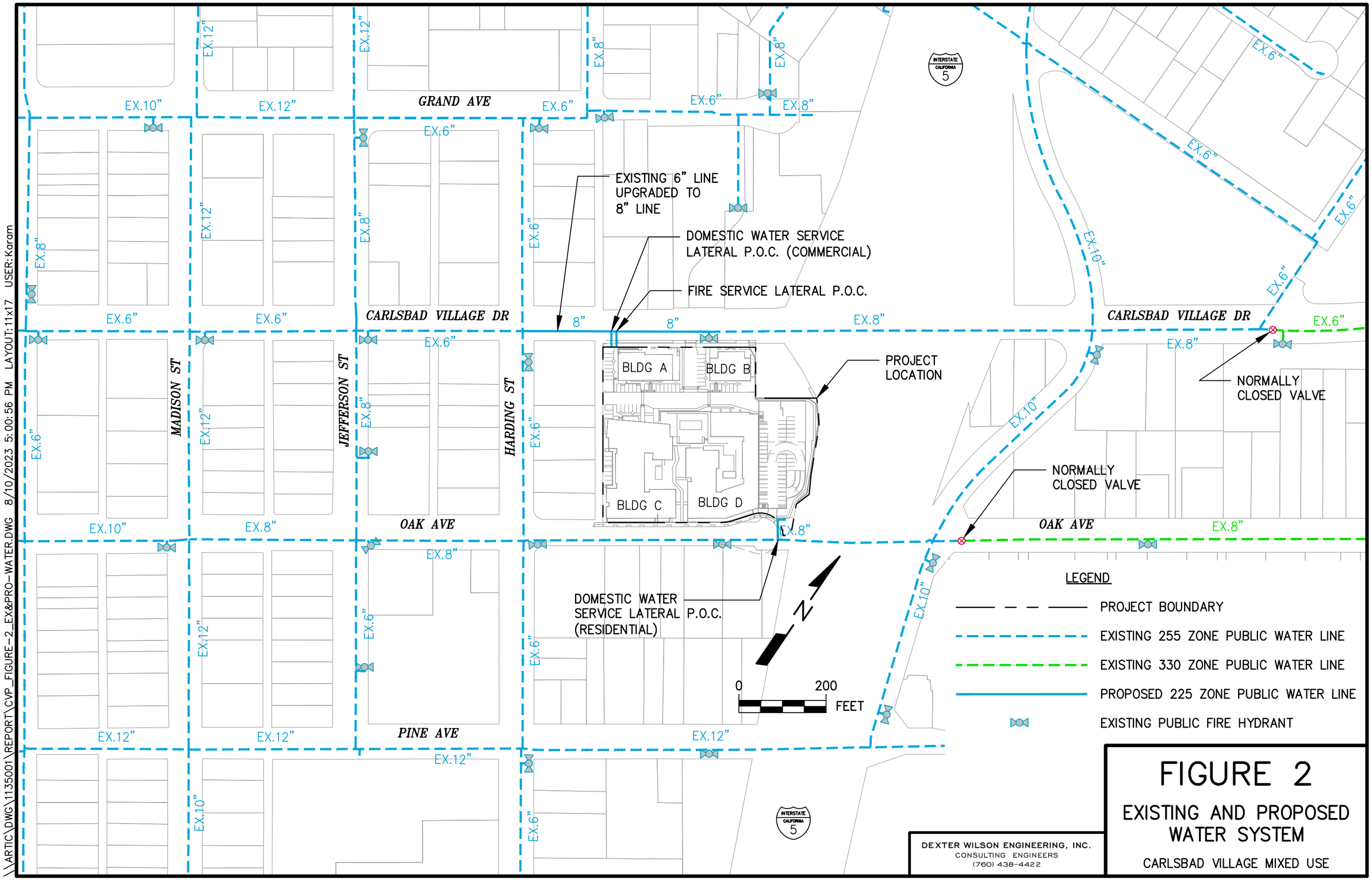

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FIGURE 2

EXISTING AND PROPOSED WATER SYSTEM

CARLSBAD VILLAGE MIXED USE

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Proposed Water System

The Carlsbad Village Mixed Use project will connect to the 255 Pressure Zone water lines in Carlsbad Village Drive and Oak Avenue. The Carlsbad Municipal Water District has indicated that the existing 6-inch water line in Carlsbad Village Drive, from Harding Street to the existing fire hydrant near the northeast corner of the project site, will need two be upgraded to an 8-inch water line to meet the District's minimum pipeline diameter criterion. Because the upgrade is not necessary from a capacity standpoint, the Carlsbad Municipal Water District has indicated that they will enter into a cost-sharing agreement with the project to upgrade the water line in question. Figure 2 presents the proposed water system for the Carlsbad Village Mixed Use project.

As shown in Figure 2, the Carlsbad Village Mixed Use project will make two connections to the proposed 8-inch water line in Carlsbad Village Drive to provide domestic water service to the retail portion of the project and to provide water service for the onsite private fire protection system. The domestic water service in Carlsbad Village Drive will include a master meter that will serve two retail buildings. The private fire protection system will supply water to the private fire sprinklers systems proposed for the buildings within the project; there are no private fire hydrants proposed onsite. The project will also connect to the existing 8-inch water line in Oak Avenue to provide domestic water service to the residential portion of the project. The domestic water service in Oak Avenue will include a master meter that will serve two residential buildings. In accordance with City of Carlsbad Standards, each domestic water meter will be followed by a reduced pressure principle backflow preventer, and the fire service lateral will include a double check detector assembly backflow preventer.

A preliminary analysis for the sizing of the domestic water service laterals and meters is included in this study. The final design of the public improvements including domestic laterals, irrigation laterals, and fire services will be a part of the public improvement plan preparation phase for this project.

Domestic Water Meter Sizing

Two master water meters are proposed to provide domestic water service to the project: one water meter will provide water service to the retail portion of the project and the other water meter will provide water service to the residential portion of the project. The meter sizing was determined based on the total number of Water Fixture Units that will be served by the meter. Irrigation internal to the project is proposed to be connected separately and, therefore, only domestic demands are being met by the domestic water meter.

For the retail master water meter, the meter is expected to be a 2-inch meter but there is not enough information available to provide a meter size at this point. For the residential master water meter, the total number of Water Fixture Units was determined using the preliminary architectural plans for the residential buildings. A breakdown of Water Fixture Units for the proposed building by floor plan is provided in Appendix C. The total Water Fixture count for the residential buildings proposed for the Carlsbad Village Mixed Use project is 4,790.5. Using an extrapolation of Chart A 103.1(1) from the California Plumbing Code, this converts to a maximum expected demand of 580 gpm.

The Carlsbad Municipal Water District uses Badger E-Series G2 Ultrasonic Meters (see Appendix D for meter cutsheet). Because a 4-inch Badger E-Series G2 Ultrasonic Meter has an allowable capacity of 1,100 gpm, the maximum expected demand for the project is proposed to be satisfied by use of a single 4-inch meter. The final meter sizes for the retail master meter and the residential master meter will need to be confirmed during final engineering.

Public Water System Analysis

The public water system in the vicinity of the Carlsbad Village Mixed Use project was analyzed using a computer model. The University of Kentucky KYPIPE program was used to model the existing and proposed water system for the Carlsbad Village Mixed Use project. This computer program utilizes the Hazen-Williams equation for determining head-loss in pipes; the Hazen-Williams "C" value used for all pipes is 120.

Available Hydraulic Grade Line. The available hydraulic grade line (HGL) was determined using fire hydrant flow test data for a fire hydrant located on the south side of Carlsbad Village Drive fronting the project. The fire hydrant flow test is provided in Appendix E.

The tested fire hydrant was used as the water source in the computer model. Using the data provided in the hydrant flow test, an extrapolation calculation was used to determine the available pressure and HGL at average day demand, maximum day demand, peak hour demand, and maximum day plus fire flow scenarios for the project. The extrapolation calculation is provided at the end of Appendix E. The results pertinent to the analysis are highlighted in the extrapolation calculation for reference.

Computer Model Results

Computer modeling of the existing and proposed offsite public water system in the vicinity of the Carlsbad Village Mixed Use project was analyzed under average day, peak hour, and maximum day plus 2,500 gpm fire flow demand scenarios. For the maximum day plus 2,500 gpm fire flow demand scenario, the 2,500 gpm fire flow requirement was split among two fire hydrants in the computer model run.

Appendix F provides the results of the computer modeling for the existing public water system and Appendix G provides the results of the computer modeling for the proposed public water system. Exhibit A at the back of this report provides the Node and Pipe Diagram for the computer model.

Analysis of Computer Model Results – Existing Public Water System. The results in Appendix F show that the existing public water system presented in Figure 2 (no upgrade to 6-inch line in Carlsbad Village Drive) is able to provide adequate flow and pressure to the Carlsbad Village Mixed Use project for domestic and fire protection service.

Under peak hour demand, the minimum pressure fronting the site in Carlsbad Village Drive is 70 psi. Under the maximum day plus fire flow demand scenario, the results show that a 2,500 gpm fire flow can be provided with a minimum residual pressure of 27 psi in the public water system in the vicinity of the project. The maximum velocity in the public water system under the maximum day plus fire flow scenario is 20.2 fps which is less than the allowable 15 fps for maximum day plus fire flow scenarios.

Analysis of Computer Model Results – Proposed Public Water System. The results in Appendix G show that the proposed public water system presented in Figure 2 (with upgrade to 6-inch line in Carlsbad Village Drive) is able to provide adequate flow and pressure to the Carlsbad Village Mixed Use project for domestic and fire protection service.

Under peak hour demand, the minimum pressure fronting the site in Carlsbad Village Drive is 70 psi. Under the maximum day plus fire flow demand scenario, the results show that a 2,500 gpm fire flow can be provided with a minimum residual pressure of 28 psi in the public water system in the vicinity of the project. The maximum velocity in the public water system under the maximum day plus fire flow scenario is 12.0 fps which is less than the allowable 15 fps for maximum day plus fire flow scenarios.

The results of the analyses show that there are no capacity-related improvements needed, as the existing water system can provide adequate service to the Carlsbad Village Mixed Use project.

Conclusions and Recommendations

The following recommendations and conclusions are made based on an analysis of the potable water system analysis for the Carlsbad Village Mixed Use project.

1. The Carlsbad Village Mixed Use project will be served by the City of Carlsbad 255 Pressure Zone.

2. Finish grade elevations within the existing site range from 66 feet to 70 feet. This results in a maximum static pressure range of 80 psi to 81 psi with service from the City of Carlsbad 255 Pressure Zone.

3. Individual pressure regulators must be installed at each building where static pressure exceeds 80 psi in order to maintain building service pressures below 80 psi in accordance with the California Plumbing Code.

4. Water service is proposed to include three connections to the existing public water system: two connections will be made for domestic water service and one connection will be made for fire protection service.

5. The Carlsbad Municipal Water District has indicated that the existing 6-inch water line in Carlsbad Village Drive, from Harding Street to the existing fire hydrant near the northeast corner of the project site, will need two be upgraded to an 8-inch water line to meet the District's minimum pipeline diameter criterion. Because the upgrade is not necessary from a capacity standpoint, the Carlsbad Municipal Water District has indicated that they will enter into a cost-sharing agreement with the project to upgrade the water line in question.

6. The existing and proposed public water system can provide a maximum day plus 2,500 gpm fire flow demand for the project with a minimum residual pressure greater than 20 psi. The proposed public water system is presented in Figure 2.

7. All new water service laterals to be installed shall conform to the requirements of the Carlsbad Municipal Water District.

Thank you for the opportunity to assist with the potable water planning for the Carlsbad Village Mixed Use project. If you have any questions about the enclosed information and recommendations, please do not hesitate to call.

Dexter Wilson Engineering, Inc.

Fernando Fregoso, P.E.

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Attachments

APPENDIX A

CARLSBAD MUNICIPAL WATER DISTRICT
WATER SYSTEM DESIGN CRITERIA

3.2 PLANNING AND DESIGN CRITERIA

3.2.1 Water Flow Generation

The following domestic water supply demands are used in the development of the water system.

A. Residential

Average daily flow: 450 GPD/Single Family per dwelling unit
185 GPD/Multi-Family per dwelling unit

B. Non-Residential

Average daily flow: 1,500 gpd/acre

C. Fire Flow

Fire flow requirements for the development type shall be based on the following criteria. The Engineer of Work shall determine the required fire flow capacity based on the latest California Fire Code and National Fire Protection Association standards adopted by the City. In case of conflict, the more stringent requirement shall apply. The Engineer of Work shall obtain the approval of the project-specific fire protection system design criteria from the Fire Marshal.

1. Residential: a minimum of 1,500 gpm from any two hydrants at a minimum of 20 psi of residual pressure at the main for 2 hours duration.

2. Multi-family: a minimum of 3,000 gpm from any two hydrants at a minimum of 20 psi of residual pressure at the main for 2 hours duration.

3. Schools, commercial and industrial: a minimum of 4,000 gpm for 4 hours duration out of four hydrants at a minimum of 20 psi of residual pressure at the main. Higher requirements may be required if building floor area exceeds 300,000 square feet or is located near open space.

3.2.2 Pipeline Sizing Criteria

A. Water System Design Criteria

1. Minimum static pressure of 60 psi.

2. Maximum static pressure of 125 psi. Pressures up to 150 psi may be allowed with specific approval of the City Engineer.

3. The elevation of the tank floor of existing or proposed tanks shall be the basis for determining the minimum static pressure. The elevation of the tank overflow shall be the basis for the maximum static pressure.

4. For pipelines served by pressure regulating stations, the pressure control valve set point of the supply station, as provided by the District, shall be the basis for determining the maximum static pressure.

5. Use existing pressure zones to the extent possible. A request for the creation of a new pressure zone shall be supported by a hydraulic study and approval shall be at the sole discretion of the District.

6. Pressure zone overlap (where one zone can be served by an adjacent zone) shall be included at the boundary of a new pressure zone when required by the District. In such case, the maximum elevation difference between the two zones shall not exceed 100 feet.

B. Hydraulic analysis of the water system dynamic pressures shall meet the following requirements or as specified in the latest adopted Potable Water Master Plan:

1. Dynamic pressures shall be analyzed with reservoir levels half full.

2. Under peak hour demand and no fire flow, minimum pressure should be no less than 40 psi and maximum pipeline velocity shall be 8 ft/s.

3. Under maximum day demand plus fire flow:
   a. pumps shall be assumed to be off, and 100 percent of the fire flow requirement delivered from storage tanks,
   b. pressure in the system shall not be less than 20 psi for the period of the fire incident (with reservoir levels half full),
   c. maximum allowable head loss shall be 10 feet/1,000 feet of pipe and maximum allowable pipeline velocity shall be 15 ft/s, and
   d. maximum allowable velocity through pressure regulating station control valves shall be 15 ft/s.

4. The maximum pressure drop between static and dynamic pressures shall not exceed 25 psi.

5. At least two sources of water which can be independently isolated (generally from two different streets) should be available for each development (i.e., looped system). Dead-end water lines longer than 150 feet are generally not permitted without special approval.

6. Dead-end water lines are to serve no more than 18 residences. A looped water system is required for 19 or more residences or where required at the District's discretion. Commercial/Industrial developments require looped water systems unless approved otherwise by the District and the Fire Marshal.

7. No more than one fire hydrant shall be allowed on a dead-end water line. Water systems requiring 2 or more fire hydrants shall be looped.

8. The minimum pipeline diameter for public water mains serving a hydrant, a fire service or more than four residences shall be 8 inches.

9. Approved double check detector assemblies (DCDAs) are required for all non-residential fire sprinkler systems, including schools and commercial developments, in accordance with CMWD standards. A higher degree of protection may be required depending on the degree of hazard in accordance with Title 17, CCR Section 7604.

3.2.3 Water Master Plan Peaking Factors

Average Day Demand (ADD)	1.0
Maximum Month Demand (MMD)	1.4 x ADD
Maximum Day Demand (MDD)	1.60 x ADD
Peak Hour Demand (PHD)	2.90 x ADD

3.3 LOCATION, TYPE AND SIZE OF WATER FACILITIES

3.3.1 Distribution Lines

Distribution lines are defined as 8-inch through 12-inch in diameter and shall be polyvinyl chloride (PVC) conforming to AWWA C900, DR 18 or DR 14 as shown on the Plans or where specified.

3.3.2 Transmission Mains

Transmission main pipe shall be either (PVC) conforming to AWWA C900 for 14- and 16-inch diameters or, for 18-inch and larger diameters, pipe and fittings shall be cement mortar-lined and tape coated steel with cement mortar shield conforming to AWWA C200, C205, C209 and C214. Steel pipelines shall be designed and constructed with cathodic protection in accordance with District standards.

3.3.3 In-Line Valves

In-line water valving shall be placed every 500 feet for potable water distribution lines and 1,000 feet for recycled water distribution lines and potable water transmission lines or every 58 feet of elevation difference, whichever occurs first.

3.3.4 Valves for 16-inch and Smaller Pipelines

Valves for potable and recycled water pipelines (16-inch and smaller) shall be resilient wedge gate valves per the Approved Materials List, Appendix C. In locations where 4-inch recycled water mains or services are allowed, the valve on the tee branch at the main shall be 6-inch.

3.3.5 Valves for 18-inch and Larger Pipelines

Valves for potable and recycled water pipelines 18 inches in diameter and larger shall be flanged butterfly valves per the Approved Materials List, Appendix C.

3.3.6 Valve and Appurtenance Locations

A. Water valves shall be placed on all branches of tees and crosses and with manual air release or blow-off assemblies, as appropriate (exception will be fire hydrant tees).

B. Fire hydrant locations and model type shall be established by the Fire Marshal and will be placed at common lot lines, end or beginning of curb returns and a minimum of five feet (5') from the edge of driveway.

C. Two-inch (2") manual air release or two-inch (2") blow-off assemblies shall be placed at all ends of pipelines (i.e., cul-de-sacs) as required.

APPENDIX B

2022 CALIFORNIA FIRE CODE EXCERPTS

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

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

User note:

About this appendix: *Appendix B provides a tool for the use of jurisdictions in establishing a policy for determining fire-flow requirements in accordance with Section 507.3. The determination of required fire flow is not an exact science, but having some level of information provides a consistent way of choosing the appropriate fire flow for buildings throughout a jurisdiction. The primary tool used in this appendix is a table that presents fire flow based on construction type and building area based on the correlation of the Insurance Services Office (ISO) method and the construction types used in the* International Building Code®.

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 (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The fire code official 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 code official is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall be not 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.

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 that are separated by fire walls without openings, constructed in accordance with the *California 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, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration requirements for one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration for buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(2) and B105.2.

Exception: ***[SFM]*** *Group B, S-2 and U occupancies having a floor area not exceeding 1,000 square feet, primarily constructed of noncombustible exterior walls with wood or steel roof framing, having a Class A roof assembly, with uses limited to the following or similar uses:*

1. *California State Parks buildings of an accessory nature (restrooms).*
2. *Safety roadside rest areas, (SRRA), public restrooms.*
3. *Truck inspection facilities, (TIF), CHP office space and vehicle inspection bays.*
4. *Sand/salt storage buildings, storage of sand and salt.*

TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the *California Fire Code* or Section *313.3* of the *California Residential Code*	500	$^1/_2$
3,601 and greater	Section 903.3.1.3 of the *California Fire Code* or Section *313.3* of the *California Residential Code*	$^1/_2$ value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

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 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.
a. Types of construction are based on the *California Building Code*.
b. Measured at 20 psi residual pressure.

TABLE B105.2
REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *California Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *California Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire flow shall be not less than 1,000 gallons per minute.

b. The reduced fire flow shall be not less than 1,500 gallons per minute.

B105.3 Water supply for buildings equipped with an automatic sprinkler system. For buildings equipped with an approved automatic sprinkler system, the water supply shall be capable of providing the greater of:

1. The automatic sprinkler system demand, including hose stream allowance.
2. The required fire flow.

SECTION B106
REFERENCED STANDARDS

B106.1 General. See Table B106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE B106.1
REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CBC—22	*California Building Code*	B104.2
CRC—22	*California Residential Code*	Table B105.1(1)
NFPA 1142—17	*Standard on Water Supplies for Suburban and Rural Fire Fighting*	B103.3

APPENDIX C

WATER FIXTURE UNIT SUMMARY
AND
CPC CHART A-103.1 EXTRAPOLATION

Project Name Carlsbad Village Mixed Use

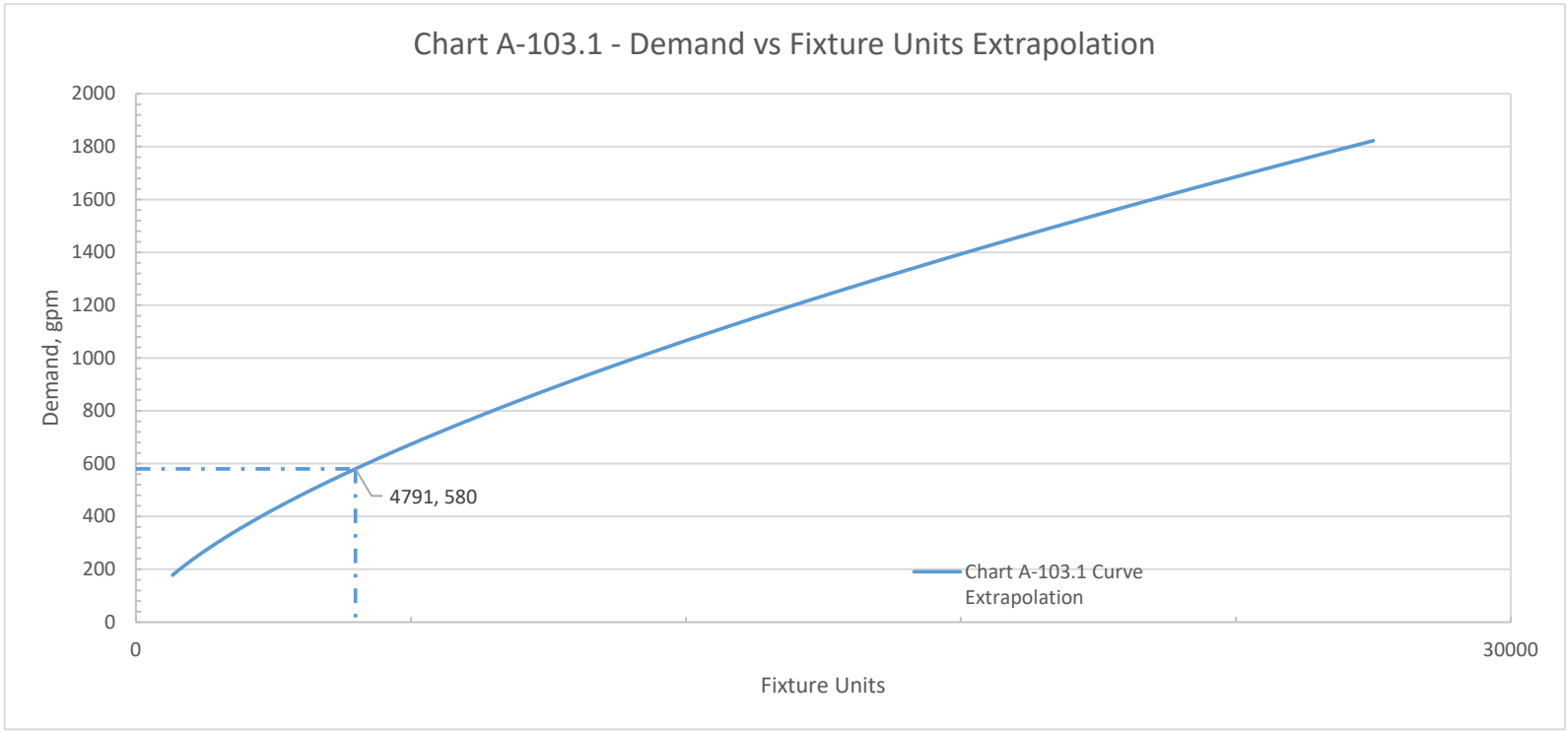
Job number 1135-001
Date 8/11/2023

Water Fixture Units
The basis for the Water Fixture Units is "private" per the 2022 California Plumbing Code.

DESCRIPTION	Studios			1 Bed x 1 Bath			2 Bed x 2 Bath			3 Bed x 2 Bath			Amenity Spaces		
	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS
CLOTHES WASHER	1	4	4	1	4	4	1	4	4	1	4	4		4	0
LAUNDRY SINK		1.5	0		1.5	0		1.5	0		1.5	0		1.5	0
TUB/SHOWER	1	4	4	1	4	4	2	4	8	2	4	8		4	0
SHOWER		2	0		2	0		2	0		2	0	6	2	12
KITCHEN SINK	1	1.5	1.5	1	1.5	1.5	1	1.5	1.5	1	1.5	1.5	1	1.5	1.5
DISHWASHER	1	1.5	1.5	1	1.5	1.5	1	1.5	1.5	1	1.5	1.5		1.5	0
LAVATORY	2	1	2	2	1	2	3	1	3	3	1	3	4	1	4
WATER CLOSET (>1.6 GPF)	1	2.5	2.5	1	2.5	2.5	2	2.5	5	2	2.5	5		2.5	0
HOSE BIBB	1	2.5	2.5	1	2.5	2.5	1	2.5	2.5	1	2.5	2.5	1	2.5	2.5
EACH ADDTL HB		1	0		1	0		1	0		1	0	1	1	1
MOP BASIN		1.5	0		1.5	0		1.5	0		1.5	0	1	1.5	1.5
URINAL		2	0		2	0		2	0		2	0	2	2	4
OTHER			0			0			0			0			0
TOTAL			18			18			25.5			25.5			26.5

Plan	Quantity	WFU/Plan	WFUs
Studios	15	18	270
1 Bed x 1 Bath	91	18	1638
2 Bed x 2 Bath	86	25.5	2193
3 Bed x 2 Bath	26	25.5	663
Amenity Spaces	1	26.5	26.5
TOTAL	--	--	**4790.5**

WFU	Demand, gpm
4,790.5	580



APPENDIX D

BADGER E-SERIES G2
ULTRASONIC METER

E-Series G2® Ultrasonic Meter

Lead-Free Bronze Alloy, 3, 4, 6 and 8 inch

DESCRIPTION

The next generation E-Series G2® Ultrasonic meter uses solid-state technology in a compact, tamper protected, weatherproof and UV-resistant housing, suitable for commercial applications. Electronic metering provides information—such as rate of flow and status and alarm indication—and data not typically available through traditional, mechanical meters and registers. Electronic metering minimizes measurement errors due to sand, suspended particles and pressure fluctuations.

Ultrasonic 3, 4, 6 and 8 inch Meter Features

- Open flow tube design prevents flow obstruction to reduce pressure loss
- Greater turn-down ratio for extended flow ranges and increased revenue
- Easy-to-read, 9-digit LCD display, which presents consumption, rate of flow, unit of measure, pressure, temperature, alarm conditions and firmware version
- Pressure alarm and pressure and temperature data reported through ORION Cellular LTE-M/LTE endpoints and BEACON®
- Field programmable registration and maintains an hourly internal logging capacity of 160 days of data
- Single and dual outputs include high resolution industry standard ASCII encoder protocol, scaled/unscaled and 4-20 mA

The meter is available with an inline connector for easy connection and installation to ORION endpoints. It is also available with a flying lead for field splice connection.

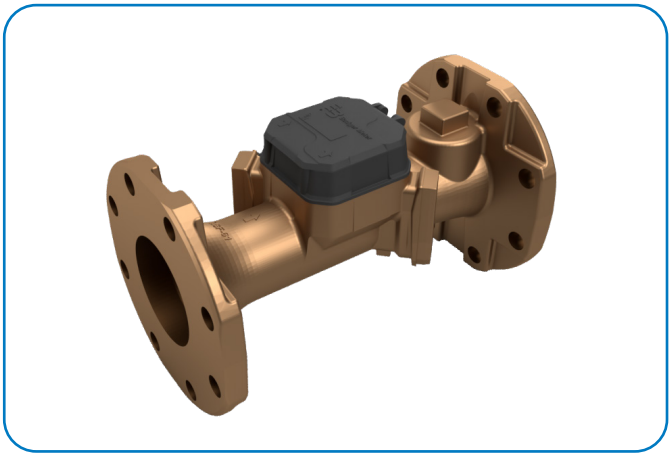
APPLICATIONS

Use the E-Series Ultrasonic meter for measuring potable cold water in commercial and industrial services. The meter is also ideal for non-potable, reclaimed irrigation water applications or less than optimum water conditions where small particles exist.

E-Series Ultrasonic meters meet and exceed AWWA C715 and the most recent revision of AWWA C750 Standards. The lead-free bronze alloy meters comply with the lead-free provisions of the Safe Drinking Water Act and NSF/ANSI/CAN Standards 61 and 372. E-Series Ultrasonic meters also conform to UL 327B and FM 1044 for fire service applications.

OPERATION & PERFORMANCE

As water flows into the measuring tube, ultrasonic signals are sent consecutively in forward and reverse directions of flow. Velocity is then determined by measuring the time difference between the measurement in the forward and reverse directions. Total volume is calculated from the measured flow velocity using water temperature and pipe diameter. The LCD shows total volume, unit of measure, rate of flow, pressure, temperature, firmware and



alarm conditions (reverse-flow, no usage, empty pipe, exceeding max flow, suspected leak, pressure, temperature, end of life and measurement error).

In normal temperature range of 45…122° F (7…50° C), the Ultrasonic "new meter" consumption measurement is accurate to:

- ±1.5% over the normal flow range
- ±3.0% from the extended low flow range to the minimum flow value

CONSTRUCTION

The E-Series Ultrasonic meter features lead-free bronze alloy meter housing, ultrasonic transducers, a meter-control circuit board with associated wiring, LCD and battery. Wetted elements are limited to the pressure vessel and transducers. The electronic components are housed and fully potted within a molded, engineered polymer enclosure, which is attached to the meter housing. The transducers extend through the housing and are sealed by O-rings, enabling turbulence-free water flow through the tube. The open flow tube design prevents obstruction of flow to reduce pressure loss and provide long-term accuracy.

METER INSTALLATION

For long-term performance the meter is weatherproof, UV-resistant, fully submersible and can be installed using horizontal or vertical piping. The registration electronics and battery are encapsulated to withstand harsh environments and protect the electronics in flooded or submerged pit applications. The meter will not measure flow when an "empty pipe" condition is experienced. An empty pipe is defined as a condition that occurs when the flow sensors are not fully submerged.

FM APPROVED

UL LISTED

Badger Meter

ESM-DS-02781-EN-18 (June 2023)

Product Data Sheet

SPECIFICATIONS

E-Series G2 Ultrasonic Meter Size	3 in.		4 in.		6 in.		8 in.
	3 × 12 in. (76 × 305 mm)	3 × 17 in. (76 × 432 mm)	4 × 14 in. (102 × 356 mm)	4 × 20 in. (102 × 508 mm)	6 × 18 in. (152 × 457 mm)	6 × 24 in. (152 × 610 mm)	8 × 20 in. (203 × 508 mm)
Normal Test Flow Limits	0.75…560 gpm		1.5…1100 gpm		2.2…2000 gpm		4…3500 gpm
Minimum Test Flow Limits	0.37 gpm		0.75 gpm		1.1 gpm		2.0 gpm
Safe Maximum Operating Condition (SMOC)	560 gpm		1100 gpm		2000 gpm		3500 gpm
Typical Pressure Loss	2.6 psi @ 350 gpm		2.1 psi @ 630 gpm		1.5 psi @ 1400 gpm	1.8 psi @ 1400 gpm	2.4 psi @ 2800 gpm
Totalization Display Resolution	*3 inch and 4 inch meters* • Gallons: 0.1 • Cubic feet: 0.01 • Cubic meters: 0.001				*6 inch and 8 inch meters* • Gallons: 1.0 • Cubic feet: 0.1 • Cubic meters: 0.01		
Operating Performance	In normal temperature range of 45…122° F (7…50° C), new meter consumption measurement is accurate to: • 100% ±1.5% over the normal test flow limits • 100% ±3.0% for the minimum test flow limits						
Storage Temperature	– 40…140° F (– 40…60° C)						
Maximum Ambient Storage (Storage for One Hour)	150° F (66° C)						
Measured Fluid Temperature Range	34…140° F (1…60° C) .						
Humidity	0…100% condensing; meter is capable of operating in fully submerged environments						
Maximum Working Pressure of Meter Housing	175 psi (12 bar)						
Maximum Operating Pressure of Pressure Sensor	150 psi (10 bar)						
Pressure Sensor Accuracy	±2% of full scale pressure, up to 150 psi (10 bar)						
Register Type	Straight reading, permanently sealed electronic LCD; digits are 0.28 in. (7 mm) high						
Register Display	• Consumption (up to nine digits) • Rate of flow • Alarms • Pressure				• Temperature • Firmware version • Unit of measure factory programmed for gallons, cubic feet and cubic meters		
Scaled/Unscaled Output*	Solid-state relay with 4-20mA output; open drain MOSFET with encoder output						
Max. Voltage	30V DC						
Current	100 mA						
Pulse Width	50 ms (programmable 30…100 ms)						
Analog 4-20 mA Output*	Two-wire/passive						
Input Voltage Range	9…50V DC supply						
Current	4…20 mA						
Max. Load Resistance (Ohms)	50 Ohms + 50 Ohms (supply voltage - 9V)						
Battery	3.6-volt lithium thionyl chloride battery is fully encapsulated within the register housing and is not replaceable. 20-year battery life; 15-year battery life for scaled/unscaled dual output meters						

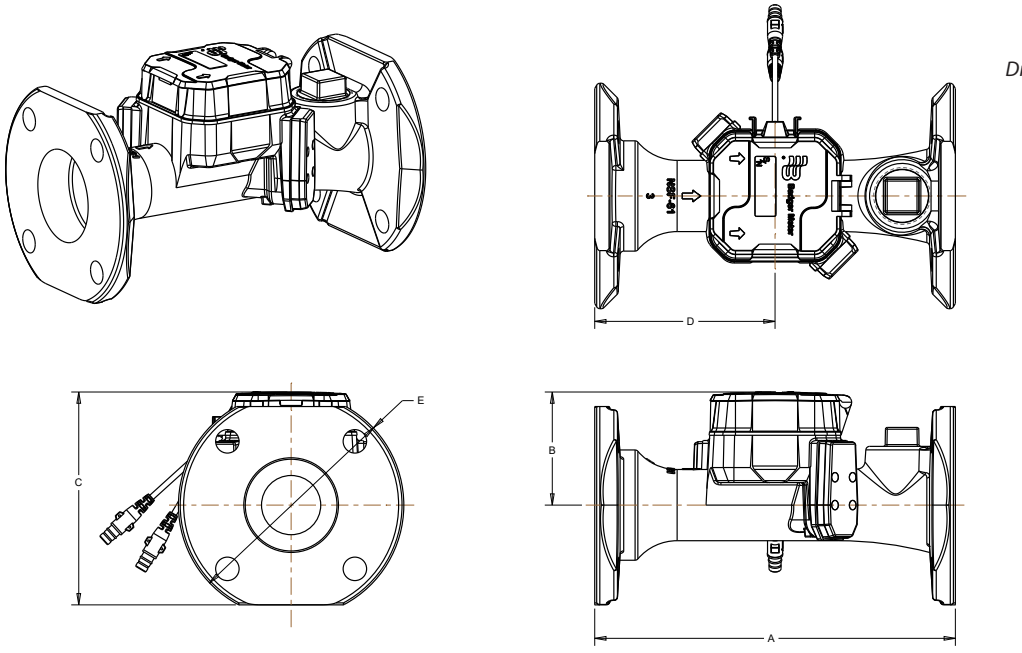
NOTE: See Pressure Loss Chart on *page 4* for typical pressure loss over complete UL 327B flow range.

* Applicable to meters with dual output options

PHYSICAL DIMENSIONS

E-Series G2 Ultrasonic Meter Size	3 in.		4 in.		6 in.		8 in.
Housing	**Round**	**Round**	**Round**	**Round**	**Round**	**Round**	**Round**
Size Designation X Lay Length	3 × 12 in. (76 × 305 mm)	3 × 17 in. (76 × 432 mm)	4 × 14 in. (102 × 356 mm)	4 × 20 in. (102 × 508 mm)	6 × 18 in. (152 × 457 mm)	6 × 24 in. (152 × 610 mm)	8 × 20 in. (203 × 508 mm)
Weight (without AMR)	26 lb (11.8 kg)	28.5 lb (12.9 kg)	38 lb (17.2 kg)	42 lb (19.1 kg)	59 lb (26.8 kg)	66 lb (29.9 kg)	96 lb (43.5 kg)
See illustration below for Measurement Designations							
Length (A)	12 in. (305 mm)	17 in. (432 mm)	14 in. (356 mm)	20 in. (508 mm)	18 in. (457 mm)	24 in. (610 mm)	20 in. (508 mm)
Height (B)	3.76 in. (95 mm)	3.76 in. (95 mm)	3.99 in. (101 mm)	3.99 in. (101 mm)	5.15 in. (131 mm)	5.15 in. (131 mm)	6.49 in. (165 mm)
Height (C)	7.08 in. (180 mm)	7.08 in. (180 mm)	8.5 in. (216 mm)	8.5 in. (216 mm)	10.36 in. (263 mm)	10.36 in. (263 mm)	13.05 in. (331 mm)
Height with Lifting Ring	NA	NA	NA	NA	12.96 in. (329 mm)	12.96 in. (329 mm)	15.65 in. (398 mm)
Length (D)	6 in. (152 mm)	8.5 in. (216 mm)	7 in. (178 mm)	10 in. (254 mm)	8 in. (203 mm)	8 in. (203 mm)	9 in. (229 mm)
Width (E)	7.5 in. (191 mm)	7.5 in. (191 mm)	9 in. (229 mm)	9 in. (229 mm)	11 in. (279 mm)	11 in. (279 mm)	13.50 in. (343 mm)
Number of Bolts	4	4	8	8	8	8	8
Bolt Hole Diameter	0.781 in. (19.84 mm)						
Companion Flange	3 in. (76 mm)	3 in. (76 mm)	4 in. (102 mm)	4 in. (102 mm)	6 in. (152 mm)	6 in. (152 mm)	8 in. (203 mm)
NPT Test Port	1.5 in. (38 mm)	1.5 in. (38 mm)	2 in. (51 mm)	2 in. (51 mm)	2 in. (51 mm)	2 in. (51 mm)	2 in. (51 mm)

Measurement Designations



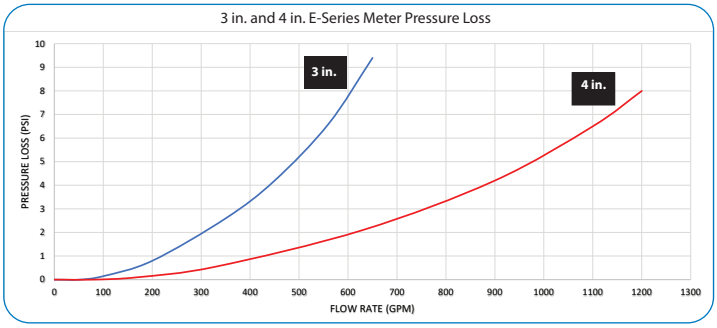
Drawings illustrate the 3 inch meter

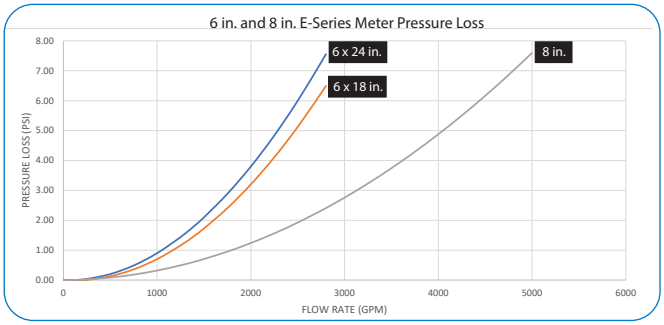
MATERIALS

Meter Housing	Lead-free bronze alloy
Measuring Section	Ultrasonic sensors located in the flow tube
Register Housing & Lid	Engineered polymer
Transducer Port Covers 3 in., 4 in.	Lead-free bronze alloy
Transducer Port Covers 6 in., 8 in.	Engineered polymer

PRESSURE LOSS CHARTS

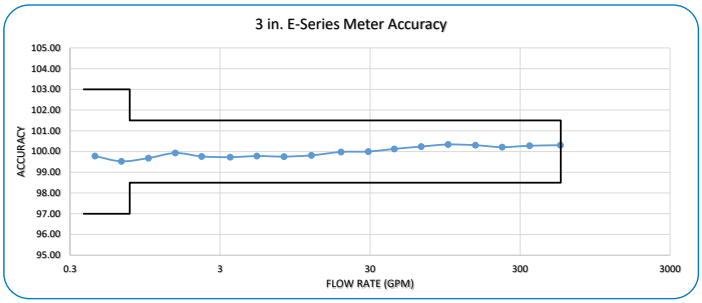
Charts represent typical meter performance. Rate of flow in gallons per minute (gpm).

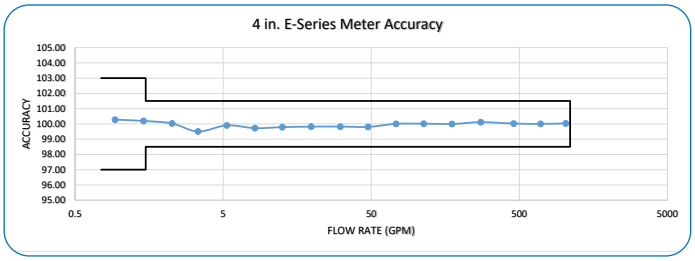


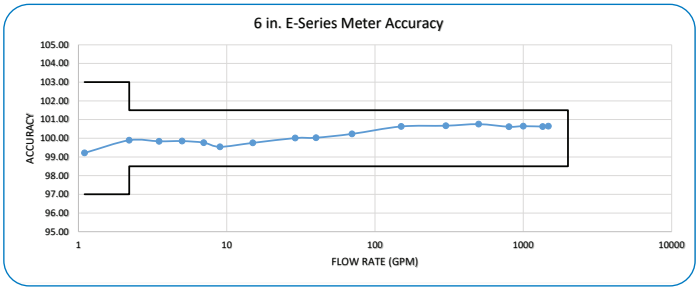


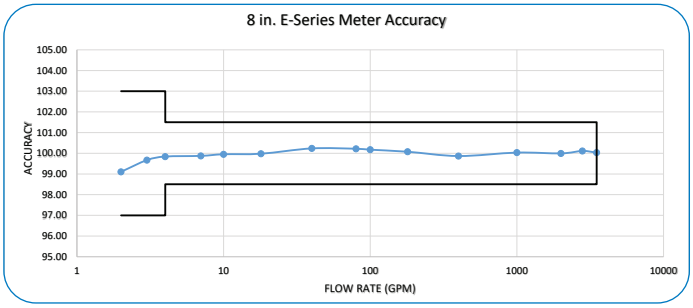
ACCURACY CHARTS

Charts represent typical meter performance. Rate of flow in gallons per minute (gpm).









SMART WATER IS *BADGER METER*

www.badgermeter.com

APPENDIX E

FIRE HYDRANT FLOW TEST
AND
EXTRAPOLATION CALCULATION

CARLSBAD FIRE DEPARTMENT
Fire Prevention Division
1635 Faraday Avenue -- Carlsbad CA 92008
442.339.2665

WATER AVAILABILITY FORM

SECTION A: TO BE COMPLETED BY CUSTOMER

PROJECT NAME: Carlsbad Village Plaza SR#: _____ (Assigned upon plan submittal)

PROJECT ADDRESS: 945-1065 Carlsbad Village Drive CITY: Carlsbad

PHONE: (760) 438-4422 FAX NUMBER: (760) 438-0173

Largest Building (ft.^{2}): 124,332 Sprinkled? Yes Construction Type: IIIA

Commercial/Residential 13,800 sqft Existing Development EDUs: _____ Proposed Development EDUs _____

SECTION B: TO BE COMPLETED BY CARLSBAD FIRE DEPARTMENT

Required fire flow (GPM): _____ **Duration (hours):** _____ **Number of hydrants required:** _____

SECTION C: TO BE COMPLETED BY LOCAL WATER COMPANY. CUSTOMER TO PROVIDE RESULTS TO CFD.

Water Purveyor: _____

Location of test (reference map required): _____

TEST INFORMATION IS VALID FOR 6 MONTHS FROM DATE PERFORMED

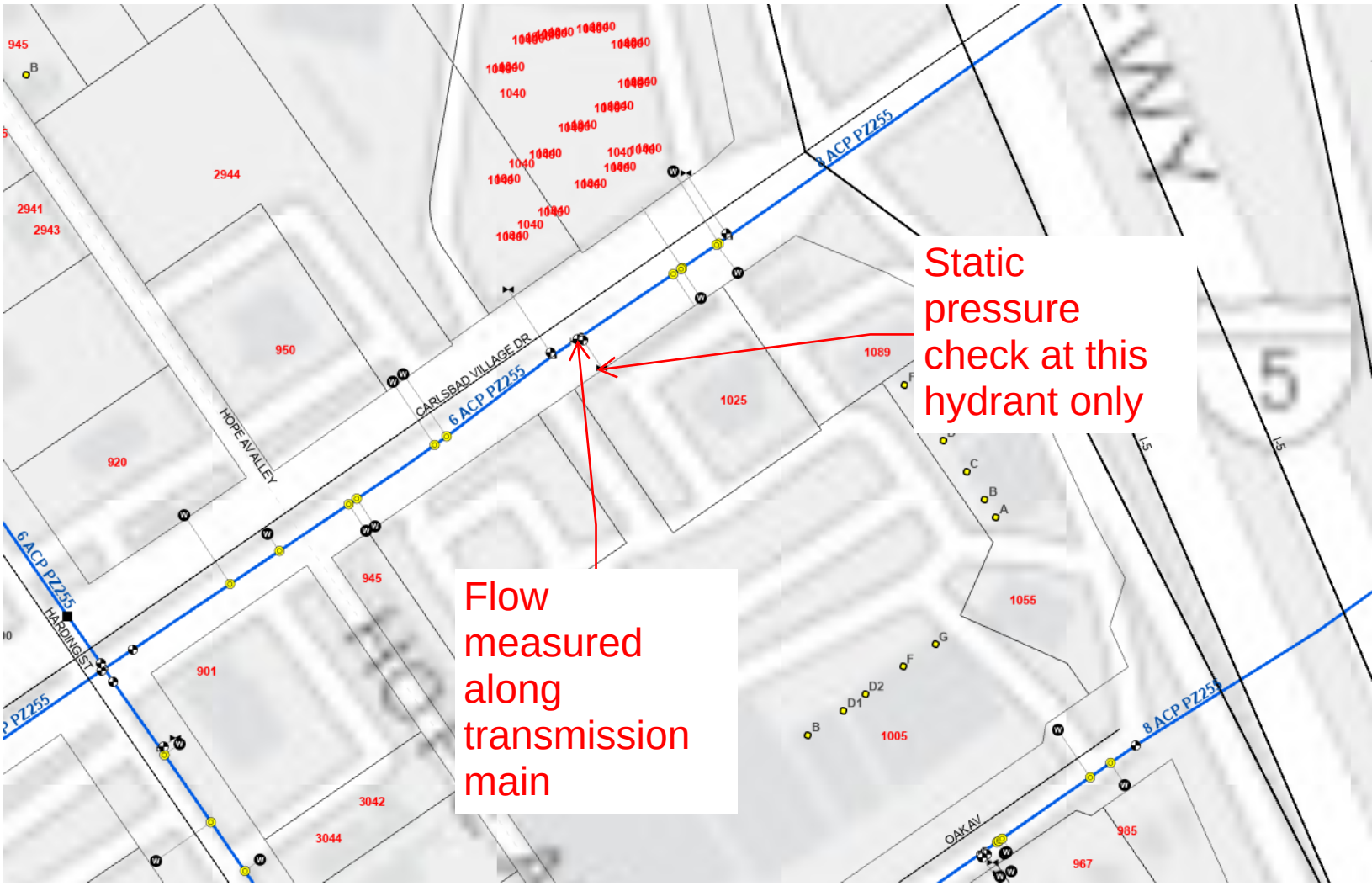
Flow Test Results	
Static pressure: 80 **PSI**	Hydrant Number (if applicable): H60912
Elevation of test: 70 Feet	Date/Time of Test[1]: _____
Pitot Tube Reading: _____ PSI	Corresponding Flow: _____ GPM
Total Flow: 3,461 **GPM**	**Residual Pressure**: 20 **PSI**

At max day demand, this water system is capable of providing a fire flow discharge @ 20 psi of no less than 3,461 gpm.

At max day demand, the maximum fire flow available in the water system within the water purveyor's engineering standard for maximum velocity is no more than _____ gpm.

[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


Static pressure check at this hydrant only
Flow measured along transmission main
8 ACP PZ255
6 ACP PZ255
CARLSBAD VILLAGE DR
HOPE AV ALLEY
HASDINGST
OAK AV
945
2944
2941
2943
950
920
1040
1089
1025
1055
901
3042
3044
1005
985
967

Fire Hydrant Flow Test Date 7/26/2023

Input Flow Test Results

Static Pressure	80 PSI			
Residual Pressure	20 PSI			
Hydrant Flow	3461 GPM			
Actual Hydrant Elevation	Feet	HGL		Feet
Estimated Hydrant Elevation	70 Feet	HGL	254.6	Feet

Equation $\Delta H = k\,Q^{1.85}$

k = 3.92522E-05

Extrapolated Calculations

Q, gpm	Residual Pressure	Available HGL
28.3	80.0 psi	254.6 ft
45.3	80.0 psi	254.6 ft
82.2	79.9 psi	254.5 ft
1100	72.8 psi	238.0 ft
1300	70.2 psi	232.0 ft
1500	67.2 psi	225.2 ft
1700	63.9 psi	217.5 ft
1900	60.2 psi	209.0 ft
2000	58.2 psi	204.4 ft
2100	56.2 psi	199.7 ft
2300	51.8 psi	189.6 ft
2545.3	46.0 psi	176.2 ft
2700	42.1 psi	167.2 ft
3000	33.9 psi	148.3 ft
3100	31.1 psi	141.7 ft
3300	25.1 psi	127.8 ft
3500	18.7 psi	113.3 ft
3700	12.1 psi	98.0 ft
3900	5.2 psi	81.9 ft
4046	-0.1 psi	69.8 ft
4100	-2.1 psi	65.2 ft
4300	-9.6 psi	47.7 ft
4500	-17.5 psi	29.6 ft
4700	-25.7 psi	10.7 ft
4900	-34.2 psi	-8.8 ft
5000	-38.5 psi	-18.9 ft

Residual Pressure, psi	Available Flow, gpm
0 psi	4,043
10 psi	3,762
20 psi	3,461
30 psi	3,136
40 psi	2,780
50 psi	2,379
60 psi	1,911
70 psi	1,314
80 psi	Residual Pressure Exceeds Static Pressure
90 psi	Residual Pressure Exceeds Static Pressure
100 psi	Residual Pressure Exceeds Static Pressure
110 psi	Residual Pressure Exceeds Static Pressure
120 psi	Residual Pressure Exceeds Static Pressure
130 psi	Residual Pressure Exceeds Static Pressure
140 psi	Residual Pressure Exceeds Static Pressure
150 psi	Residual Pressure Exceeds Static Pressure
160 psi	Residual Pressure Exceeds Static Pressure
170 psi	Residual Pressure Exceeds Static Pressure
180 psi	Residual Pressure Exceeds Static Pressure
190 psi	Residual Pressure Exceeds Static Pressure

APPENDIX F

COMPUTER MODELING RESULTS
EXISTING PUBLIC WATER SYSTEM ANALYSIS

NODE AND PIPE DIAGRAM REFERENCE:

Exhibit A at the back of the report.

CONDITIONS MODELED:

1. Average Day Demand.

2. Peak Hour Demand.

3. Maximum Day Demand plus 2,500 gpm Fire Flow split between Nodes 12 and 24.

U N I T S S P E C I F I E D

FLOWRATE ..... = gallons/minute
HEAD (HGL) ..... = feet
PRESSURE ..... = psig

P I P E L I N E D A T A

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
5	0	4	862.10	8.00	120.0000	0.00
9	4	8	618.50	10.00	120.0000	0.00
13	8	12	483.70	8.00	120.0000	0.00
17	12	16	455.90	8.00	120.0000	0.00
21	16	20	480.30	6.00	120.0000	0.00
25	20	24	427.70	6.00	120.0000	0.00
29	0	24	18.90	8.00	120.0000	0.00

P U M P/L O S S E L E M E N T D A T A

THERE IS A DEVICE AT NODE 0 DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (ft)	FLOWRATE (gpm)
184.62	0.00
46.15	3461.00
-315.23	6922.00

N O D E D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
4		20.00	91.00	
8		20.00	79.00	
12		0.00	65.00	
16		20.00	62.00	
20		20.00	62.00	
24		28.30	70.00	
0		----	70.00	70.00

O U T P U T O P T I O N D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 3
MAXIMUM AND MINIMUM VELOCITIES = 4

S Y S T E M C O N F I G U R A T I O N

NUMBER OF PIPES .....(P) = 7
NUMBER OF END NODES .....(J) = 6
NUMBER OF PRIMARY LOOPS .....(L) = 1
NUMBER OF SUPPLY NODES .....(F) = 1
NUMBER OF SUPPLY ZONES .....(Z) = 1

==========

Case: 0

RESULTS OBTAINED AFTER 7 TRIALS: ACCURACY = 0.35795E-05

Carlsbad Village Mixed Use
Existing Public Water System Analysis
Average Day Demand

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
5	0	4	48.21	0.07	0.00	0.31	0.08	0.08
9	4	8	28.21	0.01	0.00	0.12	0.01	0.01
13	8	12	8.21	0.00	0.00	0.05	0.00	0.00
17	12	16	8.21	0.00	0.00	0.05	0.00	0.00
21	16	20	-11.79	0.01	0.00	0.13	0.02	0.02
25	20	24	-31.79	0.06	0.00	0.36	0.14	0.14
29	0	24	60.09	0.00	0.00	0.38	0.12	0.12

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft
0	108.30	0.00	184.39	184.4

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
4		20.00	254.32	91.00	163.32	70.77
8		20.00	254.32	79.00	175.32	75.97
12		0.00	254.32	65.00	189.32	82.04
16		20.00	254.31	62.00	192.31	83.34

20	20.00	254.32	62.00	192.32	83.34
24	28.30	254.39	70.00	184.39	79.90
0	----	254.39	70.00	184.39	79.90

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
20	83.34	4	70.77
16	83.34	8	75.97
12	82.04	24	79.90

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
29	0.38	13	0.05
25	0.36	17	0.05
5	0.31	9	0.12
21	0.13	21	0.13

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
0	108.30	

NET SYSTEM INFLOW = 108.30
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 108.30

==========
Case: 1

C H A N G E S F O R N E X T S I M U L A T I O N (Change Number = 1)

JUNCTION DEMANDS CHANGED - PLEASE SEE RESULTS TABLE

RESULTS OBTAINED AFTER 3 TRIALS: ACCURACY = 0.26483E-07

Carlsbad Village Mixed Use
Existing Public Water System Analysis
Peak Hour Demand

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
5	0	4	139.81	0.48	0.00	0.89	0.55	0.55
9	4	8	81.81	0.04	0.00	0.33	0.07	0.07
13	8	12	23.81	0.01	0.00	0.15	0.02	0.02
17	12	16	23.81	0.01	0.00	0.15	0.02	0.02
21	16	20	-34.19	0.08	0.00	0.39	0.17	0.17
25	20	24	-92.19	0.44	0.00	1.05	1.04	1.04
29	0	24	174.26	0.02	0.00	1.11	0.83	0.83

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft
0	314.07	0.00	182.99	183.0

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
4		58.00(2.90)	252.51	91.00	161.51	69.99
8		58.00(2.90)	252.47	79.00	173.47	75.17
12		0.00	252.46	65.00	187.46	81.23
16		58.00(2.90)	252.45	62.00	190.45	82.53
20		58.00(2.90)	252.53	62.00	190.53	82.56
24		82.07(2.90)	252.97	70.00	182.97	79.29
0		----	252.99	70.00	182.99	79.30

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
20	82.56	4	69.99
16	82.53	8	75.17
12	81.23	24	79.29

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
29	1.11	13	0.15
25	1.05	17	0.15
5	0.89	9	0.33
21	0.39	21	0.39

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
0	314.07	

NET SYSTEM INFLOW = 314.07
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 314.07

==========
Case: 2

C H A N G E S F O R N E X T S I M U L A T I O N (Change Number = 2)

JUNCTION DEMANDS CHANGED - PLEASE SEE RESULTS TABLE

RESULTS OBTAINED AFTER 3 TRIALS: ACCURACY = 0.39299E-04

Carlsbad Village Mixed Use
Existing Public Water System Analysis
Maximum Day Demand plus 2500 GPM Fire Flow split between Nodes 12 and 24

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
5	0	4	870.76	14.14	0.00	5.56	16.40	16.40
9	4	8	838.76	3.19	0.00	3.43	5.16	5.16
13	8	12	806.76	6.89	0.00	5.15	14.24	14.24
17	12	16	-443.24	2.14	0.00	2.83	4.70	4.70
21	16	20	-475.24	10.42	0.00	5.39	21.69	21.69
25	20	24	-507.24	10.46	0.00	5.76	24.47	24.47
29	0	24	1802.54	1.19	0.00	11.50	63.09	63.09

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft
0	2673.30	0.00	98.79	98.8

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
4		32.00(1.60)	154.65	91.00	63.65	27.58
8		32.00(1.60)	151.46	79.00	72.46	31.40
12		1250.00	144.58	65.00	79.58	34.48
16		32.00(1.60)	146.72	62.00	84.72	36.71
20		32.00(1.60)	157.13	62.00	95.13	41.22
24		1295.30(**)	167.60	70.00	97.60	42.29
0		----	168.79	70.00	98.79	42.81

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
0	42.81	4	27.58
24	42.29	8	31.40
20	41.22	12	34.48

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
29	11.50	17	2.83
25	5.76	9	3.43
5	5.56	13	5.15
21	5.39	21	5.39

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
0	2673.30	

NET SYSTEM INFLOW = 2673.30
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 2673.30

APPENDIX G

COMPUTER MODELING RESULTS
PROPOSED PUBLIC WATER SYSTEM ANALYSIS

NODE AND PIPE DIAGRAM REFERENCE:

Exhibit A at the back of the report.

CONDITIONS MODELED:

1. Average Day Demand.

2. Peak Hour Demand.

3. Maximum Day Demand plus 2,500 gpm Fire Flow split between Nodes 12 and 24.

U N I T S S P E C I F I E D

FLOWRATE ..... = gallons/minute
HEAD (HGL) ..... = feet
PRESSURE ..... = psig

P I P E L I N E D A T A

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
5	0	4	862.10	8.00	120.0000	0.00
9	4	8	618.50	10.00	120.0000	0.00
13	8	12	483.70	8.00	120.0000	0.00
17	12	16	455.90	8.00	120.0000	0.00
21	16	20	480.30	6.00	120.0000	0.00
25	20	24	427.70	8.00	120.0000	0.00
29	0	24	18.90	8.00	120.0000	0.00

P U M P/L O S S E L E M E N T D A T A

THERE IS A DEVICE AT NODE 0 DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (ft)	FLOWRATE (gpm)
184.62	0.00
46.15	3461.00
-315.23	6922.00

N O D E D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
4		20.00	91.00	
8		20.00	79.00	
12		0.00	65.00	
16		20.00	62.00	
20		20.00	62.00	
24		28.30	70.00	
0		----	70.00	70.00

O U T P U T O P T I O N D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 3
MAXIMUM AND MINIMUM VELOCITIES = 4

S Y S T E M C O N F I G U R A T I O N

```
    NUMBER OF PIPES ..................(P) =     7
    NUMBER OF END NODES ..............(J) =     6
    NUMBER OF PRIMARY LOOPS ..........(L) =     1
    NUMBER OF SUPPLY NODES ...........(F) =     1
    NUMBER OF SUPPLY ZONES ...........(Z) =     1
```

==========

Case: 0

RESULTS OBTAINED AFTER 7 TRIALS: ACCURACY = 0.17919E-05

Carlsbad Village Mixed Use
Proposed Public Water System Analysis
Average Day Demand

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
5	0	4	40.85	0.05	0.00	0.26	0.06	0.06
9	4	8	20.85	0.00	0.00	0.09	0.01	0.01
13	8	12	0.85	0.00	0.00	0.01	0.00	0.00
17	12	16	0.85	0.00	0.00	0.01	0.00	0.00
21	16	20	-19.15	0.03	0.00	0.22	0.06	0.06
25	20	24	-39.15	0.02	0.00	0.25	0.05	0.05
29	0	24	67.45	0.00	0.00	0.43	0.14	0.14

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft
0	108.30	0.00	184.39	184.4

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
4		20.00	254.34	91.00	163.34	70.78
8		20.00	254.34	79.00	175.34	75.98
12		0.00	254.34	65.00	189.34	82.05
16		20.00	254.34	62.00	192.34	83.35

20	20.00	254.36	62.00	192.36	83.36
24	28.30	254.39	70.00	184.39	79.90
0	----	254.39	70.00	184.39	79.90

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
20	83.36	4	70.78
16	83.35	8	75.98
12	82.05	24	79.90

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
29	0.43	13	0.01
5	0.26	17	0.01
25	0.25	9	0.09
21	0.22	21	0.22

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
0	108.30	

NET SYSTEM INFLOW = 108.30
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 108.30

==========
Case: 1

C H A N G E S F O R N E X T S I M U L A T I O N (Change Number = 1)

JUNCTION DEMANDS CHANGED - PLEASE SEE RESULTS TABLE

RESULTS OBTAINED AFTER 3 TRIALS: ACCURACY = 0.31501E-07

Carlsbad Village Mixed Use
Proposed Public Water System Analysis
Peak Hour Demand

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
5	0	4	118.45	0.35	0.00	0.76	0.41	0.41
9	4	8	60.45	0.02	0.00	0.25	0.04	0.04
13	8	12	2.45	0.00	0.00	0.02	0.00	0.00
17	12	16	2.45	0.00	0.00	0.02	0.00	0.00
21	16	20	-55.55	0.20	0.00	0.63	0.41	0.41
25	20	24	-113.55	0.16	0.00	0.72	0.38	0.38
29	0	24	195.62	0.02	0.00	1.25	1.03	1.03

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft
0	314.07	0.00	182.99	183.0

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
4		58.00(2.90)	252.64	91.00	161.64	70.04
8		58.00(2.90)	252.61	79.00	173.61	75.23
12		0.00	252.61	65.00	187.61	81.30
16		58.00(2.90)	252.61	62.00	190.61	82.60
20		58.00(2.90)	252.81	62.00	190.81	82.68
24		82.07(2.90)	252.97	70.00	182.97	79.29
0		----	252.99	70.00	182.99	79.30

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
20	82.68	4	70.04
16	82.60	8	75.23
12	81.30	24	79.29

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
29	1.25	13	0.02
5	0.76	17	0.02
25	0.72	9	0.25
21	0.63	21	0.63

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
0	314.07	

NET SYSTEM INFLOW = 314.07
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 314.07

==========
Case: 2

C H A N G E S F O R N E X T S I M U L A T I O N (Change Number = 2)

JUNCTION DEMANDS CHANGED - PLEASE SEE RESULTS TABLE

RESULTS OBTAINED AFTER 4 TRIALS: ACCURACY = 0.94577E-07

Carlsbad Village Mixed Use
Proposed Public Water System Analysis
Maximum Day Demand plus 2500 GPM Fire Flow split between Nodes 12 and 24

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
5	0	4	802.11	12.14	0.00	5.12	14.08	14.08
9	4	8	770.11	2.72	0.00	3.15	4.41	4.41
13	8	12	738.11	5.84	0.00	4.71	12.07	12.07
17	12	16	-511.89	2.79	0.00	3.27	6.13	6.13
21	16	20	-543.89	13.37	0.00	6.17	27.84	27.84
25	20	24	-575.89	3.26	0.00	3.68	7.62	7.62
29	0	24	1871.19	1.28	0.00	11.94	67.61	67.61

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft
0	2673.30	0.00	98.79	98.8

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
4		32.00(1.60)	156.65	91.00	65.65	28.45
8		32.00(1.60)	153.92	79.00	74.92	32.47
12		1250.00	148.08	65.00	83.08	36.00
16		32.00(1.60)	150.88	62.00	88.88	38.51
20		32.00(1.60)	164.25	62.00	102.25	44.31
24		1295.30(**)	167.51	70.00	97.51	42.25
0		----	168.79	70.00	98.79	42.81

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
20	44.31	4	28.45
0	42.81	8	32.47
24	42.25	12	36.00

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
29	11.94	9	3.15
21	6.17	17	3.27
5	5.12	25	3.68
13	4.71	13	4.71

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
0	2673.30	

NET SYSTEM INFLOW = 2673.30
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 2673.30

EXHIBIT A

NODE AND PIPE DIAGRAM

LEGEND

PROJECT BOUNDARY

EXISTING 255 ZONE PUBLIC WATER LINE

EXISTING 330 ZONE PUBLIC WATER LINE

PROPOSED 225 ZONE PUBLIC WATER LINE

EXISTING PUBLIC FIRE HYDRANT

0 COMPUTER MODEL NODE NUMBER

1 COMPUTER MODEL PIPE NUMBER

GRAND AVE

CARLSBAD VILLAGE DR

OAK AVE

PINE AVE

MADISON ST

JEFFERSON ST

HARDING ST

INTERSTATE CALIFORNIA 5

EXISTING 6" LINE UPGRADED TO 8" LINE

PROJECT LOCATION

NORMALLY CLOSED VALVE

NORMALLY CLOSED VALVE

0 200 FEET

N

EX.6" EX.8" EX.10" EX.12"

20 24 25 29 0 4 5 16 21 17 12 8 9 13

8" EX.8" EX.6" EX.10"

\\ARTIC\DWG\113500 1\REPORT\CVP_EXHIBIT-A-WTR.DWG 8/10/2023 3:29:07 PM LAYOUT:11x17 USER:Karam

EXHIBIT A

NODE AND PIPE DIAGRAM

CARLSBAD VILLAGE MIXED USE

DEXTER WILSON ENGINEERING, INC.
CONSULTING ENGINEERS
(760) 438-4422