

**KING WILLIAM COUNTY
CENTRAL GARAGE WATER SYSTEM
KING WILLIAM COUNTY, VIRGINIA**

WATER MASTER PLAN

NOVEMBER 2020

Bowman
CONSULTING

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I. EXECUTIVE SUMMARY

Purpose of the Master Plan

The purpose of this Master Plan is to provide guidance for the orderly and timely implementation of upgrades to the water utility system to serve future growth within the Central Garage Water System. This guidance is based on the completion of a technical review of the County's water supply, water storage and water transmission system at current and future growth conditions. The recommendations for upgrades are intended to ensure that the County's water utility maintains an adequate capacity and level of service to all existing and future customers. This will enable King William County to continue its objective of providing a high-quality water utility system to serve the needs of its customers. This Master Plan will serve as an update to the findings of the previous Master Utility Plan dated May 14, 2010.

As part of this updated plan, growth projections and the associated needs for utility system upgrades will be reviewed and documented at the future milestone years of 2025, 2030 and 2040. To ensure that the water system has adequate capacity, a hydraulic model was also developed to review capacities, pressures, and the overall hydraulic performance at each milestone planning year scenario with the predicted future demands. A recommended Capital Improvement Projects (CIP) is provided as part of this Master Plan to coincide with the future planning milestone years.

Water System Demands

Existing demands on the system were determined from Annual Daily Groundwater Withdrawal Reports as well as historical monthly groundwater withdrawal data back to 2005. Average daily demands were projected to the year 2035 in the Groundwater Withdrawal Permit Application and Supporting Documentation (GWWP) by Cardno, Inc. dated January 22, 2019. A linear regression analysis was done to project the average day demands to 2040. Peaking factors determined from the groundwater use data, summarized in Table III-1 within this document, were used to project the Maximum Month Demand (MMD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD) to each Milestone Year.

Water System Capacities

Capacity of the existing system was evaluated with regard to both water supply and system storage. The existing 300,000-gallon elevated storage tank currently does not meet requirements for domestic and fire flow storage. A 600,000-gallon elevated storage tank, set at the at the same hydraulic elevation as the existing tank, is recommended to provide sufficient storage for the system through the year 2040. The current pumping capacities of the Kennington and McCauley Park wells are sufficient to meet the peak hour demands of the system through the year 2036. An in depth well yield evaluation by a licensed hydrogeologist is recommended.

Water System Analysis and Recommendations

Based on the analysis of the system with the anticipated future demands, a recommended Capital Improvement Projects (CIP) is provided as part of this Master Plan to with each future planning milestone year.

The 2025 Milestone Year CIP consists of three main projects: (1) construction of a new 600,000-gallon storage tank, (2) several water main upsizing projects to meet fire flow requirements, and (3) closure of a water main loop at the US Rte. 360 and State Rte. 30 intersection. The approximate total cost of the 2025 Milestone Year projects is \$ 6,761,328. Providing water to the Fontainebleau Industrial Park was identified as an alternative project for the 2025 Milestone. The first option for this alternative project is to connect directly to the Central Garage System. This option was evaluated in the model and has an approximate cost of \$ 5,377,320. The second option is to provide a new groundwater well and storage tank dedicated to the Industrial Park and separate from Central Garage. This option has an approximate cost of \$ 1,454,000. However, a full analysis of the feasibility and effectiveness of this option was not evaluated as part of this Master Plan and will need to be conducted separately.

The 2030 Milestone Year CIP consists of two projects: (1) extension of 12-inch water transmission main to Aylett, and (2) an evaluation of the existing groundwater wells. The approximate total cost of the 2030 Milestone Year projects is \$ 2,340,160. The 2040 Milestone Year CIP includes one main project: extension of 12-inch water transmission main to the King William Commerce Park. The approximate total cost of the 2040 Milestone CIP is \$4,773,600.

II. OVERVIEW OF EXISTING WATER SYSTEM INFRASTRUCTURE

A. General

The Central Garage Public Water System, PWSID No. 4101110, serves several communities in King William County. The system consists of two active water production wells, one 300,000-gallon elevated water storage tank, water transmission and distribution system piping, and associated treatment equipment and appurtenances.

The two active wells, the Kennington Well and the McCauley Park Well, were constructed in 2005. A third well, the Central Garage Well, was taken out of service in 2012 due to MTBE contamination and is not expected to be brought back into service for the duration of this analysis.

B. Existing Water System Demands

The current demands of the existing water system were determined based on the 2019 DEQ Annual Daily Groundwater Withdrawal Reports, provided by King William County, which document the daily flow meter readings of groundwater withdrawn by both the Kennington and McCauley Park wells. From the historic monthly groundwater withdrawal data, the annual average day demand of the water system over the past 15 years was determined.

In 2019, the combined total volume of groundwater withdrawn by both wells was 33,265,400 gallons. This annual total, when averaged over 365 days, gives an Average Daily Demand of 91,138 gallons per day (gpd). The single month in 2019 with the greatest water use occurred in July. The total groundwater withdrawal during July 2019 was 3,987,300 gallons. When averaged over 31 days, this yields a Maximum Month Demand of 128,623 gpd. Over the entire year, the greatest volume of groundwater withdrawn over a single day by both wells combined was 187,400 gallons. This indicates a Maximum Day Demand of approximately 130 gallons per minute (gpm).

C. Established Capacities

The Waterworks Operation Permit No. 4101110 for the Central Garage system indicates that the well pump capacity for the McCauley Park Well and the Kennington Well are 410 gpm and 430 gpm respectively. Therefore, the system has a total pumping capacity of 840 gpm, or 1,209,600 gpd. The system has effective storage of 300,000 gallons yielding design capacity of 600,000 gpd. The Central Garage water system is permitted for a capacity of 600,000 gpd due to the limited storage capacity.

As part of the Waterworks permit, the Virginia Department of Health (VDH) establishes a criterion that the design capacity of a waterworks shall exceed the maximum daily water demand of the system, in accordance with 12VAC5-590-690 Capacity of Waterworks. Additionally, VDH engineering staff recommend storage of half of maximum day demand plus fire flow volume for community systems, and that the water supply meets the peak hour demands on the system.

D. Peaking Factors Within the System

The peaking factors within the system were determined from the County's groundwater withdrawal data over the previous five years. Daily groundwater withdrawal data was only available for the four-year period from 2016 through 2019. A rolling average based on the consumption over these four years was used for determining the Max Day peaking factor. Although monthly groundwater withdrawal data has been recorded since 2005, only the most recent 5-year period was deemed adequate, and a five-year rolling average was used for the Max Month peaking factor. The Max Month peaking factor was determined from the average of the ratio of the MMD to the ADD from recorded data between 2015 and 2019. A 2.5 Peak Hour Demand (PHD) peaking factor was selected based on experience with similar systems since data is not recorded hourly in the system. The peaking factors used for the water system demand projections are summarized in Table II-1.

Table II-1: Peaking factors for PHD, MMD, and MDD determined from the previous five years of groundwater withdrawal data and used in the system demand projections.

Peaking Factors	
Peak Hour	2.50
Max Month	1.52
Max Day	2.09

E. Water Source Supplies

The Kennington and the McCauley Park wells are the two production wells for the Central Garage system and have well yields of approximately 410 gpm and 450 gpm, respectively. Pump capacity for the McCauley Park Well and the Kennington Well are 410 gpm and 430 gpm respectively, as discussed in Section II-C.

A preliminary theoretical maximum safe yield evaluation of the McCauley Park and Kennington Wells was conducted previously by Cardno Inc. which indicated that the theoretical capacity of each well is potentially 840 gpm and 1,112 gpm respectively, for a total of 1,952 gpm.

F. Existing Water Storage Facilities

The system is currently served by one 300,000-gallon elevated water storage tank located at the intersection of State Route 30 and US Route 360. The tank is fed through a 6" riser pipe by both the McCauley Park and Kennington Wells in a lead/lag operation controlled by a SCADA system. The tank is kept full at 95% capacity. When capacity in the tank drops to 85%, the two production wells alternate operation to fill the tank back to 95% full. When the water level drops to 80% full, both well pumps run simultaneously to fill the tank. The spheroid of the tank is 46'-6" in diameter. The base of the tank is approximately at 170.5' elevation, and the discharge pipe is 12". The maximum water surface within the elevated tank is 314 feet in elevation which establishes the hydraulic grade elevation of the Central Garage System.

G. Existing Water Distribution System

As stated in the County's VDH Waterworks Permit description sheet dated November 2015, the distribution system includes 35,590 ft of 12-inch main, 11,740 feet of 8-inch water main, 16,560 feet of 6-inch water main, and 2,390 ft of 4-inch water main.

III. GROWTH AND WATER SYSTEM DEMAND PROJECTIONS

A. General

In this section, the anticipated water system demands for ADD, MMD, MDD, and PHD are projected out for Planning Years 2025, 2030, and 2040. These demand projections are consistent with the demand projections provided within the *Groundwater Withdrawal Permit Application and Supporting Documentation (GWWP)* dated January 22, 2019 as prepared by Cardno. This document is included in Appendix A of this report. Additional demands anticipated within the system due to a private development on Venter Rd. were provided by the County.

B. Unit Water Demands

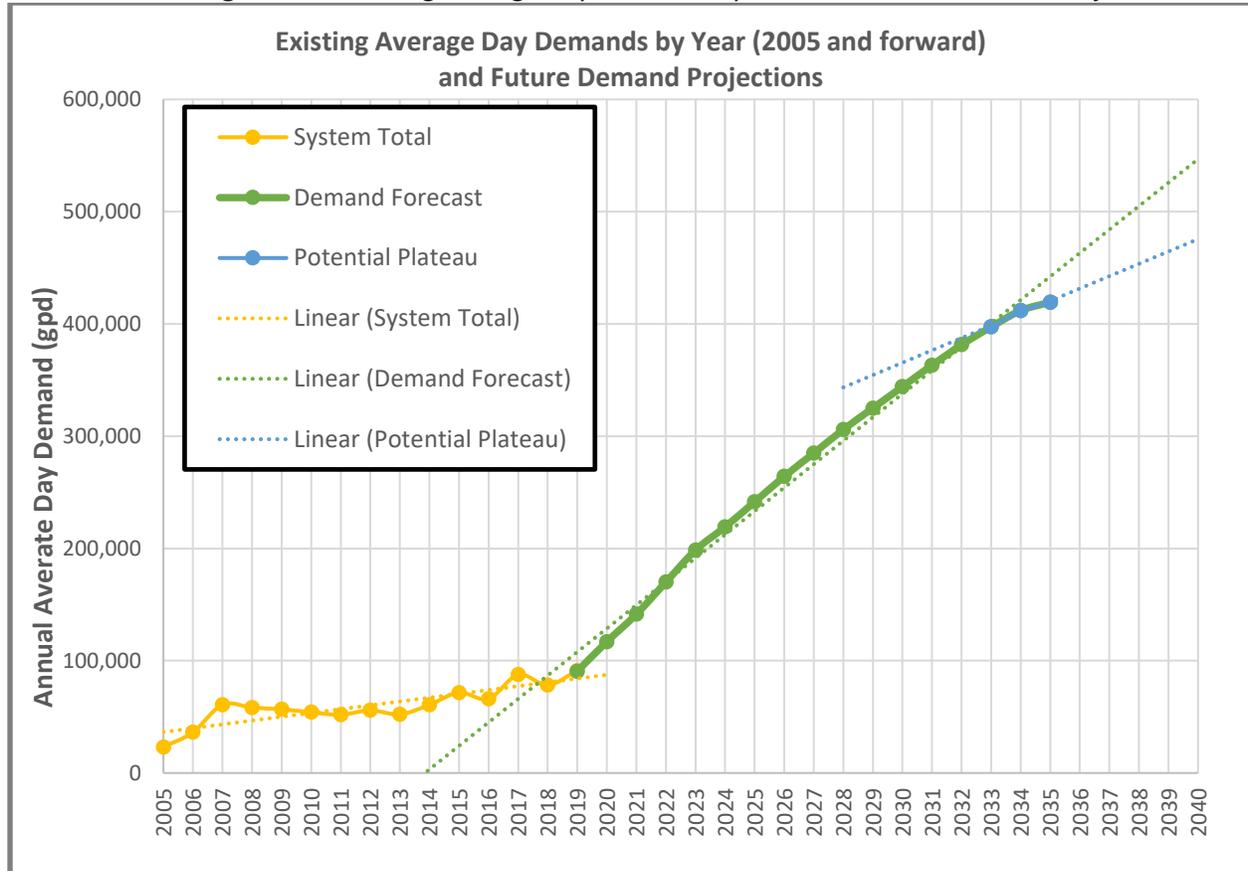
The water use demands per customer connection for the system, based on 2015-2018 data from the county, were provided in the GWWP Renewal Application. According to the GWWP Application, the average residential water use is estimated to be 180 gpd per connection, and 50 gpd per connection for the average commercial use.

C. Water Demand Projections

The GWWP renewal application contains a Water Demand Projection model developed by Cardno. The model was created with detailed input from the County and the area's main developer/homebuilder Rogers Chenault, Inc. (RCI) and projects both future development and expected annual water use, based on the unit water demands, out to the year 2035. The projected annual water use volumes were averaged over 365 days to give anticipated average day demands. Using the data compiled by Cardno Inc., a linear regression analysis was performed for both the historical and projected ADD values to

determine the rate of growth of the demands in the future. The growth data is shown graphically in Figure III-1.

Figure III-1: Existing Average Day Demands by Year and Future Demand Projections



Based on the historical flow rates, the demands from 2005 through 2019 are shown in yellow. The average historical increase in water demand averages to approximately 4,900 gpd per year in this time frame. The forecasted future demands within the GWWP renewal application is shown in green and blue lines. In the green portion from years 2019 through 2035, the forecasted demands are anticipated to increase by approximately 20,500 gpd per year. Since this represents a significantly higher rate of growth than the historical values, there will be increased emphasis to evaluate the associated impact to the water system infrastructure.

The last three years of the projected demands, shown in Figure III-1, are indicated as a blue line. The blue line represents when demands are forecasted to begin plateauing for planning years 2033 to 2035. This slower growth rate is a natural expected occurrence when a system begins to approach milestone conditions. Since the GWWP only extended to planning year 2035 and this Master Plan forecasts to year 2040, a linear regression was plotted for the 2033-2035 projected Annual ADD values. The regression trendline equation for those three years was used to project the Average Day Demand for the Planning Year 2040.

The Venter Rd. development has been added to the projections previously developed in the GWWP since that development was not included in those projections. This development anticipates 100 new connections to the Central Garage system by 2025, with a total buildout of 400 residential connections by 2040. The average day water use for 100 connections has been included for planning year 2025, then each year an additional 20 connections per year are anticipated until the buildout level of 400 connections in 2040 is reached in 2040. The average day water use anticipated at this development was added to the ADD projections for a total expected annual water use per year up to 2040.

Using the ADD information, the anticipated demands for MMD, MDD, and PHD were developed for planning year milestones of 2025, 2030, and 2040 using the peaking factors given in Table II-1. The water demands for each planning year are given in Table III-1.

Table III-1: Anticipated Future Water System Demand Projections

Year	ADD (gpd)	MMD (gpd)	MDD		PHD
			(gpd)	(gpm)	(gpm)
2025	259,330	393,834	542,000	376	450
2030	379,860	576,878	793,907	551	659
2040	547,220	831,041	1,143,690	794	950

IV. WATER SYSTEM ANALYSIS & RECOMMENDATIONS

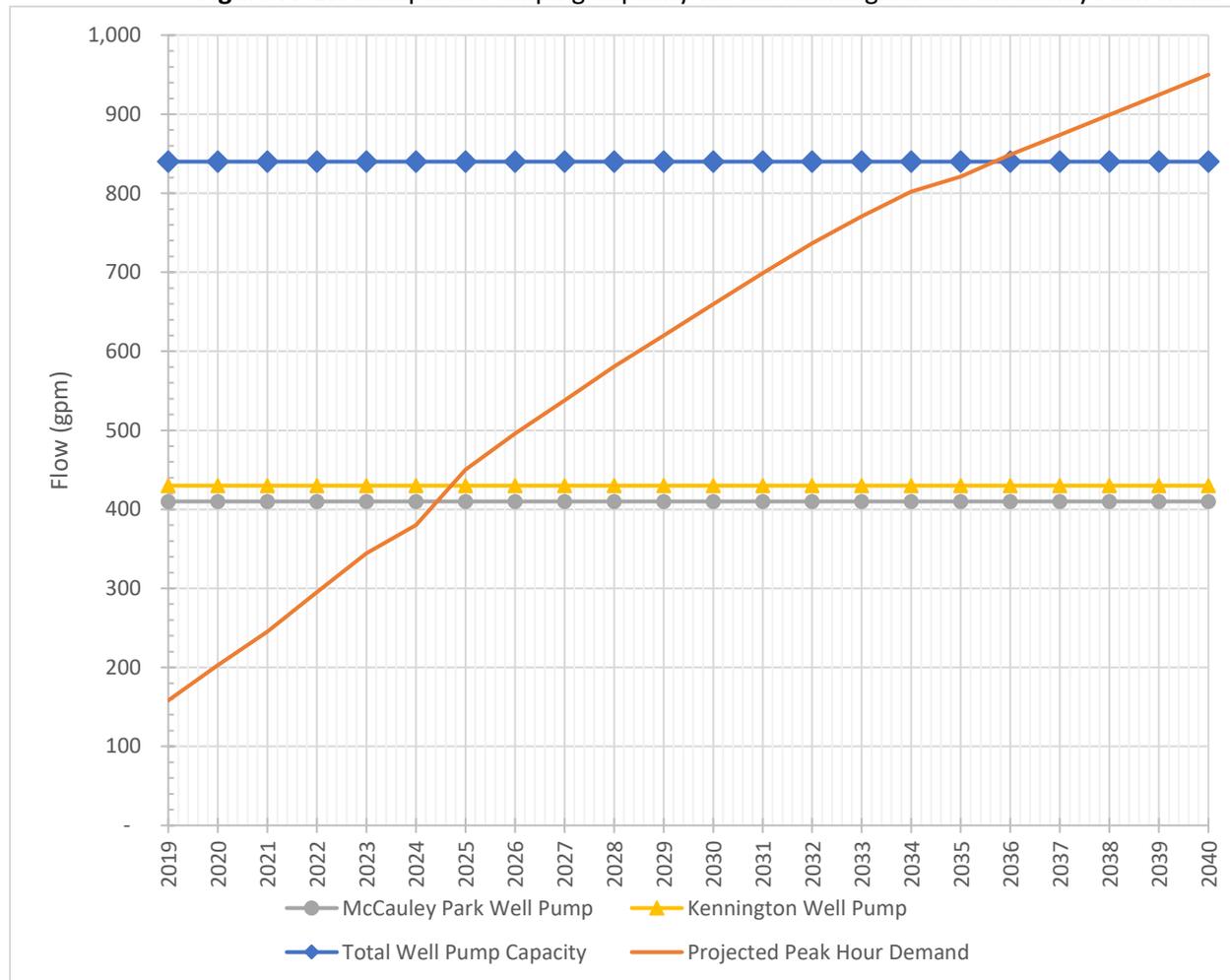
A. General

The water system demands anticipated by 2025, 2030, and 2040 were used to evaluate the capacity of the existing infrastructure including the water supply wells, water storage capacity, and the water transmission and distribution system.

B. Water Source Supplies

The pumping capacity of both the McCauley Park and Kennington Wells was analyzed against the projected Peak Hour water demand values. Figure IV-1 indicates that by year 2036, the peak hour demand of the system exceeds the combined well pump capacity of 840 gpm. The preliminary capacity review of the Kennington and McCauley Park Wells suggests the two wells are each capable of additional yield. The existing well pumps were installed in 2005 and the condition of the well pumps was not evaluated as part of this Master Plan. A more in depth well yield evaluation by a licensed hydrogeologist is recommended. The evaluation would determine if an upgrade of the two existing wells can result in higher source capacity. If the evaluation fails to result in higher yields, then an option for a third groundwater well can be explored.

Figure IV-1: Anticipated Pumping Capacity for the Kennington and McCauley Park wells.



C. Water Storage Facilities

As a minimum, VDH requires half of the maximum day demand of storage for community waterworks. In addition, storage must be provided for fire flows. King William County’s Utility Design Standards require fire flows of 1,000 gpm for single family and duplex residential structures. Multi-family residential, commercial, and industrial structures must meet flows required in the International Building Code. Following consultation with both the Fire Chief and County officials, fire flows of 1,000 gpm in residential areas and 2,500 gpm for commercial, industrial, and multi-family areas will be provided. Therefore, fire flow storage of 2,500 gpm for 2 hours will be provided for future development.

The existing 300,000-gallon storage tank provides sufficient domestic storage until 2026. However, providing a two hour 2,500 gpm fire storage will require an additional 300,000 gallons of dedicated fire storage. To meet this fire storage requirement, a new 600,000-gallon storage tank is proposed to be in operation by the 2025 planning year. This tank will provide sufficient storage for both domestic and fire flows through the year 2040. Figure IV-2 projects the required fire storage utilizing the VDH criteria of providing ½ of a max day of effective storage (shown as a blue line on the graph) and the commercial fire storage criteria. The total volume of storage needed for both domestic and fire flow is shown on Figure IV-2 as a grey line with diamond point markers.

Figure IV-2: Water Storage Capacity of the Central Garage System Using VDH and Fire Storage Criteria

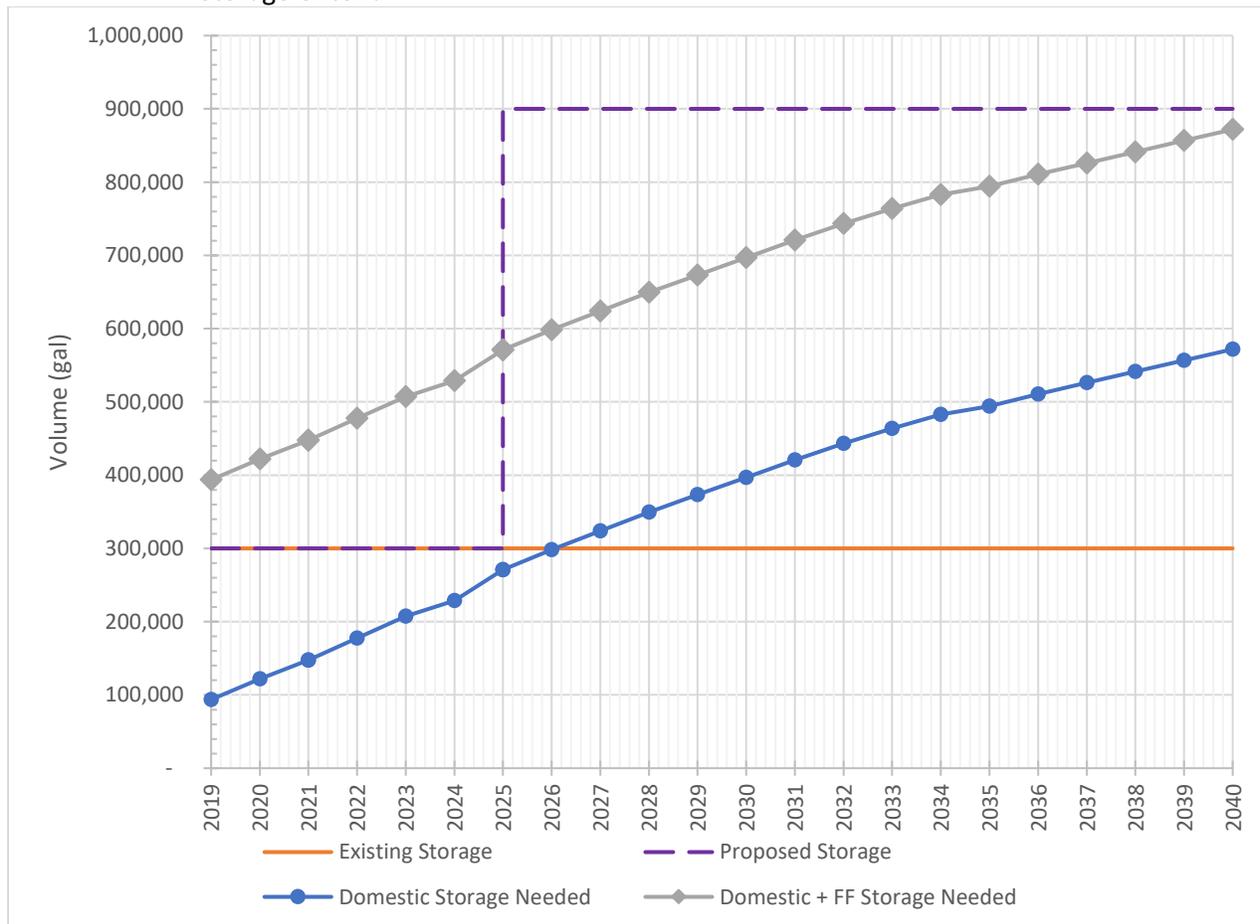


Figure IV-2 analyzes the anticipated storage required against the demands of the Central Garage system with the anticipated demands projected in Section III, excluding the potential connection to the Fontainebleau Industrial Park. With the connection to the

Industrial Park, the proposed 600,000-gallon storage tank provides sufficient storage through the year 2040.

Four (4) locations for the proposed 600,000-gallon storage tank were analyzed. The four location options evaluated for the tank are summarized in Table IV-1 below and are shown in Appendix B. Each site varies in elevation and requires extensions of the water main to the tank.

Table IV-1: Summary of 600,000-gallon Tank Location Options

Option	Location	Approx. Grade Elevation (ft)	Approx. LF of Water Main Extension
1	Route 360 near Jack Pen Lane	165	250
2	Fontainebleau Industrial Park	156	8,000
3	Venter Road Property	160	1,250
4	Kelley Lane Property	170	1,300

Tank location Options 3 and 4 are potential tank sites preliminarily offered to the County as the site for a second storage tank by land developers. Option 4, the Kelley Lane property, is the ideal location for the 600,000-gallon tank since the property, parcel #29-8, has the highest grade elevation and is more centrally located in the system than at the Venter Rd. property. Option 4 will require approximately 1,300 LF of new water main extension.

D. Water Distribution System

The existing water distribution system was evaluated using hydraulic modeling software, Bentley WaterCAD Connect version 10.03. The existing system modeling was adapted from a water model previously created by Dewberry, dated April 2018, and the existing water system GIS data provided by the county. Calibration of the model of the existing system by flow testing of fire hydrants was not part of this evaluation.

1. Modeling Assumptions

The following assumptions regarding the model were used in the setup of the Water System.

- a. The existing well pump and tank settings from the County's water system hydraulic model as received by their consultant are assumed accurate and up to date and the model is anticipated to be adequately calibrated for use in this planning project.
- b. Scenarios were run with the storage tanks at 90% capacity, with the Kennington Well Pump on and the McCauley Park Well Pump off.
- c. Proposed pipes throughout the future developments are assumed to be PVC with Hazen-Williams friction coefficients of 130.
- d. The hydraulic model, as received from the County's consultant, is assumed to be adequately calibrated for use in this evaluation.
- e. Existing pipe sizes that differed in the model from that which was depicted in the County's GIS system were changed to reflect the GIS data.
- f. Elevations within the existing model are assumed to be accurate.
- g. Areas in the GWWP application anticipated to be connected by 2020 were moved to the 2025 scenario after confirmation from the county that they do not yet exist. All other areas in the GWWP application anticipated to be connected by 2020 were assumed to be existing

2. Model Setup

The existing water model for the water system was compared with the County GIS data for accuracy. However, the most recent additions to the water main infrastructure in the GIS were from May 2019. The model was updated to a "base" with assumed existing 2020 infrastructure based on the County GIS data and using the demands identified in the GWWP application. Certain subdivisions identified in the GWWP application to be in place or under construction in 2020 were moved to a later time horizon at discretion from the county.

From the base 2020 scenario, additional scenarios were created for the future planning years, each of which model the demands anticipated by that milestone year. Each planning year models the infrastructure required to accommodate development capacity to meet demands up to and including that year. For example, the 2025 Milestone scenario includes the projected 2025 demands and the infrastructure to meet 2025 conditions. Each planning milestone year was modeled with the PHD and MDD plus Fire Flows.

Subdivisions identified in the GWWP application that are expected to be complete or beginning development by 2020 were incorporated into the model by assigning one or multiple nodes to the subdivision and assigning the average day water demand to the subdivision node based on the number of connections anticipated in the GWWP application. Some subdivisions were already incorporated into the existing water model and contained multiple nodes. The total demands across all the nodes in those areas were set to equal the expected demand for that subdivision. Subdivisions not in the existing model were added and all demands were assigned to a single node.

For each future milestone year scenario, the demands at the subdivisions were updated based on the Water Demand Projection model by Cardno to match the projected average day demands given in Table III-1 for the whole water system. For the Milestone Year 2040 scenarios, which anticipates demands and infrastructure to 2040, the nodes in the model were assigned demands up to the year 2035 which was the last year of the Cardno Water Demand Projection model. Then, the difference between the 2040 linear regression demand projection and the 2035 Cardno demand projection was split evenly across the subdivision nodes in the model.

For the Peak Hour Demand Scenario for each milestone year, the model calculation applied the 2.5 PHD peaking factor to all nodes within the model to get the total PHD expected from the water system for each year, as shown in Table III-1. For the Max Day plus Fire Flow scenario for each milestone year, the

model calculation applied the 2.09 MDD peaking factor to all the nodes within the model. This gave the entire water system the expected MDD for each year in accordance with Table III-1. The MDD + Fire Flow scenario was also modeled with a maximum pipe velocity of 10 feet per second and minimum fire flow requirements of 1,000 gpm for residential areas, and 2,500 gpm for areas zoned for multi-residential, commercial, or industrial use.

Adjustments to the timeline of anticipated development within the system was made following consultation with the county. The Fontainebleau Industrial Park was identified as a possible connection to the Central Garage system by the 2025 Milestone year scenario and was modeled in the 2030 and 2040 Milestone Year scenarios as well. Therefore, demands for each Milestone Year Scenario used in the model are as identified previously in Table III-1 with the addition of average day demands at the Fontainebleau Industrial Park of 4.54 gpm in 2025, 8.8 gpm in 2030, and 17 gpm in 2040.

Extension of the water main north along US Route 360 to Aylett was modeled in the 2030 Milestone year. The connection to King William Commerce Park, anticipated in Cardno Inc.'s growth projection to begin by 2020, was moved to the Milestone year 2040.

3. Modeling Results

2020 Base Scenario

a. Peak Hourly Flow

The velocities in the pipes do not exceed 3 fps during the PHD scenario. Pressures vary throughout the existing system and range from 57 psi to 117 psi. Areas of high pressure are attributed to the change in elevation, as the existing storage tank sits at grade elevation of approximately 170.5 ft with a hydraulic grade line (HGL) of approximately 314 ft. The areas surrounding the Central Garage system drop in elevation, particularly

along the US Route 360 corridor, with some areas as low as 55 ft in elevation.

There are two main areas where the pressures in the system exceed 100 psi: in the northern most part of the system near the Kennington Carriage and Townhomes and an area of future commercial development, and to the south of the system in the Marle Hill neighborhood. A pressure reducing valve (PRV) may be necessary in these locations to reduce pressures in the pipes.

b. Max Day + Fire Flow

With a 10 fps maximum velocity, any location in the system with 6-inch piping or smaller does not achieve the minimum 1,000 gpm fire flow. Residential areas require piping with minimum of 8-inch diameters to achieve 1,000 gpm. Commercial areas in the system require minimum 12-inch pipe diameter to achieve the desired fire flow of 2,500 gpm.

The results of the MDD + Fire Flow analysis were also compared to locations of existing fire hydrants in the system as indicated in the GIS. In the 2020 base scenario, the McCauley Park Section I residential area indicates several locations with hydrants that do not provide the 1,000 gpm fire flow due to 6-inch piping. Two commercial areas, the Central Garage Commercial and the Tractor Supply areas, also indicate locations where hydrants do not provide the 2,500 gpm fire flow.

The fire flow report and map are included in Appendix C.

2025 Milestone Year Scenario

Water lines identified as undersized in the existing base scenario were upsized to achieve the minimum required fire flow, and therefore were used in the 2025

scenarios. The 600,000-gallon tank was modeled at the Kelley Lane site option, identified in Section IV-C.

The option to connect to the Fontainebleau Industrial Park by extension of a 12-inch water main was modeled east on Route 30 from the new tank and followed Dunluce Road south to the Fontainebleau Industrial Park site. A loop to the Fontainebleau Industrial Park was closed by extending a 12-inch main from the park to US Route 360 along Jack Pen Lane.

a. Peak Hourly Flow

Pressures throughout the system ranged from 57 to 117 psi, with a maximum pipe velocity of 3 fps. The map of proposed infrastructure and peak hour pressures is included in Appendix D.

b. Max Day + Fire Flow

Initially, required fire flows were met everywhere except the Fontainebleau Industrial Park. With the completion of the loop from the park to US Route 360 along Jack Pen Road, the required 2,500 gpm fire flow was met. The closing of this loop to the Fontainebleau Industrial Park is required to meet the fire flow criteria. The fire flow report and map are included in Appendix D.

2030 Milestone Year Scenario

A 12-inch water main is extended north on US Route 360 to Aylett for the 2030 Scenario, but no demands were assigned to the area. The water main extension to Aylett was sized for commercial fire flow requirements.

a. Peak Hourly Flow

The pressures throughout the system ranged from 57 psi to 120 psi, with maximum pipe velocity up to 3 fps. The model outputs and pressure map are located in Appendix E.

b. Max Day + Fire Flow

The required fire flows were achieved at each residential and commercial location. The fire flow report and map are included in Appendix E.

2040 Milestone Year Scenario

In the 2040 scenario, the 12-inch main line on US Route 360 was extended to the south to connect to the King William Commerce Park. A water line loop was completed to the Commerce Park from Rte. 360 along Old Newcastle Rd. in order to meet the commercial fire flow requirement.

a. Peak Hourly Flow

The pressures throughout the system ranged from 57 psi to 120 psi, with maximum pipe velocity up to 3 fps. The model outputs and pressure map are located in Appendix F.

b. Max Day + Fire Flow

The required fire flows were achieved at each residential and commercial location. The fire flow report and map are included in Appendix F.

E. Recommendations and Proposed Projects

Improvements to the water system, necessary to meet the requirements of the system, are identified by milestone year and include cost estimates for each improvement. The map of overall system upgrades and the proposed projects is included in Appendix G.

1. 2025 Milestone Year Projects

The 2025 Milestone year identifies three main projects intended to be completed and in place by the year 2025 in order to support demand up to that point:

- (1) construction of the new 600,000-gallon storage tank at the Kelley Lane location,
- (2) several water main upsizing projects to meet fire flow requirements, and

(3) extension of the transmission main at the State Rte. 30 and US Rte. 360 intersection to close a loop.

A 600,000-gallon tank will be needed by 2025 to meet both domestic and fire flow storage requirements. The 600,000-gallons will accommodate the projected domestic and fire flow storage volumes through the year 2040. The Kelley Lane location adjacent to State Route 30, east of the Route 30 and US Route 360 intersection, is the recommended location for the tank. In addition to the tank, the 12-inch water main will need to be extended approximately 3,500 feet.

The existing distribution system contains a few areas that do not meet the fire flow requirements in both residential and commercial zones. These areas primarily include McCauley Park Section I, the Central Garage Commercial area, the apartment complex across Rte. 30 from Central Crossing, the Tractor Supply commercial area, and the section on Rte. 360 where the existing transmission main ends as an 8-inch pipe. Segments of the water mains in these locations require upsizing to meet fire flow at the existing hydrants.

Cost estimates for the main 2025 Milestone Year projects are given below. Cost estimates for the three alternative tank locations are included in Appendix H. Contingencies of 20% cover miscellaneous costs, including any boring under US Route 360.

Project 2025-1: New 600,000 gallon tank on Kelley Lane					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	600,000 gallon Elevated Storage Tank and Controls	LS	1	\$3,100,000	\$ 3,100,000
2	Extention of the 12-inch water main	LF	3,500	\$ 180	\$ 630,000
	Construction Cost - Subtotal				\$ 3,730,000
	Contingency (20%)				\$ 746,000
	Construction Cost				\$ 4,476,000
	Construction Phase Services (10%)				\$ 447,600
	Engineering & Survey Cost (15%)				\$ 671,400
	Project 2025-1 Total				\$ 5,595,000
Project 2025-2: Water Main Upsizing to Meet Fireflow Requirements.					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	Tractor Supply Co. [X] - Upsize to 12-inch	LF	680	\$ 180	\$ 122,400
2	Central Garage Commercial [Q] - Upsize to 12-inch	LF	1,900	\$ 180	\$ 342,000
3	Rte. 360 Transmission Main - Upsize to 12-inch	LF	150	\$ 180	\$ 27,000
4	McCauley Park Section 1 [E]- Upsize to 8-inch	LF	1,120	\$ 120	\$ 134,400
5	Central Garage Commercial [Q] - Upsize to 8-inch	LF	150	\$ 120	\$ 18,000
	Construction Cost - Subtotal				\$ 643,800
	Contingency (20%)				\$ 128,760
	Construction Cost				\$ 772,560
	Engineering & Survey Cost (15%)				\$ 115,884
	Construction Phase Services (10%)				\$ 77,256
	Land and Easement Aquisition (5%)				\$ 38,628
	Project 2025-2 Total				\$ 1,004,328
Project 2025-3: Water Main Loop Closure					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	New 12-inch main at Rte. 30 and Rte. 360 Intersection	LF	600	\$ 180	\$ 108,000
	Construction Cost - Subtotal				\$ 108,000
	Contingency (20%)				\$ 21,600
	Construction Cost				\$ 129,600
	Construction Phase Services (10%)				\$ 12,960
	Engineering & Survey Cost (15%)				\$ 19,440
	Project 2025-3 Total				\$ 162,000

The approximate total cost of the three leading 2025 milestone projects is \$ 6,761,328.

Alternative 2025 Project

An alternative project was identified which would involve the County providing water service to the Fontainebleau Industrial Park. Providing service by constructing a connection of the Fontainebleau Park to the Central Garage system was the primary option considered and was evaluated in the model.

Monthly groundwater withdrawal data from the County-owned well at the Industrial Park for 2017 to 2019 was available for evaluation. Over this time span, the Average Day Demand supplied by the County-owned Industrial Park well is 4.54 gpm. It is understood by the County that the industrial park anticipates potential water demand growth to nine million gallons per year, or approximately 17 gpm, by 2040. Table IV-# gives water demands of the Central Garage System for each planning year with the addition of the Fontainebleau Industrial Park.

Table IV-2: Future Central Garage System Demand Projections with connection to the Fontainebleau Industrial Park

Year	ADD (gpd)	MMD (gpd)	MDD		PHD
			(gpd)	(gpm)	(gpm)
2025	265,868	403,763	555,664	386	462
2030	374,425	568,624	782,549	543	650
2040	557,478	846,618	1,165,128	809	968

With a 2040 peak hour demand of 968 gpm, the system will exceed the capacity of the existing well pumps prior to 2040. The proposed well capacity evaluation discussed in Section IV-B is still recommended.

Based on the MDD values of the system, one half of a MDD plus the fire flow storage of 2,500 gpm for two hours is approximately 882,564 gallons. Therefore, even with the addition of the Fontainebleau Industrial Park, the new 600,000-gallon elevated storage tank proposed in Section IV-C in addition to the existing 300,000-gallon tank will provide sufficient storage for the system.

From the location of the 600,000-gallon storage tank, construction of a water main extension east along State Route 30 then south on Dunluce Road was evaluated. The alternative also included closing from the Fontainebleau Industrial Park back to the west along Jack Pen Lane with a connection to the existing main on Route 360. This loop will enable the system to meet a commercial fire flow requirement of 2,500 gpm.

The second option for supplying water to the Fontainebleau Industrial Park without connection to the Central Garage system consists of constructing a separate, dedicated fire storage tank and a new groundwater well at the Industrial Park. The dedicated fire storage tank could be either an elevated or ground tank; the ground level tank was used in the cost estimate as the more economically feasible choice. This option would also require a new fire booster pump and a new hydropneumatic tank for domestic flow storage. Further analysis of the effectiveness of this alternative was not evaluated in this Master Plan and will need to be conducted separately.

Cost estimates for the alternative Fontainebleau Industrial Park project are given below. Contingencies of 20% cover miscellaneous costs, including any boring under US Route 360.

Project 2025-4a: Fontainebleau Industrial Park OPTION 1 - Water Main Extension					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	12-inch extension east on Rte 30	LF	12,100	\$ 180	\$ 2,178,000
2	12-inch extension on Jack Pen Lane to complete loop	LF	8,000	\$ 180	\$ 1,440,000
Construction Cost - Subtotal					\$ 3,618,000
Contingency (20%)					\$ 723,600
Construction Cost					\$ 4,341,600
Engineering & Survey Cost (15%)					\$ 651,240
Construction Phase Services (10%)					\$ 434,160
Land and Easement Acquisition (5%)					\$ 217,080
Project 2025-4a Total					\$ 5,644,080

Project 2025-4b: Fontainebleau Industrial Park OPTION 2 - New Well and Storage Tank					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	300,000-gal Ground Water Storage Tank	LS	1	\$ 500,000	\$ 500,000
2	New Fire Pump, Enclosure, & Controls	LS	1	\$ 150,000	\$ 150,000
3	Pump House Building & Hydro Tank	LS	1	\$ 150,000	\$ 150,000
4	New Groundwater Well & Controls	LS	1	\$ 100,000	\$ 100,000
Construction Cost - Subtotal					\$ 900,000
Contingency (20%)					\$ 180,000
Construction Cost					\$ 1,080,000
Engineering & Survey Cost (15%)					\$ 162,000
Construction Phase Services (10%)					\$ 108,000
Land and Easement Acquisition (5%)					\$ 54,000
New Groundwater Well Permitting (Lump Sum)					\$ 50,000
Project 2025-4b Total					\$ 1,454,000

2. 2030 Milestone Year Projects

The 2030 Milestone year includes a 12-inch water line to Aylett, extended from where the existing main ends on US Route 360. The extension to Aylett was added with no demands assigned to the area, and the resulting pressure was 120 psi. A pressure reducing valve will be required. Due to the low elevation of the area, Aylett is not an ideal location for an additional elevated storage tank in the system unless a lower pressure zone is established. The impact of demands in this area on the Central Garage system was not evaluated in this Master Plan.

Based on the source capacity evaluation in Section IV-B, the supply wells for the Central Garage Water System are anticipated to fall below the Peak Hour Demand of the system by 2036. An in depth well yield evaluation by a licensed hydrogeologist and upgrades to the existing wells and well pumps, based on the evaluation, is recommended. This well evaluation and potential upgrade is included in the 2030 Milestone Year CIP.

Cost estimates for the 2030 Milestone Year projects are given below. Contingencies of 20% cover miscellaneous costs, such as boring under US Route 360.

Project 2030-1: Watermain Extension					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	Aylett - 12-inch extension north on US Rte 360	LF	7,700	\$ 180	\$ 1,386,000
2	Aylett - Pressure Reducing Station	LS	1	\$ 50,000	\$ 50,000
Construction Cost - Subtotal					\$ 1,436,000
Contingency (20%)					\$ 287,200
Construction Cost					\$ 1,723,200
Engineering & Survey Cost (15%)					\$ 258,480
Construction Phase Services (10%)					\$ 172,320
Land and Easement Equisition (5%)					\$ 86,160
Project 2030-1 Total					\$ 2,240,160

Project 2030-2: Well Evaluation					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	Existing Well Evaluation, Engineering, and Upgrades	LS	2	\$ 50,000.00	\$ 100,000
Project 2030-2 Total					\$ 100,000

The approximate total cost of the two 2030 milestone project is \$ 2,340,160.

An extension of a 12-inch water line to Aylett was identified as a 2030 Milestone Year project at the direction of the County. However, this project can be development driven and is not hydraulically dependent on any future projects. The 2030 and 2040 Milestone Year projects are independent of each other and can move forward interchangeably.

3. 2040 Milestone Year Projects

The 2040 Milestone year identifies one main project to be completed by 2040, the addition of the King William Commerce Park to the Central Garage System. Connection to the King William Commerce Park includes the extension of a 12-inch water main down US Route 360 to the King William Commerce Park and the extension of a 12-inch water main down Old Newcastle Road, to complete a loop around the commerce park and to meet the fire flow requirement of 2,500 gpm.

Cost estimates for the 2040 Milestone Year projects are given below. Contingencies of 20% cover miscellaneous costs, such as boring under US Route 360.

Project 2040-1: Watermain Extension					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	King William Commerce Park [W] - 12-inch extension south on US Rte 360	LF	11,800	\$ 180	\$ 2,124,000
2	King William Commerce Park [W] - loop 12-inch main down Old Newcastle Rd	LF	5,200	\$ 180	\$ 936,000
Construction Cost - Subtotal					\$ 3,060,000
Contingency (20%)					\$ 612,000
Construction Cost					\$ 3,672,000
Engineering & Survey Cost (15%)					\$ 550,800
Construction Phase Services (10%)					\$ 367,200
Land and Easement Equisition (5%)					\$ 183,600
Project 2040-1 Total					\$ 4,773,600

The approximate total cost of the 2040 milestone project is \$ 4,773,600.

An extension of a 12-inch water line to the King William Commerce Park was identified by the County as a lower priority project with less expected development. However, this project can be development driven and is not hydraulically dependent on any 2030 Milestone Year projects. The 2030 and 2040 Milestone Year projects are independent of each other and can move forward interchangeably as development needs arise.

4. Funding Assistance Options

Several program options exist for assistance with financing capital improvement projects.

The United States Department of Agriculture (USDA) Rural Business Development Grant (RBDG) Program offers competitive funding for expansion and development of water systems in support of businesses in rural areas. Funding is offered for low to mid-range incomes in the form of grants or low interest loans where the financing rates are based on the Median Household Income. The following link provides more information on the program:

<https://www.rd.usda.gov/programs-services/rural-business-development-grants>

The Department of Housing and Community Development (DHCD) has a loan program for providing funding (grants and low interest loans) for improvements to distressed residences and businesses in areas deemed poverty level. The DHCD's Community Development Block Grants (CDBG) Program includes a CDBG Construction-Ready Water and Sewer Fund and CDBG Planning Grants. The following links provide more information on these two funding opportunities:

(1) <https://www.dhcd.virginia.gov/cdbg-construction-ready-water-and-sewer-fund>

(2) <https://www.dhcd.virginia.gov/cdbg-planning-grants>

The VDH also offers various grants and low interest loans intended for helping smaller, rural communities with their water system upgrades. Applications for both Planning and Design Grants and for Construction may be submitted year-round. Grants up to \$35,000 are available for Planning and Design purposes and the applications are reviewed and offers may be made upon evaluation and scoring. For construction funding, grants may be a portion of the overall construction funding package, if applicable, and based on the Median Household Income etc. The VDH conducts one round of evaluations annually for construction

funding submitted by an advertised deadline. Normally, the deadlines for applying for a given year's funding has been April for Construction funding and September for Planning and Design Grants. The following link provides more information on the program:

<https://www.vdh.virginia.gov/drinking-water/dwsrf/>

Appendix A
Cardno Water Demand Projection

**Table 2
Water Demand Projections, Central Garage PWS GWWP Renewal Application 2019**

Subdivision / Area	Label	Use Type / Zoning	Current Status	Total Lots	Current Connections (as of Nov. 2018)	Projected New Connections (Annual Sales)																Total Connections by 2035	
						2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033		2034
McCauley Park Future Multi-Family Apts & Comm.	A	Residential	Pending	108	0			36	24	24	24												108
McCauley Park Future Commercial	B	Commercial	Pending	16	0			2	2	2	2	2	2	2	2								16
McCauley Park Section III (existing)	C	Residential	In Progress	76	68		8																76
McCauley Park Future Section II	D	Residential	Pending	77	0			18	18	18	18	5											77
McCauley Park Section I (existing)	E	Residential	Complete	94	94																		94
Central Crossing Section 1	F	Residential	In Progress	50	50																		50
Central Crossing II(A)	G	N/A - see notes to right		A conservation easement has been executed, and this area will not be developed.																			
Central Crossing Future Section (IIB)	H	Residential	Pending	115	0			15	18	18	18	18	18	10									115
Kennington Section 1 (existing)	J	Residential	In Progress	65	60		3	2															65
Kennington Carriage Homes (Future)	K	Residential	Pending	79	0		9	18	18	18	16												79
Kennington Future Residential Development	L	Residential	Pending	159	0			18	18	18	18	18	18	18	18	15							159
Marle Hill	M	Residential	Complete	55	55																		55
West Liberty Farms	N	Residential	In Progress	21	10		5	5	1														21
Kennington Carriage & Townhomes	O	Residential	In Progress	172	109		18	18	18	9													172
Kennington Commercial (Future)	P	Commercial	Pending	11	0			5	6														11
Central Garage Commercial	Q	Commercial	In Progress	38	28		2	3	3	2													38
Newcomb Area (Poss. Future Connection to PWS)	R	Residential	Pending	96	0			6	5	10	15	15	15	15	15								96
Possible Future Commercial Development	S	Commercial	Pending	20	0			5	5	3	3	2	2										20
Possible Future Development to Connect to PWS	T	Residential	Pending	382	0				5	10	15	20	25	25	35	35	40	40	45	45	40	2	382
		Commercial		56	0			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Poss. Central Garage Future Development	U	Residential	Pending	178	0				5	5	5	10	10	10	10	15	15	15	20	20	20	18	178
Future Residential Development (Local Homebuilder)	V	Residential	Pending	285	0					15	15	15	20	20	20	25	25	25	25	20	20	20	285
King William Commerce Park (Future Connection)	W	Commercial	In Progress	48	20			2	3	3	5	5	3	3	2	2							48
Poss. Future Commercial (Tractor Supply)	X	Commercial	Pending	5	0			2	2	1													5
Poss. Future Residential (Local Builder)	Y	Residential	Pending	262	0			5	10	15	15	20	20	25	25	30	30	25	25	15	2		262

TOTAL RESIDENTIAL CONNECTIONS	446	446	489	630	760	915	1,069	1,180	1,301	1,424	1,537	1,652	1,757	1,862	1,967	2,067	2,154	2,234	2,274	2,274
TOTAL COMMERCIAL CONNECTIONS	48	48	50	69	90	105	119	132	143	152	160	166	170	174	178	182	186	190	194	194
PROJECTED DAILY AVERAGE RESIDENTIAL WATER USAGE (GPD)	80,280	80,280	88,020	113,400	136,800	164,700	192,420	212,400	234,180	256,320	276,660	297,360	316,260	335,160	354,060	372,060	387,720	402,120	409,320	409,320
PROJECTED DAILY AVERAGE COMMERCIAL WATER USAGE (GPD)	2,400	2,400	2,500	3,450	4,500	5,250	5,950	6,600	7,150	7,600	8,000	8,300	8,500	8,700	8,900	9,100	9,300	9,500	9,700	9,700
PROJECTED ANNUAL AVERAGE RESIDENTIAL WATER USAGE (GPY)	29,322,270	29,322,270	32,149,305	41,419,350	49,966,200	60,156,675	70,281,405	77,579,100	85,534,245	93,620,880	101,050,065	108,610,740	115,513,965	122,417,190	129,320,415	135,894,915	141,614,730	146,874,330	149,504,130	149,504,130
PROJECTED ANNUAL AVERAGE COMMERCIAL WATER USAGE (GPY)	876,600	876,600	913,125	1,260,113	1,643,625	1,917,563	2,173,238	2,410,650	2,611,538	2,775,900	2,922,000	3,031,575	3,104,625	3,177,675	3,250,725	3,323,775	3,396,825	3,469,875	3,542,925	3,542,925
PROJECTED ANNUAL AVERAGE TOTAL WATER USAGE (GPY)	30,198,870	30,198,870	33,062,430	42,679,463	51,609,825	62,074,238	72,454,643	79,989,750	88,145,783	96,396,780	103,972,065	111,642,315	118,618,590	125,594,865	132,571,140	139,218,690	145,011,555	150,344,205	153,047,055	153,047,055

Est. Average Residential Use	180	gpd / connection	Avg. residential & commercial usage per connection based on 2015-2018 data provided by King William Co.
Est. Average Commercial Use	50	gpd / connection	

Model Comparison to Actual Usage											
2016 actual, gal	24,112,300	2017 actual, gal	31,992,900	2016-2017 actual avg., gal	28,052,600	2018 model, gal	30,198,870	diff. (model - actual), gal	2,146,270	diff (model - actual), %	7%

The figure above highlighted in yellow is used as the basis for the requested annual withdrawal amount in the GWWP renewal application

Status notes:	
PENDING	Construction has not commenced.
COMPLETE	All construction completed
IN PROGRESS	Construction is underway / currently occurring

NOTE: DATA AND INFORMATION ON THIS TABLE CURRENT AS OF NOVEMBER 2018
AREAS K & L WILL BEGIN CONSTRUCTION IN JANUARY 2019
FOR COMMERCIAL SUBDIVISIONS PENDING OR IN PROGRESS, A DENSITY OF 1.8 ACRES PER LOT WAS USED TO ESTIMATE THE # OF LOTS
FOR RESIDENTIAL SUBDIVISIONS PENDING, A DENSITY OF 0.344 ACRES PER LOT WAS USED TO ESTIMATE THE NUMBER OF LOTS

Abbreviations	
gpd	gallons per day
gpy	gallons per year
apts	apartments
comm	commercial

Volume Requested in GWWP Application (gallons per year)
154,000,000



LEGEND

 Central Garage PWS Service Areas

Subdivisions / Areas

-  McCauley Park Future Multi-Family Apts & Comm. [A]
-  McCauley Park Future Commercial [B]
-  McCauley Park Section III (existing) [C]
-  McCauley Park Future Section II [D]
-  McCauley Park Section I (existing) [E]
-  Central Crossing Section 1 [F]
-  Central Crossing II [G]
-  Central Crossing Future Section [H]
-  Kennington Subdivision [I]
-  Kennington Section 1 [J]
-  Kennington Carriage Homes (Future) [K]
-  Kennington Future Residential Development [L]
-  Marle Hill [M]
-  Kennington Carriage and Townhomes [O]
-  West Liberty Farms [N]
-  Kennington Commercial (Future) [P]
-  Central Garage Commercial [Q]
-  Newcomb Area (Poss. Future Connection to PWS) [R]
-  Possible Future Commercial Development [S]
-  Possible Future Development to Connect to PWS [T]
-  Poss. Central Garage Future Development [U]
-  Future Residential Development (Local Homebuilder) [V]
-  King William Commerce Park (Future Connection) [W]
-  Poss. Future Commercial (Tractor Supply) [X]
-  Poss. Future Residential (Local Builder) [Y]
-  Tax Parcels (County GIS)

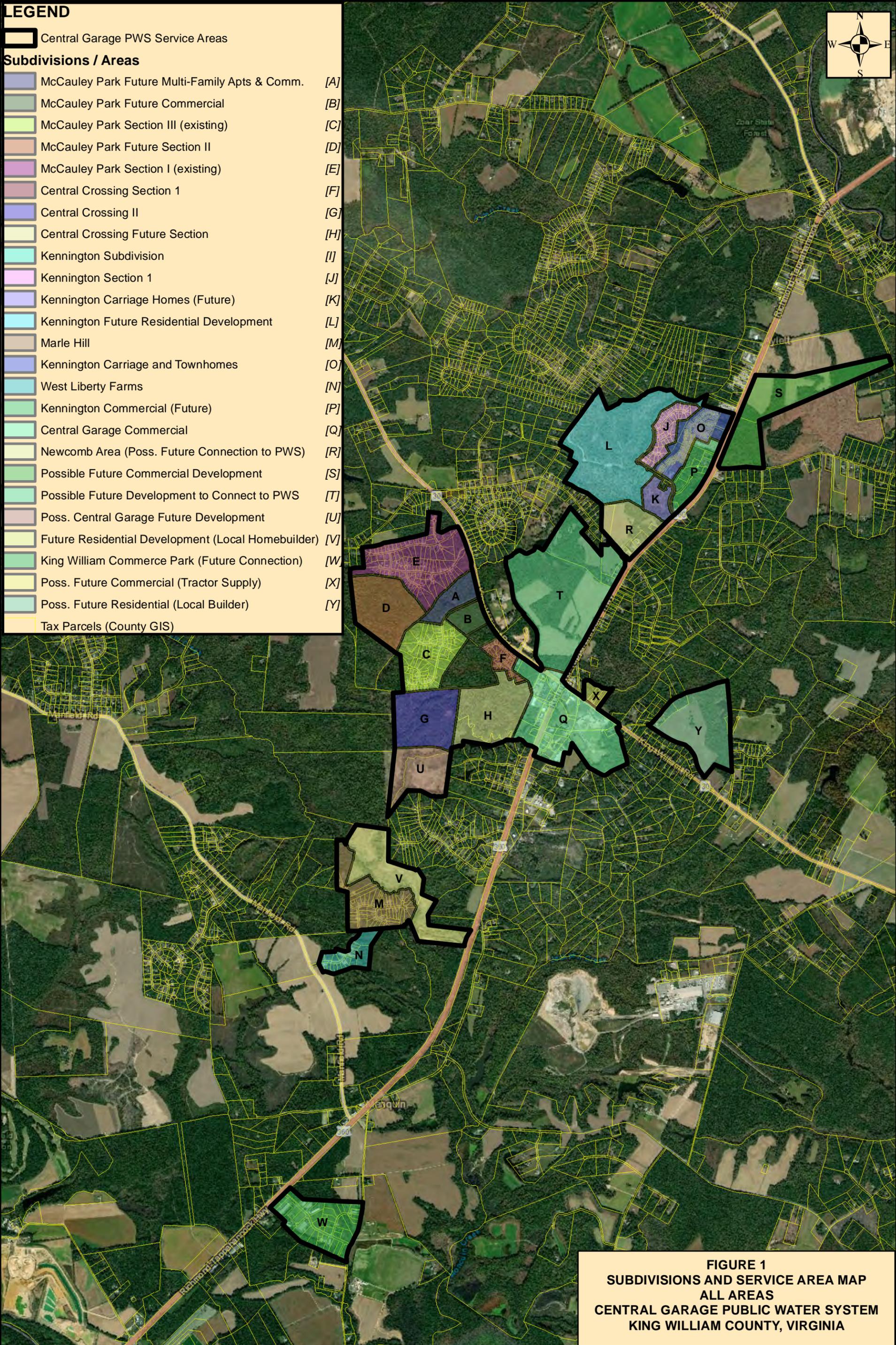


FIGURE 1
SUBDIVISIONS AND SERVICE AREA MAP
ALL AREAS
CENTRAL GARAGE PUBLIC WATER SYSTEM
KING WILLIAM COUNTY, VIRGINIA

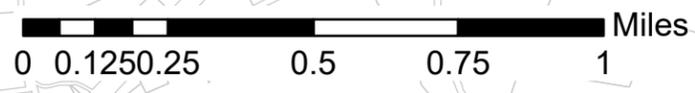


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 CNES/Airbus DS, USDA, USGS, Aero



Appendix B
Existing and Proposed Tank Location Options

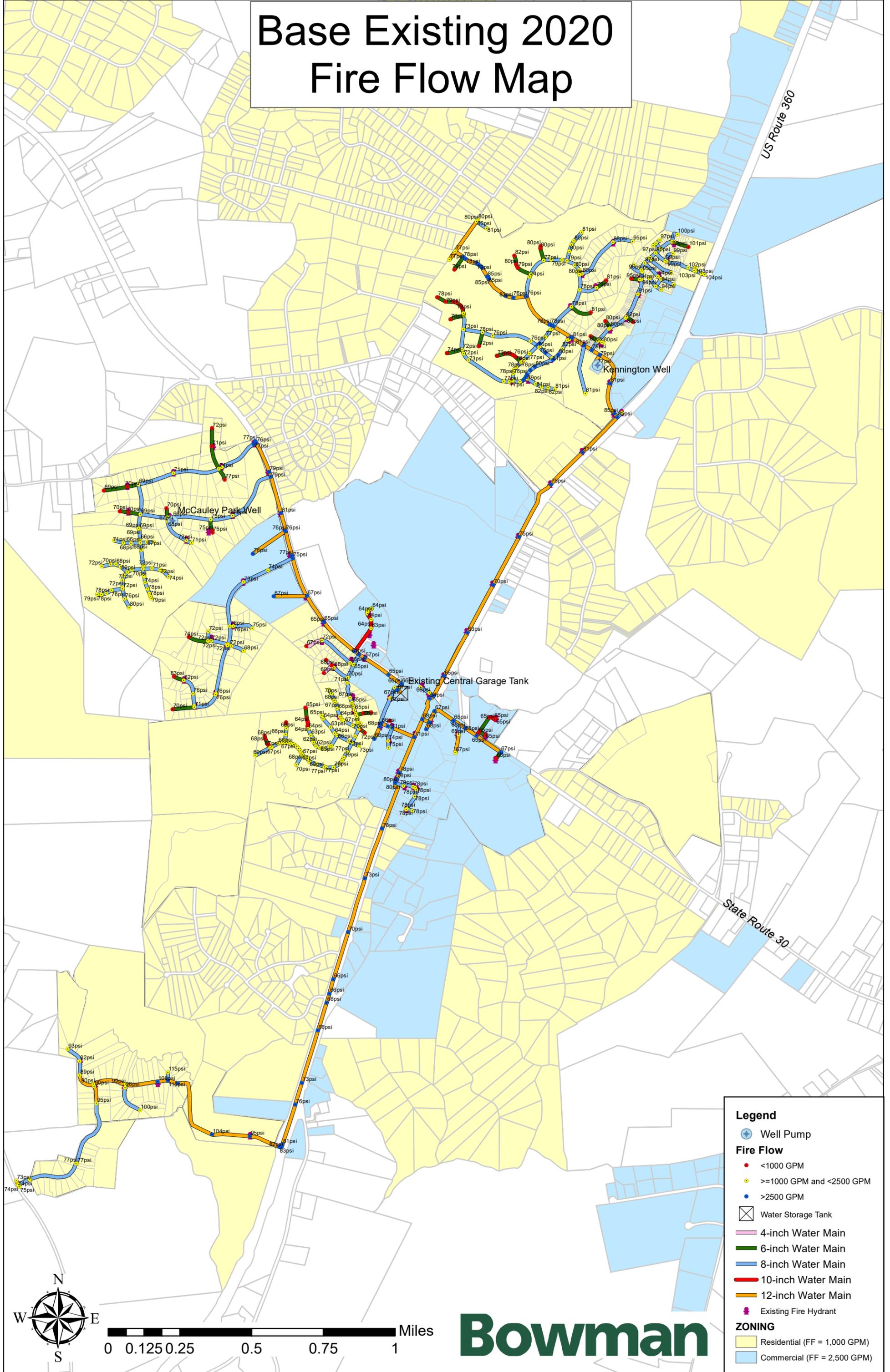
Existing and Proposed Tank Location Options



Legend	
	Well Pump
	Existing Central Garage Tank
	Proposed Tank Locations
	12-inch Proposed Pipe
	12-inch Developer Project
	Existing Pipe

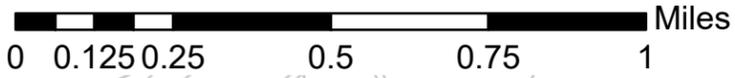
Appendix C
2020 Base Model Results

Base Existing 2020 Fire Flow Map



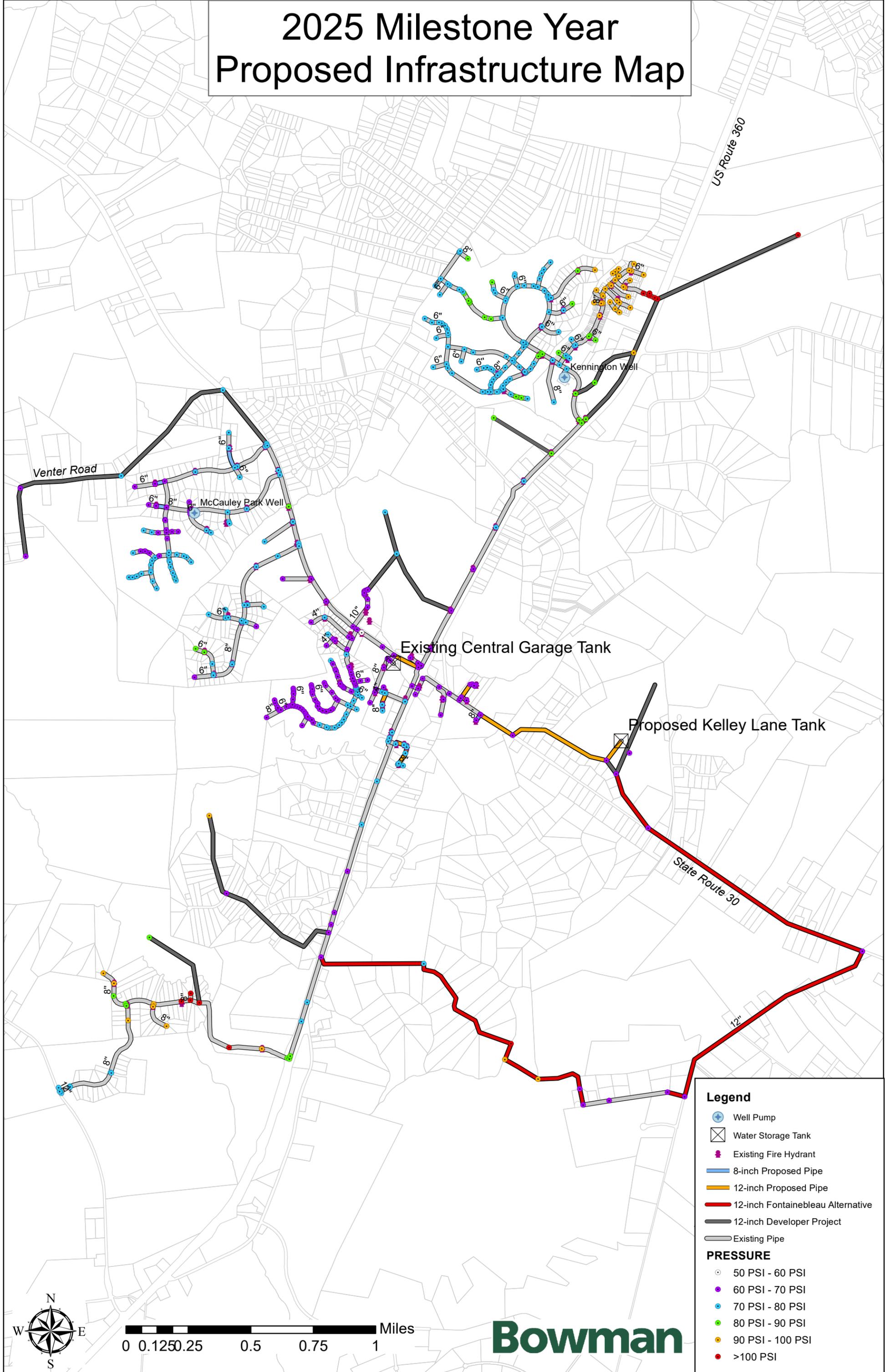
Legend

- Well Pump
- Fire Flow**
- <1000 GPM
- >=1000 GPM and <2500 GPM
- >2500 GPM
- Water Storage Tank
- 4-inch Water Main
- 6-inch Water Main
- 8-inch Water Main
- 10-inch Water Main
- 12-inch Water Main
- Existing Fire Hydrant
- ZONING**
- Residential (FF = 1,000 GPM)
- Commercial (FF = 2,500 GPM)



Appendix D
2025 Milestone Year Model Results

2025 Milestone Year Proposed Infrastructure Map



US Route 360

Kennington Well

Venter Road

McCauley Park Well

Existing Central Garage Tank

Proposed Kelley Lane Tank

State Route 30

Legend

- Well Pump
- Water Storage Tank
- Existing Fire Hydrant
- 8-inch Proposed Pipe
- 12-inch Proposed Pipe
- 12-inch Fontainebleau Alternative
- 12-inch Developer Project
- Existing Pipe

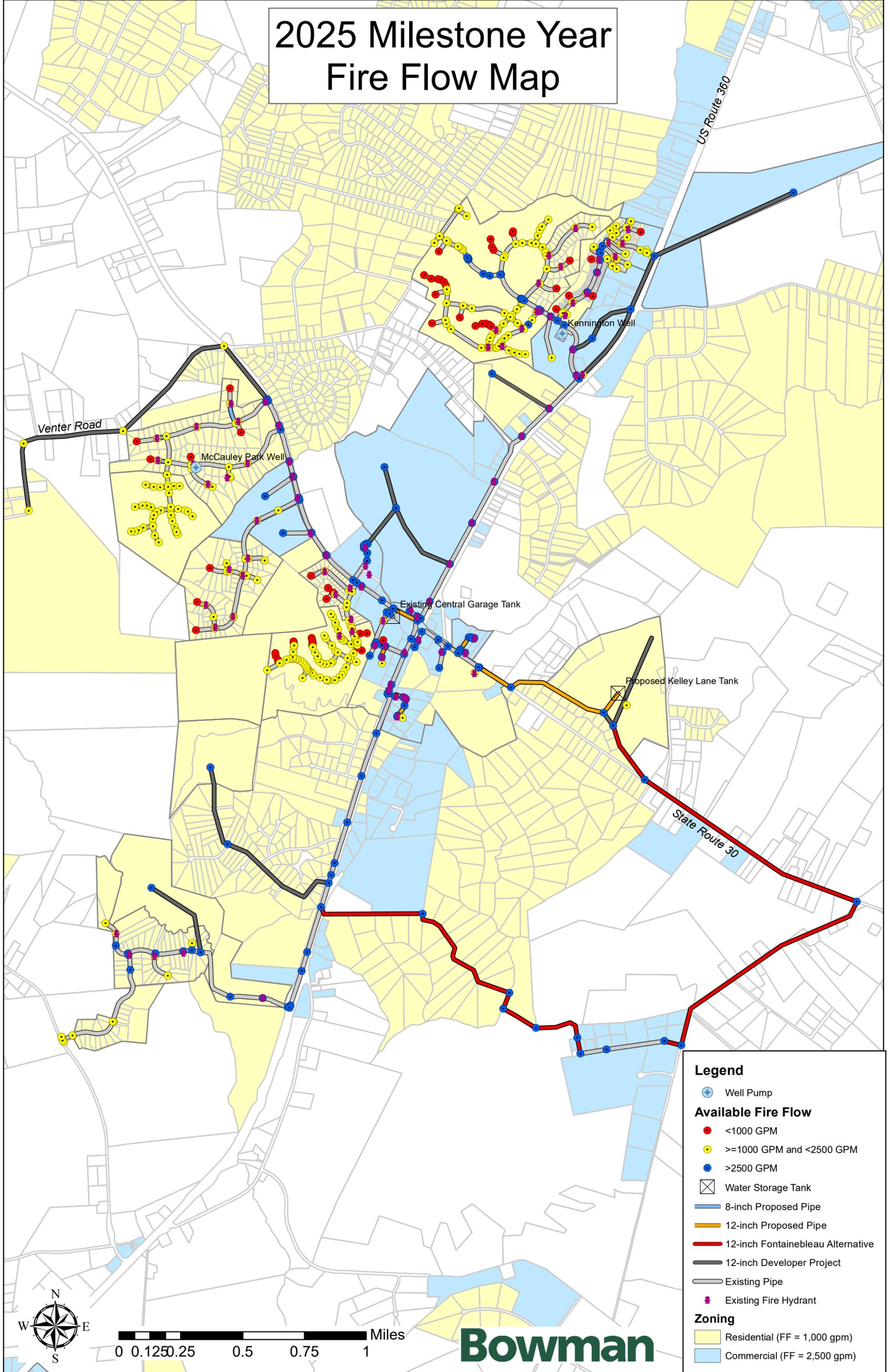
PRESSURE

- 50 PSI - 60 PSI
- 60 PSI - 70 PSI
- 70 PSI - 80 PSI
- 80 PSI - 90 PSI
- 90 PSI - 100 PSI
- >100 PSI



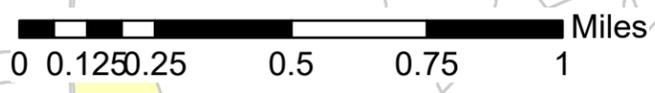
Bowman

2025 Milestone Year Fire Flow Map



Legend

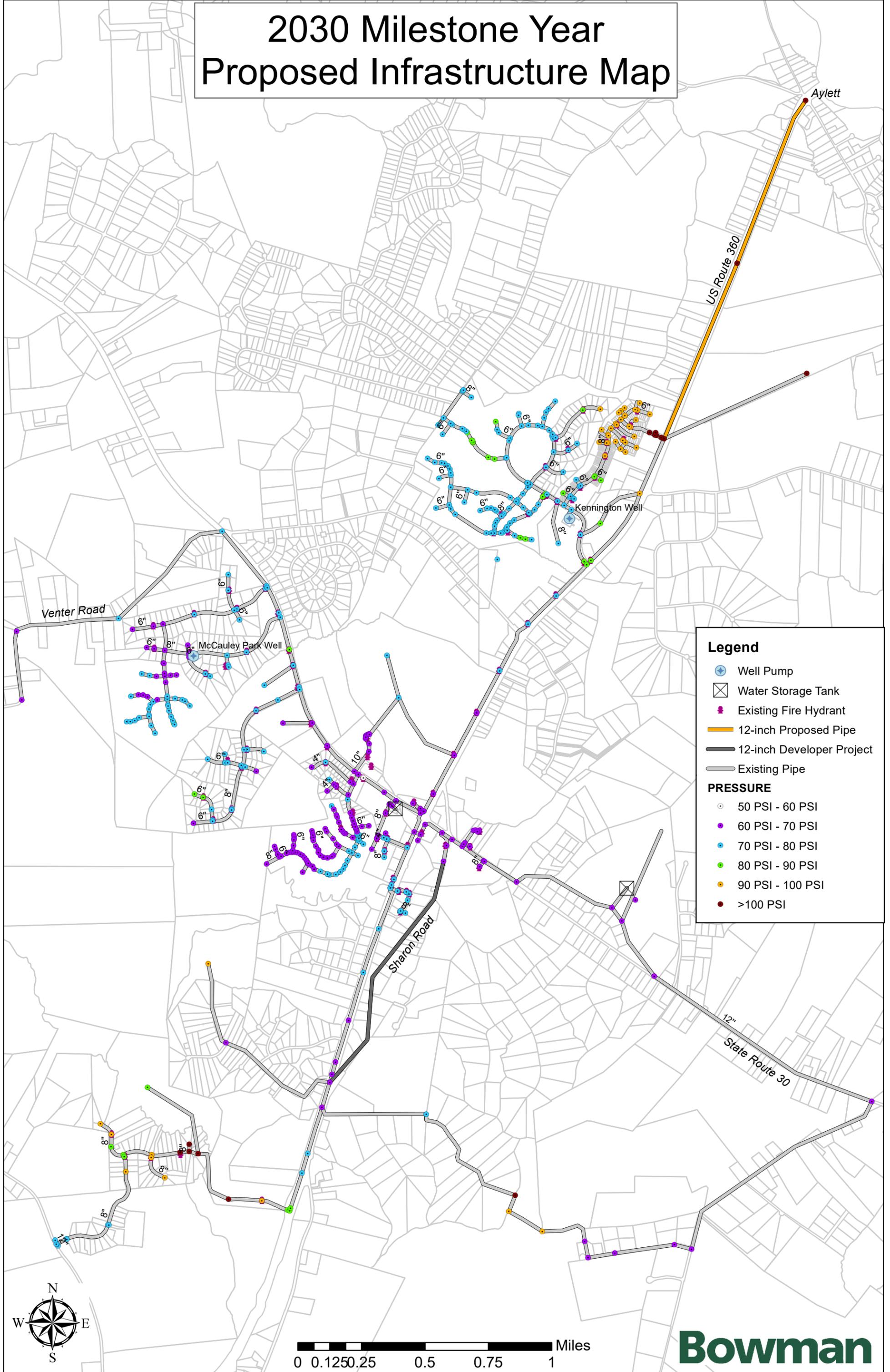
- Well Pump
- Available Fire Flow**
- <1000 GPM
- >=1000 GPM and <2500 GPM
- >2500 GPM
- Water Storage Tank
- 8-inch Proposed Pipe
- 12-inch Proposed Pipe
- 12-inch Fontainebleau Alternative
- 12-inch Developer Project
- Existing Pipe
- Existing Fire Hydrant
- Zoning**
- Residential (FF = 1,000 gpm)
- Commercial (FF = 2,500 gpm)



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Appendix E
2030 Milestone Year Model Results

2030 Milestone Year Proposed Infrastructure Map

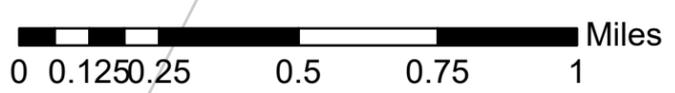


Legend

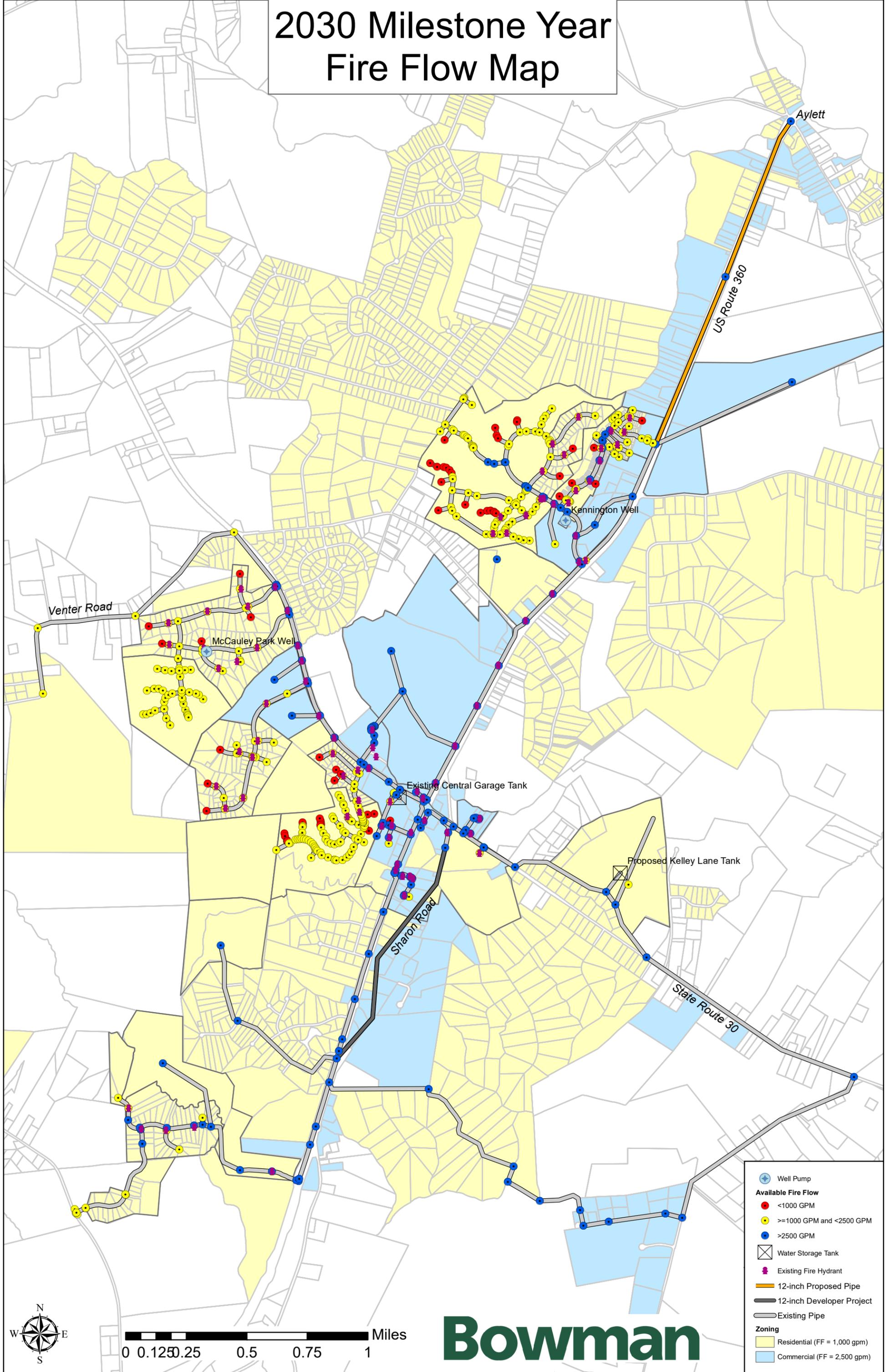
- Well Pump
- Water Storage Tank
- Existing Fire Hydrant
- 12-inch Proposed Pipe
- 12-inch Developer Project
- Existing Pipe

PRESSURE

- 50 PSI - 60 PSI
- 60 PSI - 70 PSI
- 70 PSI - 80 PSI
- 80 PSI - 90 PSI
- 90 PSI - 100 PSI
- >100 PSI pressure zone symbol"/> >100 PSI



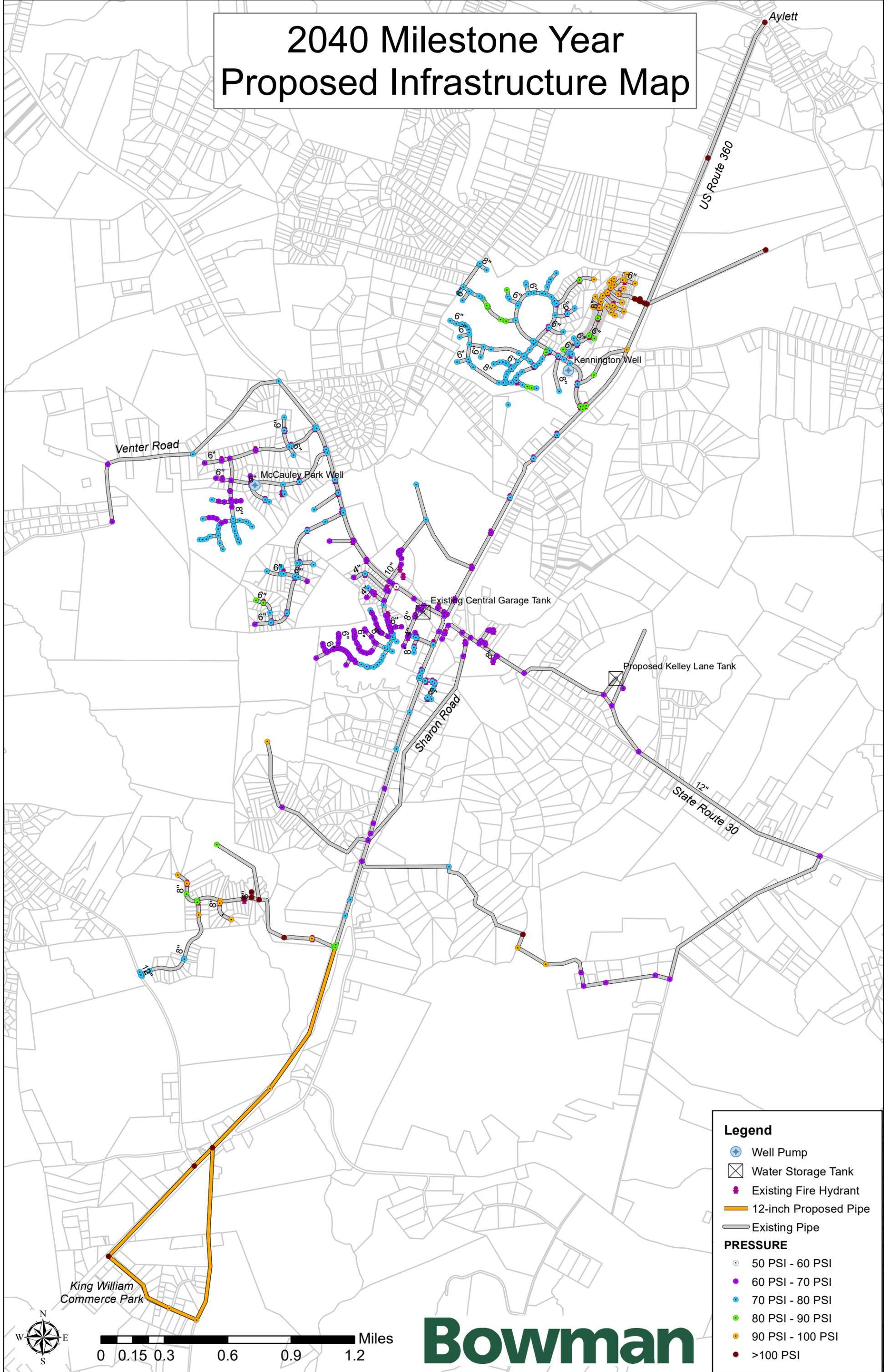
2030 Milestone Year Fire Flow Map



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Appendix F
2040 Milestone Year Model Results

2040 Milestone Year Proposed Infrastructure Map



Legend

- Well Pump
- Water Storage Tank
- Existing Fire Hydrant
- 12-inch Proposed Pipe
- Existing Pipe

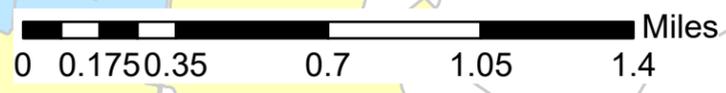
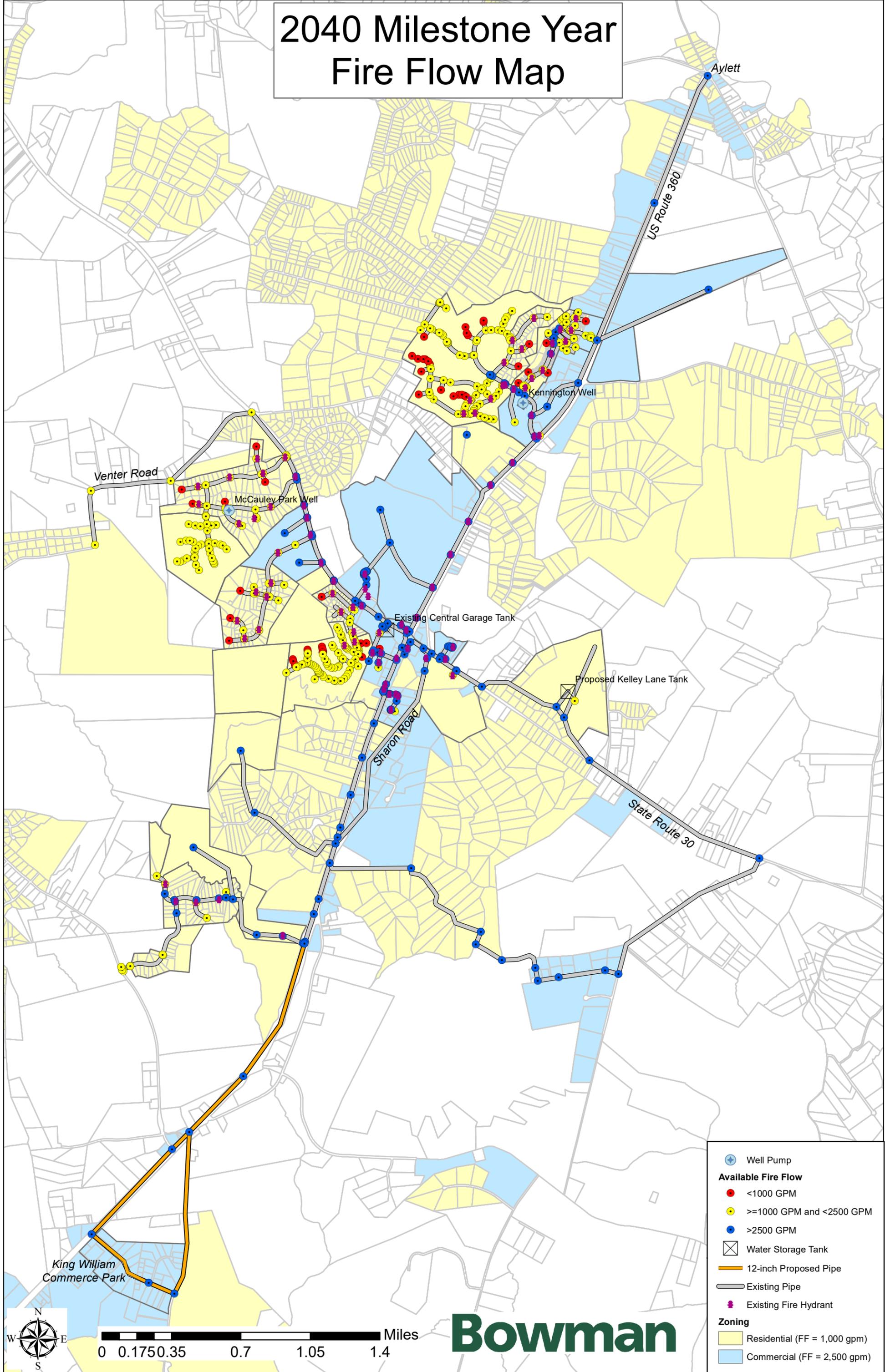
PRESSURE

- 50 PSI - 60 PSI
- 60 PSI - 70 PSI
- 70 PSI - 80 PSI
- 80 PSI - 90 PSI
- 90 PSI - 100 PSI
- >100 PSI symbol"/> >100 PSI



Bowman

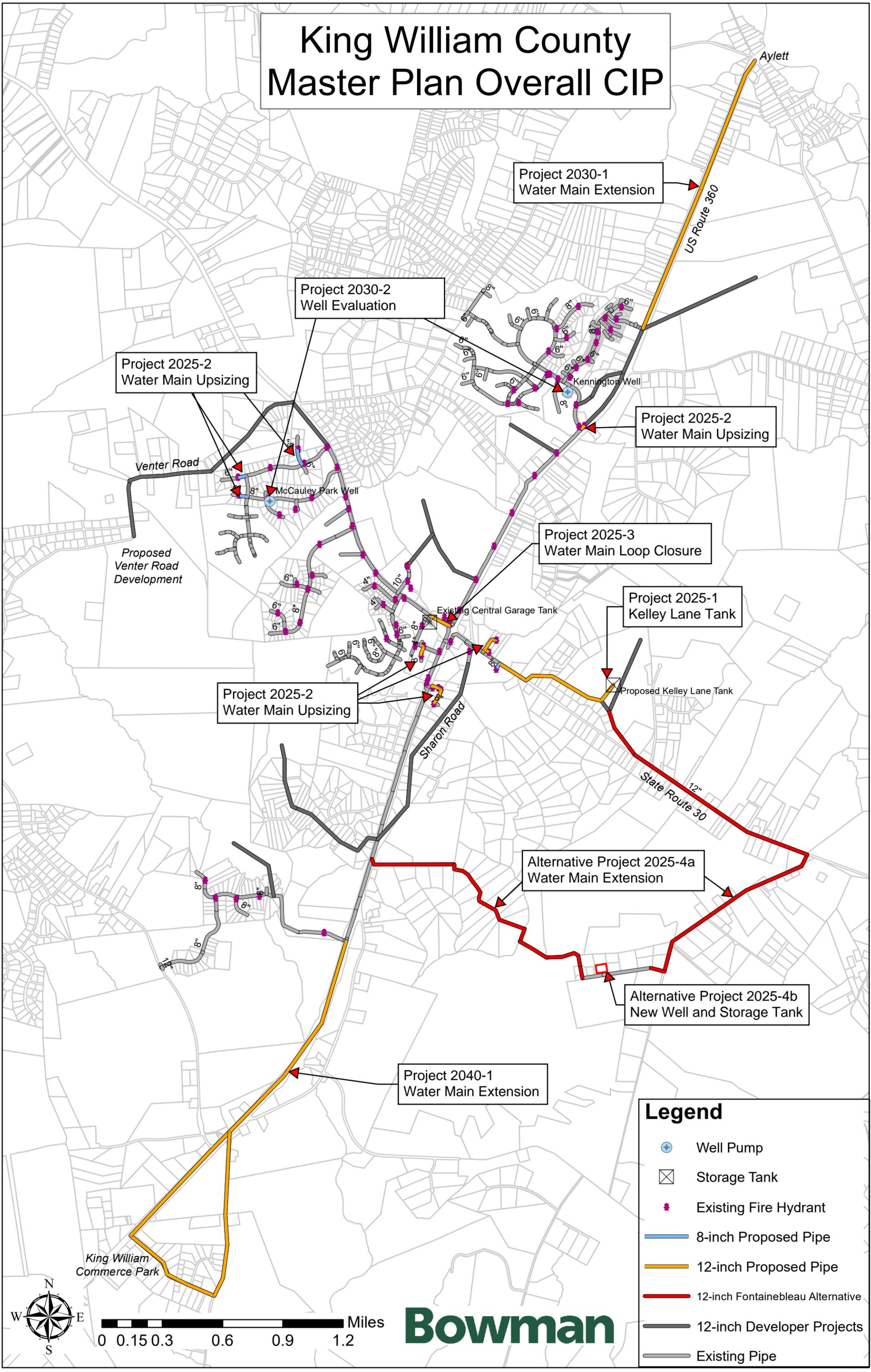
2040 Milestone Year Fire Flow Map



Bowman

Appendix G
Overall System Improvements Map

King William County Master Plan Overall CIP



Project 2025-2
Water Main Upsizing

Project 2030-1
Water Main Extension

Project 2030-2
Well Evaluation

Project 2025-2
Water Main Upsizing

Project 2025-3
Water Main Loop Closure

Project 2025-1
Kelley Lane Tank

Project 2025-2
Water Main Upsizing

Alternative Project 2025-4a
Water Main Extension

Alternative Project 2025-4b
New Well and Storage Tank

Project 2040-1
Water Main Extension

Legend

- Well Pump
- Storage Tank
- Existing Fire Hydrant
- 8-inch Proposed Pipe
- 12-inch Proposed Pipe
- 12-inch Fontainebleau Alternative
- 12-inch Developer Projects
- Existing Pipe



0 0.15 0.3 0.6 0.9 1.2 Miles



Appendix H
Alternative Tank Location Cost Estimates

Alternative 2025-1A: New 600,000 gallon tank - Route 360 South					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	600,000 gallon Elevated Storage Tank and Controls	LS	1	\$ 3,100,000	\$ 3,100,000
2	Extention of the 12" watermain	LF	250	\$ 180	\$ 45,000
Construction Cost - Subtotal					\$ 3,145,000
Contingency (20%)					\$ 629,000
Construction Cost					\$ 3,774,000
Construction Phase Services (10%)					\$ 377,400
Engineering & Survey Cost (15%)					\$ 566,100
Land and Easement Aquisition (5%)					\$ 188,700
Alternative 2025-1A Total					\$ 4,906,200

Alternative 2025-1B: New 600,000 gallon tank - Fontainebleau Industrial Park					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	600,000 gallon Elevated Storage Tank and Controls	LS	1	\$ 3,100,000	\$ 3,100,000
2	New Groundwater Well & Controls	LS	1	\$ 100,000	\$ 100,000
3	Extention of the 12" watermain	LF	8,000	\$ 180	\$ 1,440,000
Construction Cost - Subtotal					\$ 4,640,000
Contingency (20%)					\$ 928,000
Construction Cost					\$ 5,568,000
Construction Phase Services (10%)					\$ 556,800
Engineering & Survey Cost (15%)					\$ 835,200
Land and Easement Aquisition (5%)					\$ 278,400
New Groundwater Well Permitting (Lump Sum)					\$ 50,000
Alternative 2025-1B Total					\$ 7,288,400

Alternative 2025-1C: New 600,000 gallon tank - Venter Road					
Item No.	Item Description	Units	Quantity	Unit Price	Total
1	600,000 gallon Elevated Storage Tank and Controls	LS	1	\$ 3,100,000	\$ 3,100,000
2	Extention of the 12" watermain	LF	1,250	\$ 180	\$ 225,000
Construction Cost - Subtotal					\$ 3,325,000
Contingency (20%)					\$ 665,000
Construction Cost					\$ 3,990,000
Construction Phase Services (10%)					\$ 399,000
Engineering & Survey Cost (15%)					\$ 598,500
Alternative 2025-1C Total					\$ 4,987,500.00

PREPARED BY:

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