WATER SYSTEM MASTER PLAN

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July

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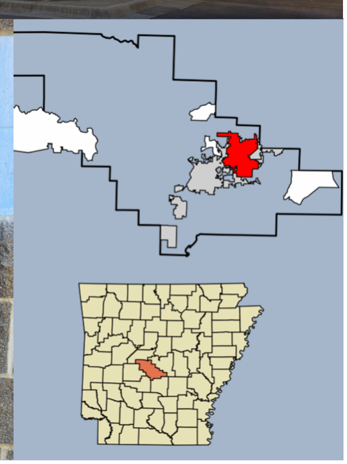

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WATER SYSTEM MASTER PLAN
City of Bryant, Arkansas
July 2024

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WATER SYSTEM MASTER PLAN

City of Bryant, Arkansas

July 2024

I. Introduction

A. PURPOSE

This Report presents a water distribution system master plan for the City of Bryant, Arkansas which is projected to meet water distribution, storage, and pumping requirements until the year 2050.

B. SCOPE

This Report includes:

- Population and water demand projections through the year 2050.
- Development of a project list to meet projected demand through 2050.
- Evaluation of water distribution water quality (TTHMs).
- On-site inspections at all sites, including water tanks, pressure reducing valve stations, and booster pump stations.
- Analysis of water pipes in the system under current demands, including identification of pipes needing upsizing or looping.
- Assessment of fire flow availability in the system and recommendations for improvements.
- Identification of potential interconnect locations with local water systems and determination of required improvements.
- Assessment of Planning Areas, underdeveloped areas, and potential future growth areas with city staff guidance.
- Rebuild the water system hydraulic model and update demand allocation and patterns using automated metering and zone metering data.
- Cost estimates and location maps for all recommendations.

II. PART 1 – BACKGROUND INFORMATION

A. GENERAL

Bryant is the second largest city in Saline County, Arkansas, and is strategically located along Interstate 30 between Benton and Little Rock as shown in **Figure II-1: Bryant Service Area**. Bryant experienced significant growth since the 1980's. Its population has increased from 2,682 in 1980 to an estimated 22,235 in 2024.

Since the late 1980's, Bryant has purchased water wholesale from Central Arkansas Water (CAW). Water is pumped from the CAW meter station into the north pressure zone. Since late 2005 Bryant has sold water wholesale to the Saline County Waterworks and Sanitary Sewer Public Facilities Board (Woodland Hills). The Bryant water system includes two CAW master meter stations with one capable of pumping 3,500 gallons per minute via two 75 HP vertical turbine pumps. Bryant water storage includes one 2,000,000- gallon elevated storage tank, two 1,000,000-gallon ground storage tanks, and two pressure zones. The elevated storage tank and one ground storage tank provide water to the north pressure zone, and the other ground storage tank provides flows to the south pressure zone. The north pressure zone has an overflow elevation of 609 feet while the south pressure zone has an overflow elevation of 541 feet.

This 26-year master plan (2024 - 2050) addresses Bryant water system improvements needed to accommodate the anticipated growth, including providing wholesale water service to Woodland Hills. The improvements are identified as near, intermediate, and long-term improvements. The plan also provides recommendations and required upgrades for a new potential source of wholesale purchased finished water from the Saline Regional Public Water Authority (SRPWA)

The Bryant water planning area is to include all areas within the Bryant Service area shown on **Figure II-1: Bryant Service Area** and is used as the basis for the population projections and water demand projections. Solely for the purposes of this report, it is assumed that Bryant will provide water to all of the water meters in the Bryant city limits boundaries as well as wholesale water to Woodland Hills but will not extend to beyond the existing Service Area as the water system is currently contiguous with the service areas of Salem Water, Central Arkansas Water, and Benton Water Systems.

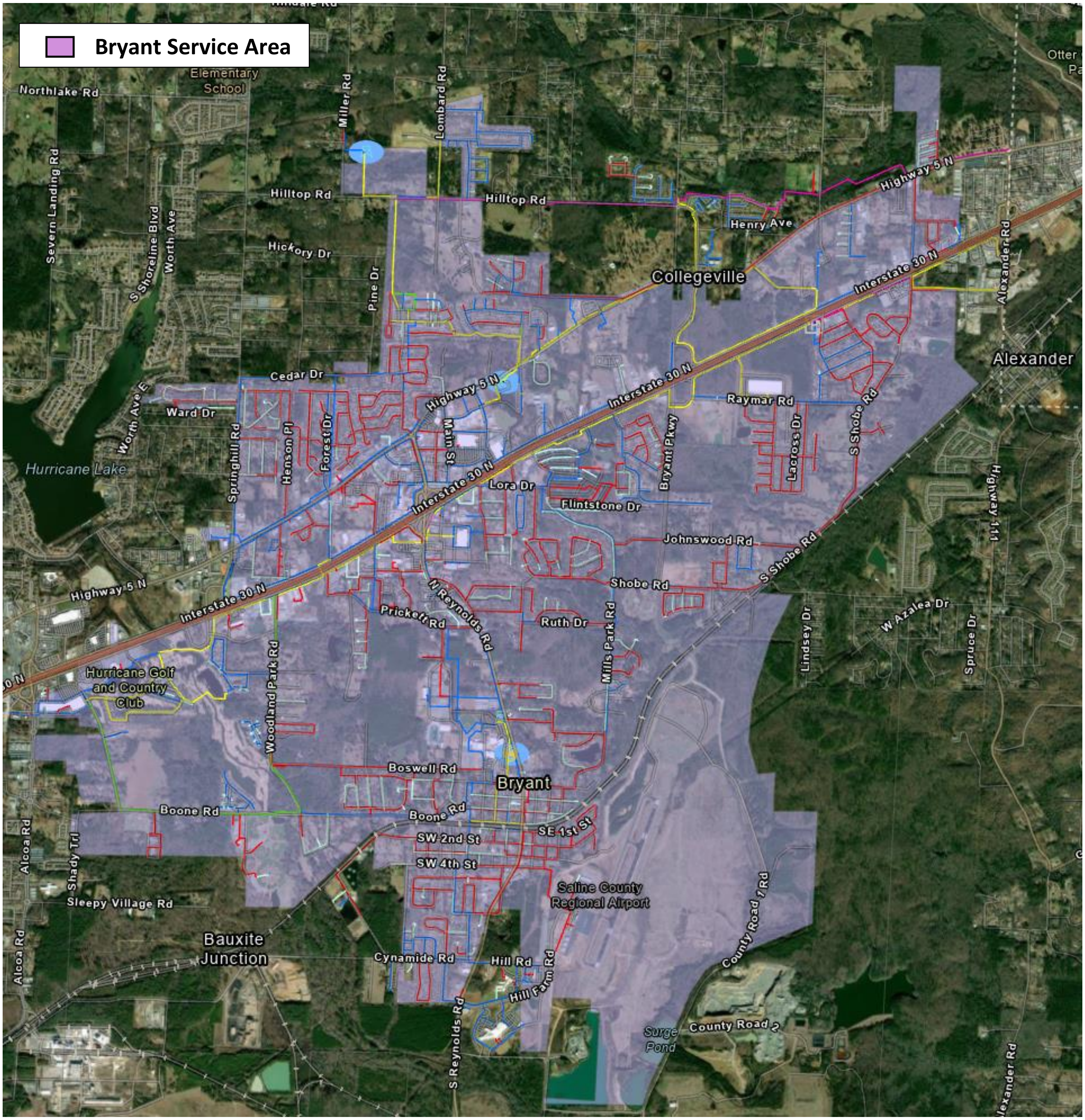


Figure II-1: Bryant Service Area

B. POPULATION AND WATER DEMAND PROJECTIONS

Table II-1: Historical, Estimated and Projected Population shows historical, estimated, and projected population for the City of Bryant and Woodland Hills, according to information from the United States Census Bureau. Data is presented through the 2050 study period.

Table II-1: Historical, Estimated and Projected Population

Bryant, Arkansas			
Year	**Bryant**	**Woodland Hills**	**Total**
1900	113		
1910	91		
1920	132		
1930	162		
1940	173		
1950	387		
1960	737		
1970	1,199		
1980	2,682	1,200	3,882
1990	5,269	1,590	6,859
2000	9,764	1,815	11,579
2010	16,688	1,928	18,616
2020	20,663	2,085	22,748
2030	25,585	2,247	27,832
2040	31,016	2,405	33,421
2050	36,889	2,567	39,456

To project future population trends, projections are made until the year 2050 using the percent growth method. The following equation illustrates the application of this method.

$$P_t = P_0(1 + k)^n$$

Where :

P_t = Population at time t

P_0 = Population at time zero

k = growth rate

n = number of periods

Based on the population data in Table 1.1 a growth rate (k) was calculated over a 10-year period (n). Using this growth rate and the equation mentioned above, projections were made. **Figure II-2: Bryant Population Trends** illustrates the population trend from 1980 to 2020, with projections extended to 2050.

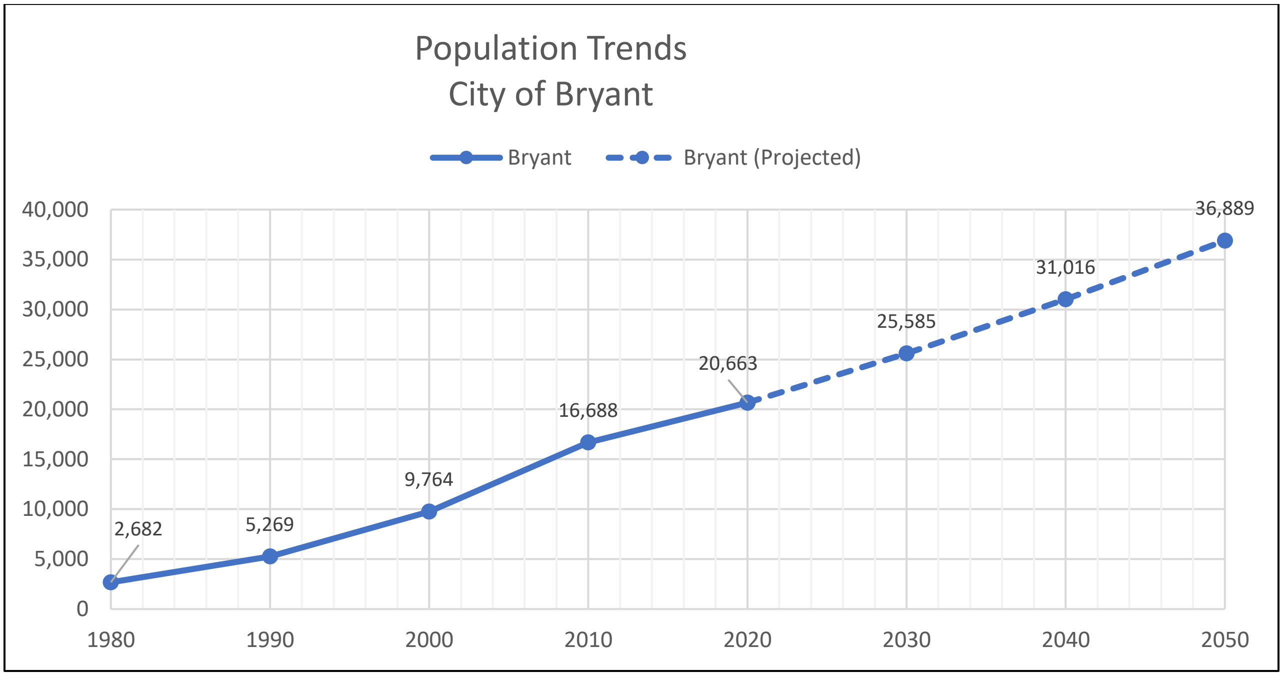


Figure II-2: Bryant Population Trends

Between 2020 and 2050, Bryant's population is projected to increase to 36,889, marking a growth of 16,226 people (79%) from the recorded 2020 census population.

Bryant currently buys water from CAW. Daily purchase data is available from January 2014 through April 2024, with gaps including all of 2019. Missing months and the year of 2019 were estimated by averaging data from the two preceding and two subsequent years for the same months. The data provided spans from 2014 to 2020, averaging between meter readings. In the summer of 2021, actual daily records were introduced. **Figure II-3: Water Purchase Data** depicts the recorded purchase quantities. Starting in 2021, data accuracy improved, with no averaging between meter readings. Transparent red and blue vertical bars indicate summer and winter months, respectively.

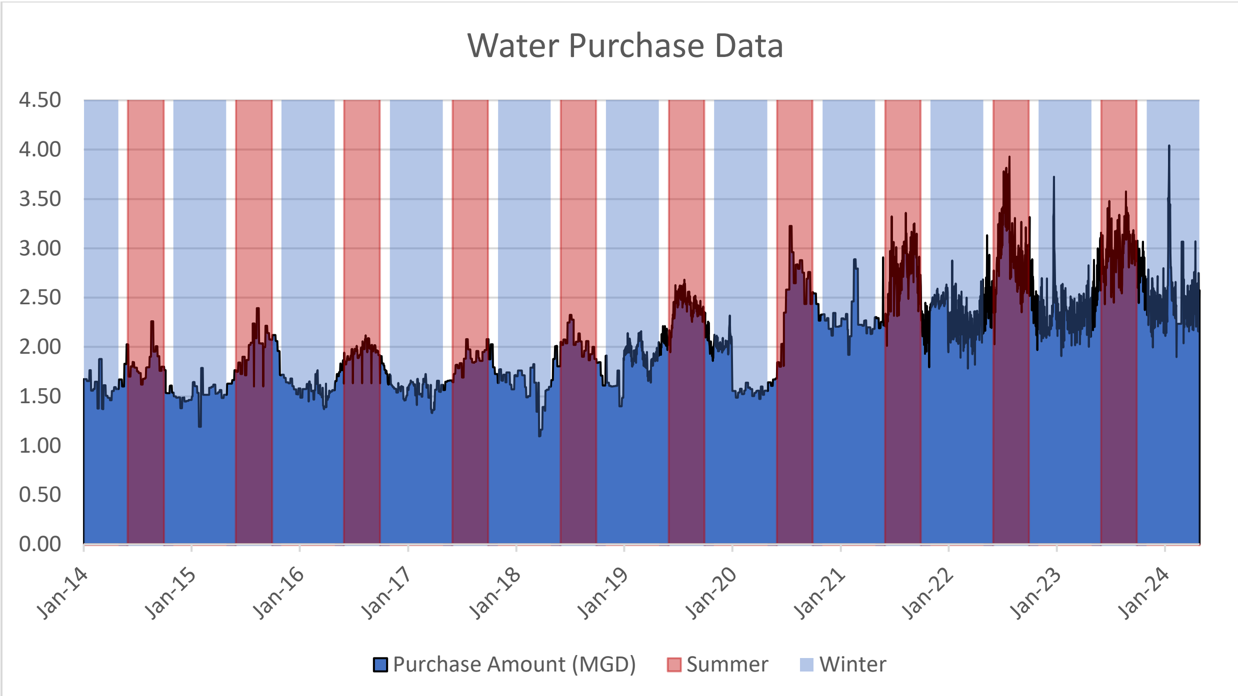


Figure II-3: Water Purchase Data

From 2014 to 2024, purchased water shows an increasing trend, with average daily demand rising from approximately 1.7 million gallons per day (mgd) to 2.5 mgd—a 48% increase. The estimated maximum daily demand in 2014 was 2.5 mgd, derived from the highest recorded average meter reading over a week period, with a 15% increase applied. In contrast, the actual recorded maximum daily demand in 2024 reached 4.04 mgd, showing a nearly 60% increase.

There are approximately 8,509 connections within Bryant's system and 9,216 meters including the wholesale meters within Woodland Hills. Using the connection amount and the historic average day and maximum day data, the average water purchased per meter ranged from 200 gallons per day to 300 gallons per day. For maximum day use, water usage per meter ranged from 280 to 480 gallons per day over the past decade. To project Maximum Day Demand (MDD), the 80th percentile usage of 425 gallons per day per meter will be used.

According to the US Census Bureau there are an average of 2.5 occupants per household in Bryant. **Figure II-5: Projected Demands** illustrates projected water demands, calculated by dividing the projected population by the average occupants per household and multiplying by the typical household usage. This value was then converted to million gallons per day (mgd) by dividing by 1,000,000. A trendline was derived from recorded maximum daily demands to establish a pattern, which was applied to project Maximum Day Demand. A similar approach using the ratio of Average Day Demand to Maximum Day Demand was used to project Average Day Demand. An additional Hot Dry Maximum Day Demand was reviewed and is considered Maximum Demand Day plus 15-percent. The ratio of Maximum and Average Day Demand ranged from 1.40 to 1.70 for the past 20 years of data, which represents the potential peaking factor each year. **Table II-2: Water Demands** shows the historical and projected future water demands for Bryant.

Figure II-4: Bryant Booster Pump Station

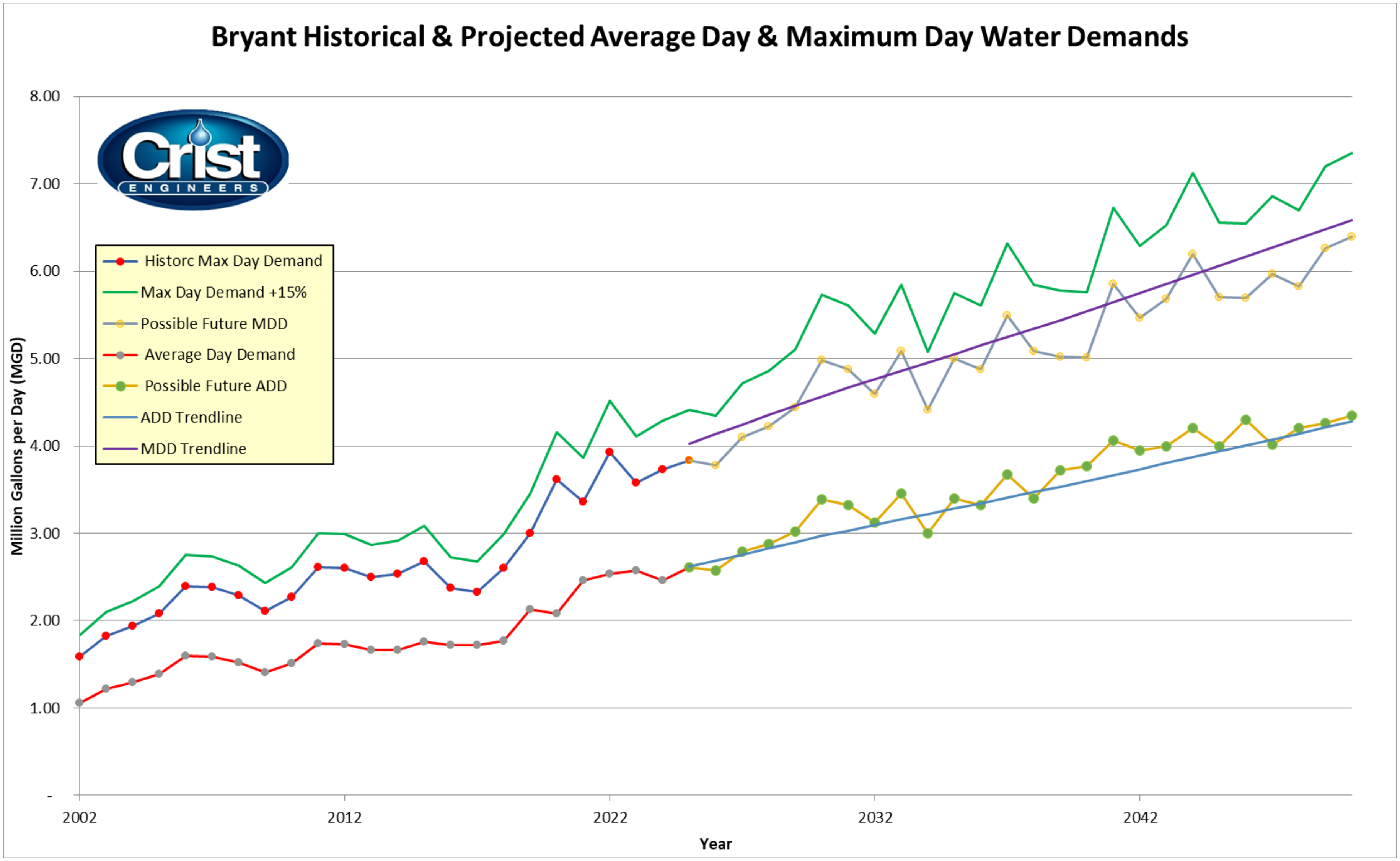


Figure II-5: Projected Demands

Table II-2: Water Demands

Bryant, Arkansas				
Year	Projected Population (From Table 1.1)	Average Day Demand (Million Gallons per Day)	Maximum Day Demand (MGD)	Hot Dry Maximum Day Demand (MGD)
2000	9,764	0.9	2.0	
2010	16,688	1.5	2.8	
2020	20,663	2.1	3.7	
2024	22,235	2.6	4.1	
2030	25,585	3.0	4.7	5.4
2040	31,016	3.6	5.6	6.4
2050	36,889	4.3	6.6	7.6

The water demand projections for Bryant are focused on primarily residential growth within the existing service area. One potentially significant factor that is not included in the projected water demands shown in Table 1.3 is water demands associated with industrial development, specifically at the Saline County Regional Airport. The Airport is in the Bryant city limits and it includes about 1200 acres, 600 acres of which are available for development as an industrial park. Typical water demands for industrial users can vary greatly depending on the type of industrial user, but can range from typical commercial flows of 100 gallons per acre per day to industrial processing facilities using over 1500 gallons per acre per day. Fully developed, the Airport industrial area could have estimated water demands ranging from as low as 60,000 to over 900,000 gallons per day and will be evaluated as part of the system hydraulic modeling based on the lower range of the expected flows.

Another potentially significant factor not included in the projected demands is the inclusion of flows from customers currently served by other systems. The addition of a large demand outside of the existing service area will need to be assessed on a case-by-case basis as the situation arises based on existing infrastructure and needed improvements to provide flows to the new area.

C. WEATHER DEPENDANT MAXIMUM DAY DEMANDS

Seasonal patterns affect the system in various ways. During winter months, usage typically is lower than during summer months but during weather events that sustain below freezing temperatures, water line breaks and customer faucet dripping can increase the base demand greatly in some cases. In summer months, demand peaks during the hottest and driest periods due to sprinkler use, summer activities, and additional bathing. However, these demands do not persist during sleeping hours.

A Maximum Day Demand (MDD) recorded during a summer month provides an accurate representation of expected recurring events. However, an MDD recorded in the winter may not accurately represent recurring events. The winter MDD might result from high base demand, typical daily use, and leaks due to frozen pipes.

Figure II-6: Winter Vs. Summer Maximum Demands below compares the MDD recorded on August 23, 2023, with the MDD experienced on January 17, 2024.

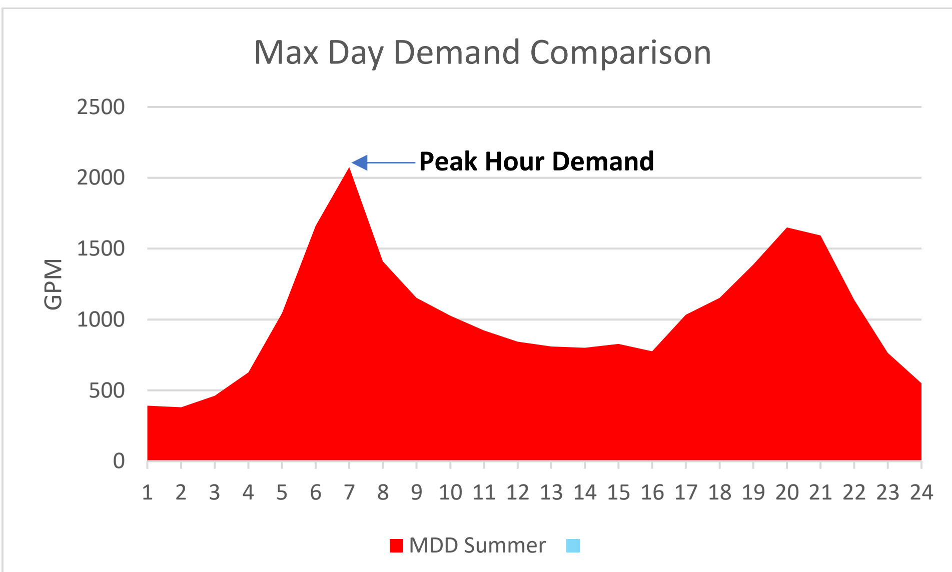


Figure II-6: Winter Vs. Summer Maximum Demands

Winter Maximum Day Demands can be highly unpredictable in nature due to the unknown timing and effects the weather will cause on the system. Daily water demands during these events can match or even exceed daily demands during typical Summer Maximum Day Demands.

The peak demand for the summer event was experienced in the morning and was much higher than the evening peak demand for winter. Conversely, the base demand for the winter event is greater than the base demand for the summer event.

Figure II-7: Average Summer Vs. Average Winter Demands below displays a typical winter and summer demand, showing that the base demands during normal winter months are usually in line with the base demands of summer months.

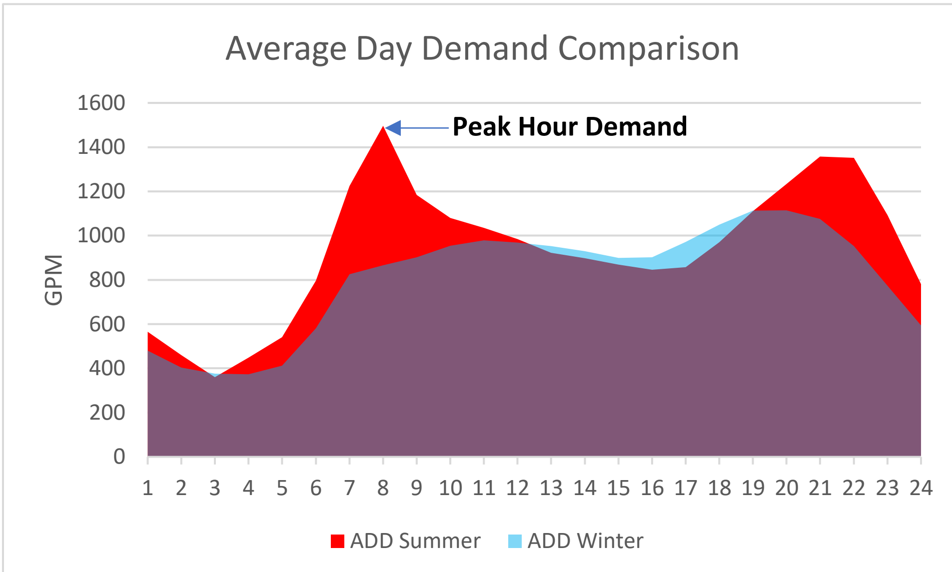


Figure II-7: Average Summer Vs. Average Winter Demands

The pattern of these curves resembles the pattern of the recorded events, indicating fairly consistent usage for each month. Interestingly, the winter peaking factors consistently maintain a higher range compared to the summer peaking factors. The maximum hourly peaking factor occurs during the summer, which aligns with the observations from the recorded summer and winter MDDs.

The high summer demand necessitates greater storage capacity to meet peak demand. Demand drops significantly during sleeping hours, allowing the system to replenish its storage. In contrast, winter demand maintains a consistently higher base demand even during sleeping hours, which limits the system's ability to replenish storage. Instead, winter demand requires sufficient pumping capacity to meet all requirements continuously.

D. WATER SUPPLY

Bryant currently purchases all of its water from CAW under a wholesale water purchase agreement. The agreement has been in place since 1988 and was renewed for a term of 20 years in 2008. Bryant can receive up to 4.0 MGD, under this agreement. As evidence of the demand projections, this 4.0 MGD allotment may not be sufficient during maximum day demands. It is recommended that the maximum allotment be reviewed and discussed in order to match projected maximum day demands.

The Saline Regional Public Water Authority (SRPWA) completed a Preliminary Engineering Report in 2021 that identified the Ouachita River as a long-term water supply option. The anticipated initial SRPWA supply of water from Ouachita River is 22 MGD, of which Bryant's minimum allocation is proposed to be 2.0 MGD. This is anticipated to be received via transmission main on the west section of Bryant, potentially near the north 1-million gallon ground storage tank or adjacent to I-30, which will be used for hydraulic considerations.

According to the SRPWA report, the total estimated cost for the Ouachita River project is $175,000,000, The SRPWA report estimates that the project could be in service by 2030.

Once the design of the SRPWA connection is established, an update to the Master Plan further clarifying the future needed improvements based on the capacity and location of the connection may be required.

E. WATER QUALITY

The Bryant water system samples four sites for trihalomethanes (TTHM) and haloacetic acids (HAA5) in accordance with the Safe Drinking Water Act. The regulated quantities, or Maximum Contaminant Levels (MCL) of TTHM and HAA5 are 80 and 60 micrograms per liter (µg/l). **Table II-3: Historical TTHM Data (µg/l)** below lists the quarterly averages and running annual averages for 2021, 2022, and 2023 for TTHM.

Table II-3: Historical TTHM Data (µg/l)

Bryant, Arkansas		
	Quarterly Average	**Running Annual Average**
2021		
First Quarter	-	48.0
Second Quarter	-	
Third Quarter	65.7	
Fourth Quarter	50.5	
2022		
First Quarter	43.5	41.9
Second Quarter	38.9	
Third Quarter	66.4	
Fourth Quarter	41.9	
2023		
First Quarter	28.5	52.3
Second Quarter	40.8	
Third Quarter	69.8	
Fourth Quarter	69.8	

Table II-4: Historical HAA5 Data (µg/l) below lists the quarterly averages and running annual averages for 2022 and 2023 for HAA5.

Table II-4: Historical HAA5 Data (µg/l)

Bryant, Arkansas		
	Quarterly Average	Running Annual Average
2022		
First Quarter	18.4	17.3
Second Quarter	21.5	
Third Quarter	17.5	
Fourth Quarter	12.0	
2023		
First Quarter	20.7	21.5
Second Quarter	31.8	
Third Quarter	19.1	
Fourth Quarter	15.2	

While HAA5 levels are below regulated levels, TTHM levels are showing an increasing trend. Several values are above the 80µ/l regulated level with a maximum reported value of 94.3 µ/l. TTHM formation depends on several factors including the amount of TTHM precursors, water temperature, chlorine concentration, pH, and water age in the distribution system. Since Bryant currently purchases its water from CAW, it does not have direct control over some of these TTHM factors. However, Bryant can help control some of the factors by making improvements to its water distribution system to decrease water age and limit dead-end lines by adequate looping. It is also anticipated that usage of finished water from SRPWA will allow for decreased TTHM levels with reduced water age from the plant to distribution when compared to CAW wholesale water.

F. EMERGENCY CONNECTIONS

Water connections to adjacent utilities can provide a benefit during times of emergency. Although the delivery of the amount of water may be limited, the connections can nevertheless provide some water. Bryant currently has an emergency connection with Salem near the North water tank and plans to establish emergency connections with Benton that will enable Bryant to either deliver or receive water in an emergency.

G. SCADA SYSTEM

Bryant has a SCADA system that provides its operators with information concerning current and ongoing system operations. The SCADA system Central Terminal Unit (CTU) monitors tank levels, booster pump operations, and CAW water meter readings.

III. PART 2

A. DISTRIBUTION AND STORAGE SYSTEM ZONES

Distribution and storage system zones refer to pressure zones within a water distribution system. The Bryant water system includes two such zones. The two pressure zones within the system are identified as the North Pressure Zone and the South Pressure Zone. Separate pressure zones are generally used to equalize water pressure across an entire water distribution system according to ground elevation.

The North Pressure Zone makes up a large percentage of the total Bryant water distribution system. Everything along and north of the Interstate 30 corridor is in the North Pressure Zone. Generally, these are the highest ground elevations in the City of Bryant. The North Pressure Zone extends down Reynolds Road to the south water storage tank where the South Pressure Zone originates. A boundary map of the existing pressure zones is shown in **Figure III-2: Bryant Pressure Zones.**

Water storage is provided in the North Pressure Zone by a 2 million gallon composite elevated tank located centrally in the system off of Highway 5 and a 1 million gallon ground storage tank located in the northwest part of town off of Hilltop Road. This north pressure zone has an overflow elevation of 609 feet. Water storage is provided in the South Pressure Zone by a 1 million gallon ground storage tank located along Reynolds Road. This south tank has an overflow elevation of 541 feet.

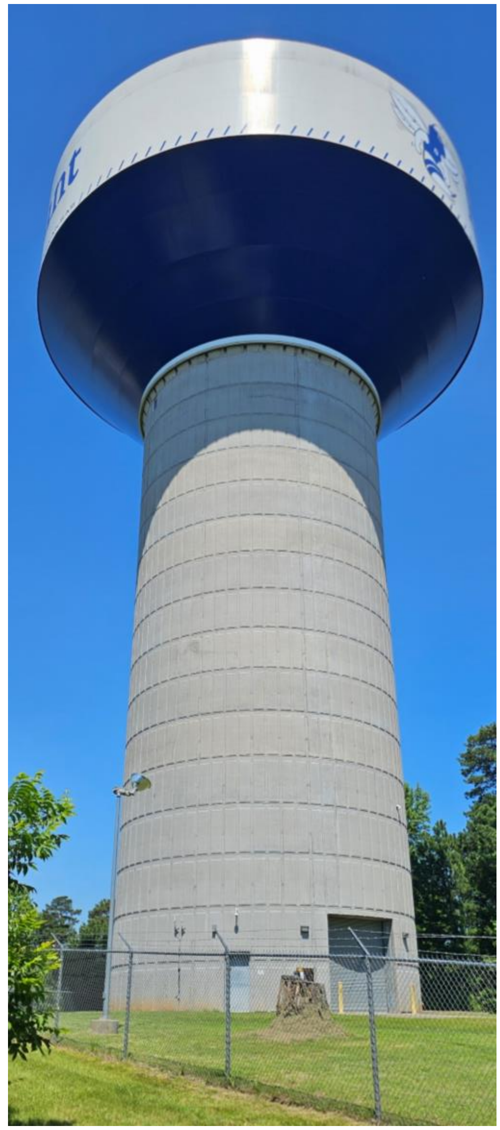


Figure III-1: Hwy 5 Tank

All water distributed by the City of Bryant is transmitted through the North Pressure Zone. Water enters the North Pressure Zone by gravity or pumping through two CAW metering sites. The original CAW meter site with pump station is located along the Interstate 30 service road near Millbrook Drive. A second CAW meter site is located at the intersection of Highway 5 and County Line Road. Water continuously flows through the original meter site and is pumped from that location into the North Pressure Zone. The South Pressure Zone is provided water from the North Pressure Zone with the operation of an altitude valve located at the base of the South Tank.

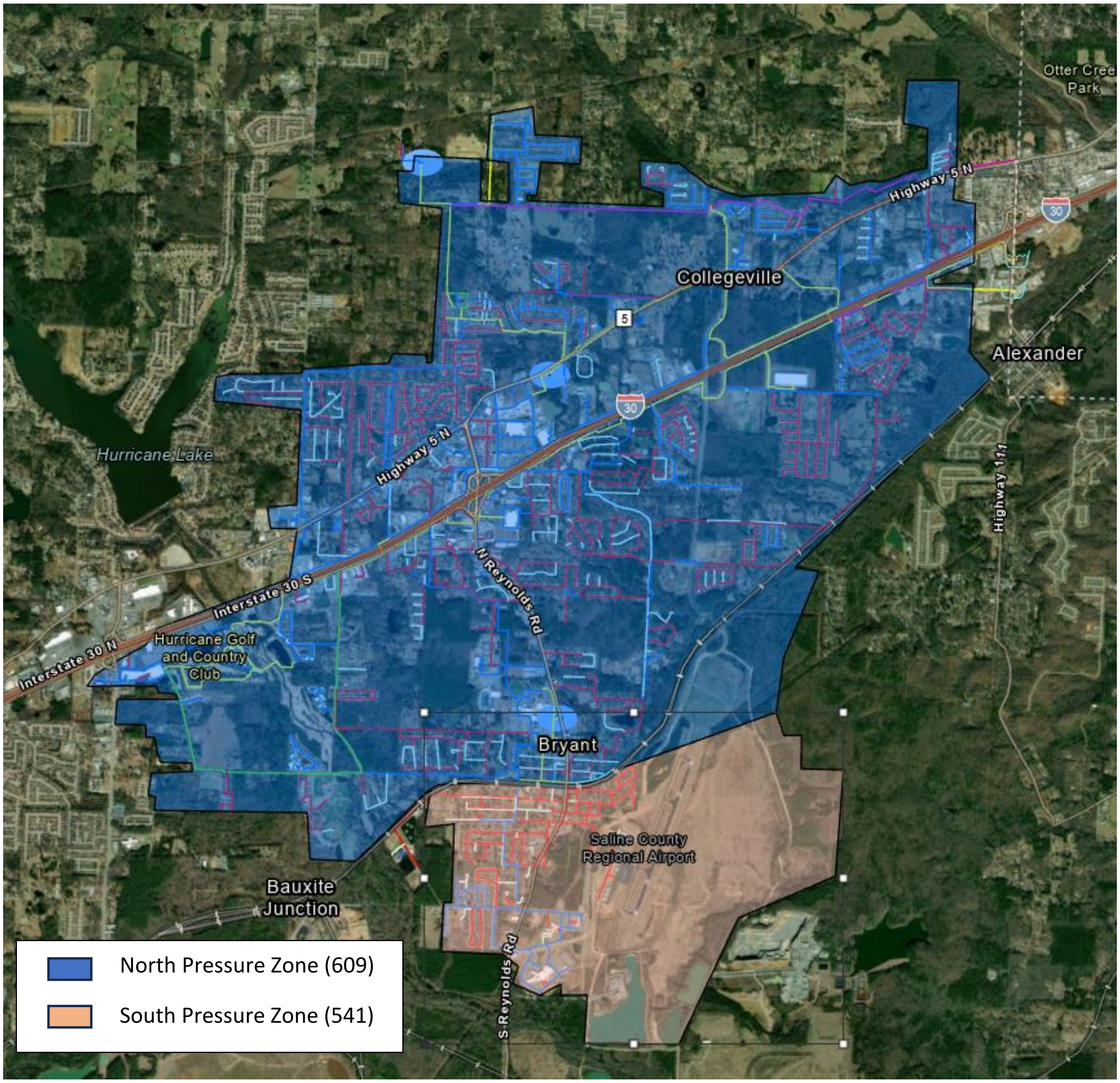


Figure III-2: Bryant Pressure Zones

B. INVENTORY OF EXISTING WATER PIPES

The water transmission capacity of a pipeline is dependent upon the pipe diameter and the relative roughness of the pipeline. For a given flow through a pipe, the head loss through that pipe increases as diameter and roughness decrease. It is important that the pipes within a distribution system are properly sized to prevent unnecessary head loss. The roughness of a pipe can vary considerably with pipe material, age, and the condition of the pipe.

Table III-1: Distribution Pipe Inventory shows the quantities of piping within the Bryant water distribution system. The total system consists of approximately 568,000 feet or 108 miles of distribution piping with 525,000 feet or 99 miles of pipe 6-inch and larger. The North Pressure Zone is the largest of the pressure zones with 86 % of the total system piping.

Table III-1: Distribution Pipe Inventory

Bryant, Arkansas		
Pipe Diameter	**TOTAL SYSTEM**	**Percent of Total**
2	17,099	3.0%
3	6,303	1.1%
4	19,534	3.4%
6	261,806	46.1%
8	160,627	28.3%
10	14,978	2.6%
12	69,540	12.3%
14	410	0.1%
16	17,228	3.0%
24	84	0.0%
TOTAL	567,611	100%
% of Total	100%	

C. PUMPING FACILITIES

The City of Bryant currently has a pump station at the CAW Master Meter along I-30 as shown in **Figure III-3: Booster Pump Station**. This pump station was constructed in 2012 and consists of two 75 HP Goulds vertical turbine pumps capable of providing 2,000 gallons per minute at 95 feet of head each or 3,500 gallons per minute at 101 feet of head combined into the North Pressure Zone. The pumps are housed in a booster pump station and booster chlorination is available at the site. The chlorination unit currently has leaks that have caused corrosion to components inside the chemical room as shown in **Figure III-4: Chlorination Unit with Corossion Evident**. It is recommended that the chlorination system be replaced.

Figure III-3: Booster Pump Station

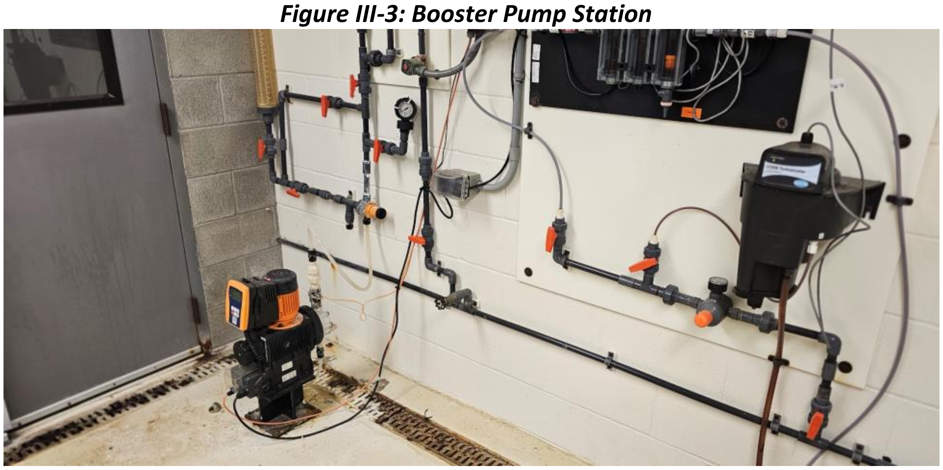


Figure III-4: Chlorination Unit with Corossion Evident

D. SYSTEM STORAGE

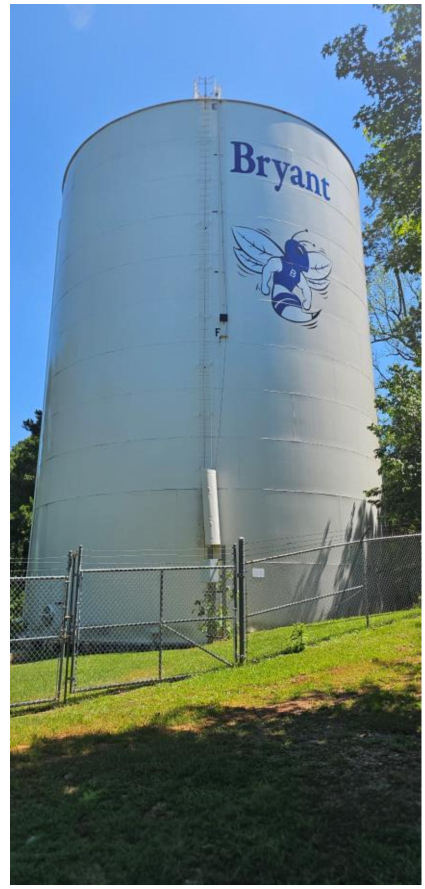


Figure III-5: South Tank

Three classes of water storage are needed for proper operation of water distribution systems, equalization storage, fire storage, and emergency or reserve storage. Adequate storage enables supply and treatment facilities to operate at a near uniform rate without the need and investment required to meet extreme peak demand. The storage requirement of each pressure zone is dependent on the demands within that particular zone. Equalization storage refers to the storage that can be used during periods of peak demand and is replenished during periods of minimum demands. The volume of equalization storage required for a w

ater distribution system is based on a 24-hour demand pattern on the maximum day demand. Fire storage refers to the water required to meet fire flow requirements. The emergency or reserve storage refers to the volume of water to be held in the reservoir for an emergency such as a facility outage. Table 2.4 summarizes the existing storage facilities within the Bryant water distribution system.

Useable storage is calculated by first establishing the minimum operating level while maintaining a static pressure of 30 psi to all water users in that tank's pressure zone. For the South Zone, a pressure residual of 20 psi will be used as the North Pressure Zone tanks are capable of maintaining the storage capacity of the South Pressure Zone via gravity.

By taking the elevation of the highest water customer in a tank's pressure zone and adding 69.3 feet (30 psi) to that critical ground elevation, a minimum drawdown level of the tank can be established. If the tank level drops below this minimum drawdown level, the static pressure will drop below 30 psi in the distribution system. After the minimum level of a tank is calculated, the tank's volume can be recalculated using this height of water. This volume is known as the "useable storage capacity." **Figure III-6 - Useable Storage Diagram** illustrates the relationship between useable storage and total storage.

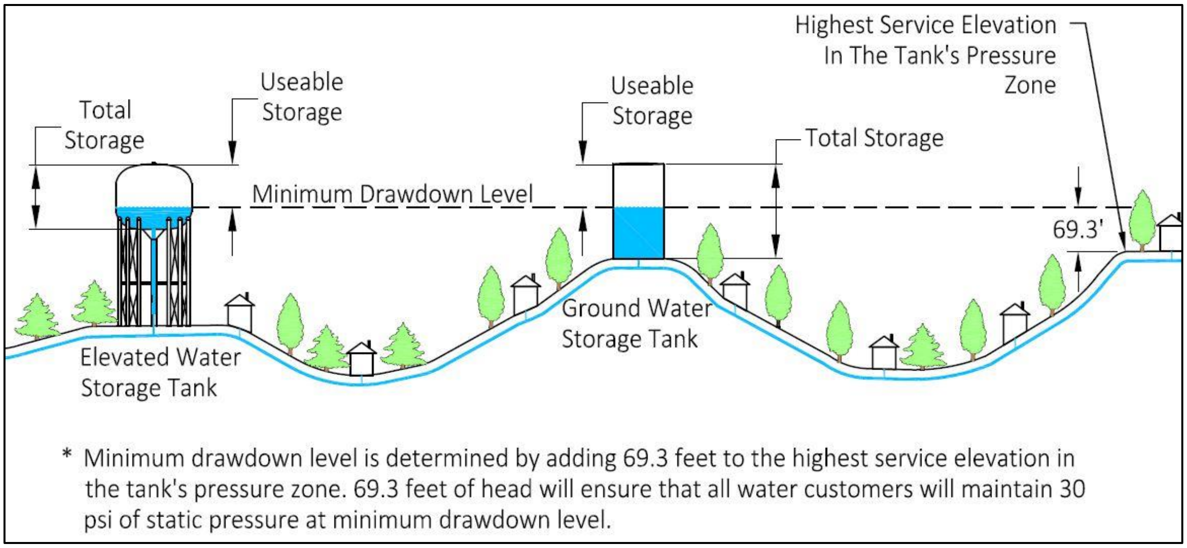


Figure III-6 - Useable Storage Diagram

The data presented in **Table III-2: Summary of Existing Storage** indicates that the system has approximately 4,227,144 gallons of total storage in the distribution system. However, only about 3,300,647 gallons, or approximately 78%, is considered useable storage. The other storage is simply "water holding up water."

Table III-2: Summary of Existing Storage

Bryant, Arkansas						
Location	**Type of Storage**	**Diameter (feet)**	**Overflow Elevation (feet)**	**Base Elevation (feet)**	**Useful Capacity (gallons)**	**Total Capacity (gallons)**
Hwy 5 Tank	Elevated	94.5	609.00	442.00	2,000,002[a]	2,000,002
South Tank	Ground	50	541.00	464.00	511,141[a]	1,130,973
North Tank	Ground	52	609.00	540.00	789,504[b]	1,096,169
a - Based upon service to elevation 460' with 20 psi static pressure. b - Based upon service to elevation 490' with 30 psi static pressure.					3,300,647	4,227,144
					TOTAL STORAGE	

1. Equalization Storage

Water distribution system pumping facilities are typically sized for the maximum day demand. Equalization storage is the amount of water required to meet the difference between peak hourly demand and maximum day demand. The required water storage volume for a distribution system is determined from an hourly hydrograph shown in **Figure III-7: Bryant Equalization Curve**. The area under the curve but above the average hourly demand on the maximum day represents the volume required for equalization storage. **Table III-3: Equalization Storage Requirements** shows the equalization storage requirements for the City of Bryant.

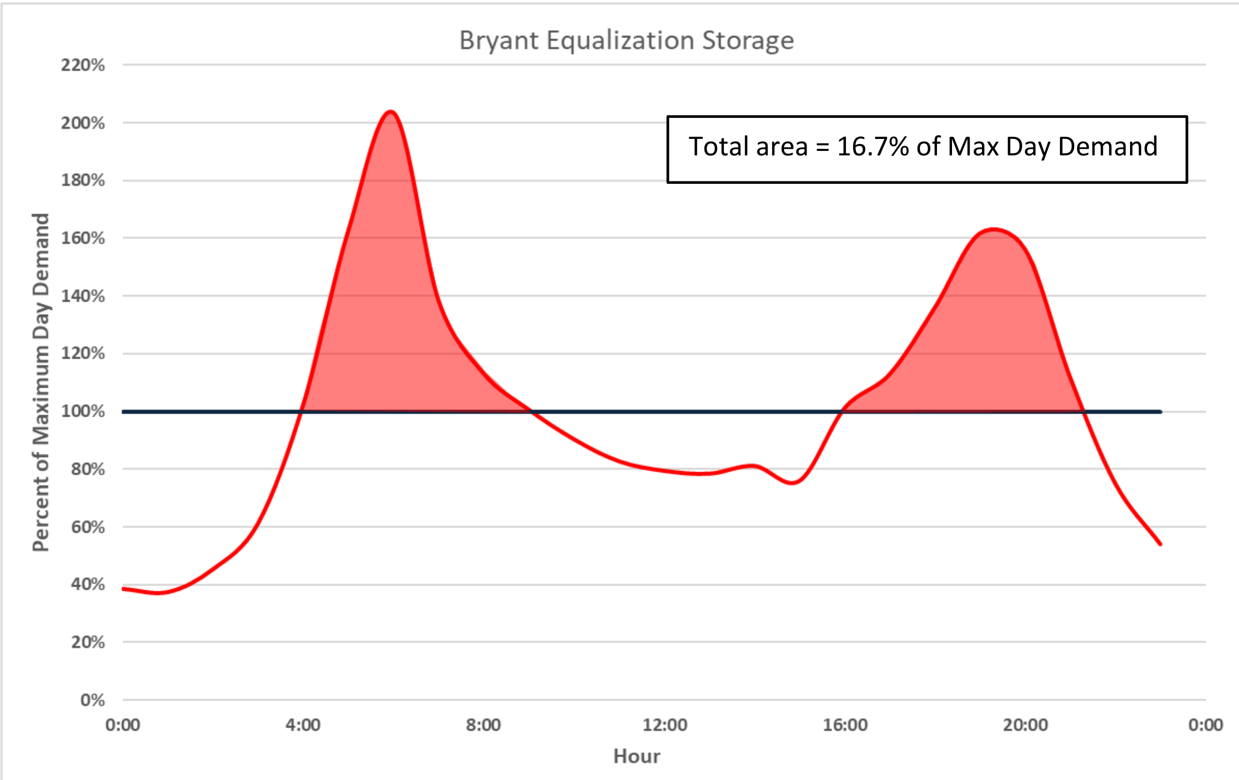


Figure III-7: Bryant Equalization Curve

Table III-3: Equalization Storage Requirements

Bryant, Arkansas	
Year	**REQUIRED EQUALIZATION STORAGE (GALLONS)**
2024	684,700
2030	784,900
2040	935,200
2050	1,102,200

2. Fire Storage

Fire storage refers to the water required to meet fire flow requirements. Typically, minimum fire storage is allocated based on the largest fire demand anticipated within the pressure zone. The required rate of flow must be able to be sustained for a particular duration; the rate and duration yield a required volume. It is recommended that the City of Bryant provide a fire flow storage equal to a 3500 gallon per minute fire for a 3-hour duration, or 630,000 gallons.

Figure III-8: Fire Hydrant

3. Emergency Storage

In addition to equalization and fire storage, emergency storage should be available to provide a supply of water in the case of a power outage or other prolonged interruption of service. It is recommended that the City of Bryant provide a minimum amount of storage of least a 6-hour emergency storage reserve for prolonged interruptions of service such as power outages, pump failures, or main breaks. **Table III-4: Emergency Storage Requirements** shows the emergency storage requirements for the Bryant water distribution system.

Table III-4: Emergency Storage Requirements

Bryant, Arkansas	
Year	**REQUIRED EMERGENCY STORAGE* (GALLONS)**
2010	1,025,000
2015	1,175,000
2020	1,400,000
2025	1,650,000
* Equal to maximum day demand x 0.25 (6-hour reserve)	

4. Total Storage

Table III-5: Total Storage Requirements shows the total storage requirements for the Bryant water distribution system, combining equalization storage, fire storage and emergency storage.

Table III-5: Total Storage Requirements

Bryant, Arkansas	
Year	REQUIRED STORAGE* (GALLONS)
2024	2,549,700
2030	2,799,900
2040	3,175,200
2050	3,592,200
* Equalization + Fire + Emergency Storage	

Table III-6: Additional Storage Requirements shows the additional recommended storage requirement for the Bryant water distribution system.

Table III-6: Additional Storage Requirements

Storage Requirements			
Year	Total Storage Required (gallons)	Total Storage Available (gallons)	Additional Storage Available (gallons)
2024	2,549,700	3,342,316	792,616
2030	2,799,900	3,342,316	542,416
2040	3,175,200	3,342,316	167,116
2050	3,592,200	3,342,316	(249,883)

IV. Hydraulic Analysis

A. HYDRAULIC ANALYSIS

Hydraulic analyses of the City's water distribution system under present conditions as well as a number of possible future conditions were performed. Each analysis utilizes information such as pipe size, pipe length, roughness coefficient, ground elevation and water demand in order to accurately model the characteristics of the water system. The goal of the analysis is to identify possible system improvements such as additional pipeline, additional storage, and additional pumping capacity that will provide sufficient water volume and pressure for anticipated system demands.

The hydraulic analysis of the City's water distribution system was created using INFOWATER™, a graphical water distribution modeling software package. INFOWATER is database-driven, Windows-based water distribution analysis software that provides a complete graphical user interface while running within the ArcMap for Windows environment. After a simulation, the program generates detailed user-defined output reports, graphics (e.g., color–coded network maps, contour lines), and customized tabular reports as needed.

The INFOWATER software is based upon a numbering system of pipes, pipe junctions, valves, pumps, and water storage tanks. Detailed characteristics of the system are required by the program in order to accurately recreate the operation of the system. Pipe information (diameter, roughness coefficient), junction information (demands, ground elevation), pump characteristics (pump curves), and water storage tank data (elevation, dimensions) are all needed inputs into the model.

Information concerning City's existing pipe network, water storage, and pumping facilities was obtained from site visits, record drawings, atlas maps, GOOGLE Earth, construction maps, City GIS files, and City Utilities Department employees. This information included pipe relationships, pipe material, pipe length, and pipe diameters. Demands within the system were estimated using past water consumption records and projections of future demands. Water demand information was supplied from WaterScope by Metron, the automatic meter reading manufacturer, and the City billing department.

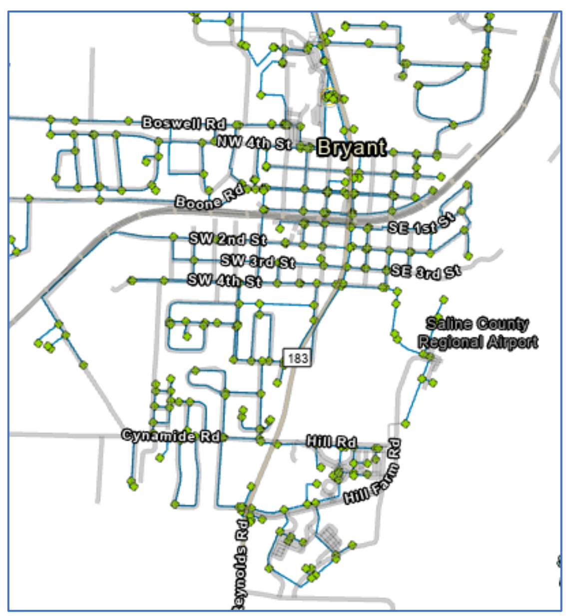


Figure IV-1: Bryant Hydraulic Model

B. Demand Allocation

The City of Bryant supplied the CAW purchased water production records from which the historical maximum day demand was established. The production data was broken down into winter (November – April) and summer (June – September) months as shown in the blue and red coloration based on yearly trends noted with the summer months averaging 3.0 MGD and winter months averaging 2.5 MGD. This breakdown was done to better represent the system, as sprinklers contribute a large portion of usage and are not utilized in the winter The City of Bryant supplied a detailed customer account list for the water customers via WaterScope that included meter numbers and meter addresses for each meter. Utilizing the two sources of data, dates were chosen to represent an average summer, average winter, and maximum day demand. Two weeks each for summer and winter usage were compared and combined to ensure data validity. The maximum day demand was produced from the week in which the maximum demand day occurred.

The water usage data included residential, commercial, irrigation, industrial, and wholesale customers. The raw data supplied by Metron over the period included several “no read” meters for each day. “No read” meters are meters that did not have a consumption value on one or more days obtained from the sample period. This no read meter could be due to either no usage, or a meter that was not installed until after the data was recorded.

In order to minimize the gaps present in the raw data, the maximum reading for each meter over the sample period was used to develop the demand allocation. For example, if a meter read a consumption value on one day out of the week sample period, the maximum consumption value recorded for that meter was used.

To account for the demand missing from the no read meters, difference between the total estimated demand and the recorded demand was then distributed evenly between all the “no read” meters for that customer class. This was also performed if there were any discrepancies in the GIS address location from the customer address provided by WaterScope where joining the data could not be performed. If a meter in the GIS layer did not match a demand provided by WaterScope, the usage was geolocated by address and not meter location and that location was utilized.

After the merger of data was completed and analyzed, the average and maximum day demand usage data specific to each meter was geolocated into the hydraulic model. The meter locations are shown in **Figure IV-2: Bryant Meter Points.**

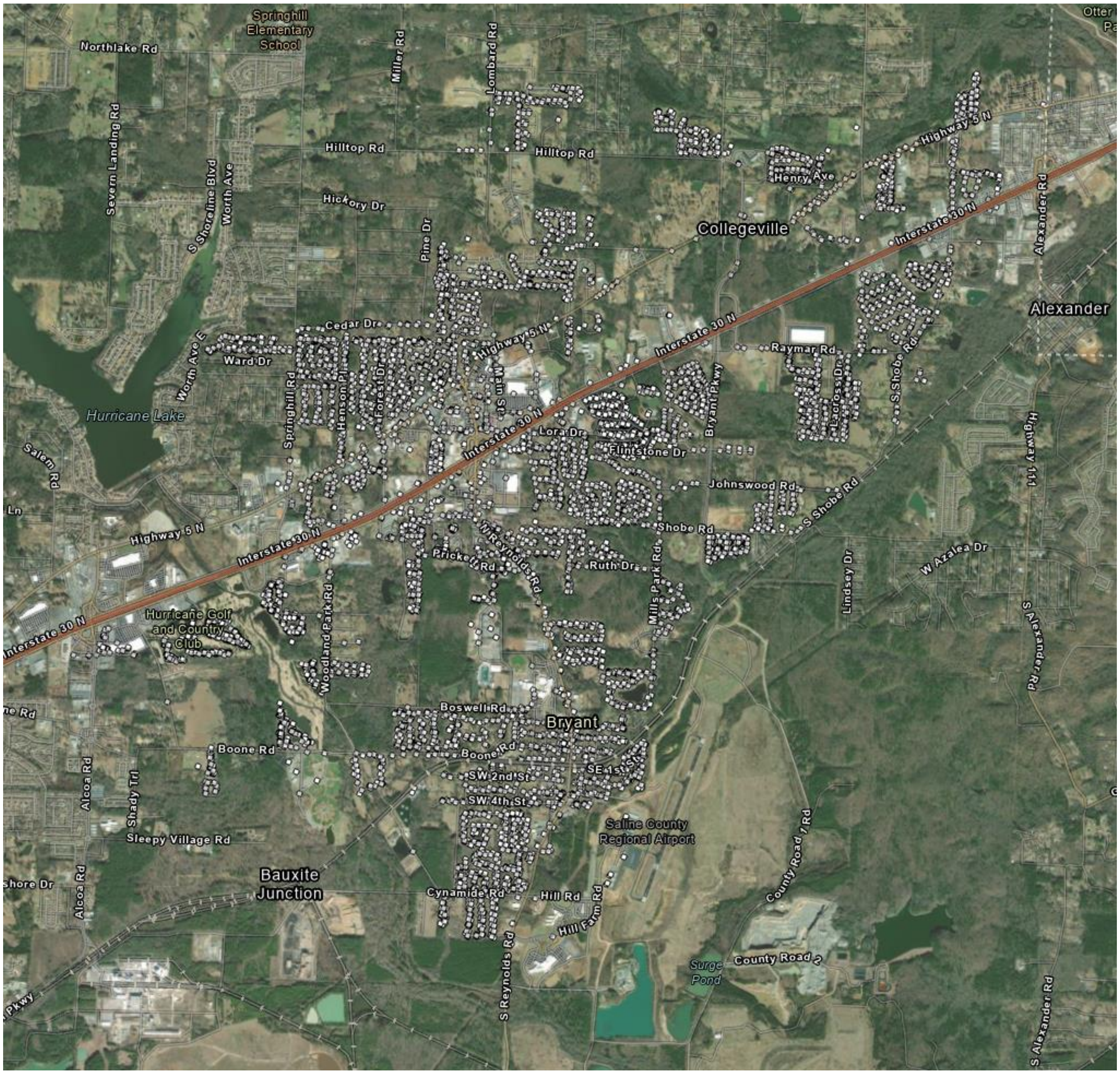


Figure IV-2: Bryant Meter Points

Hydraulic analyses of the water system included computer models for the water system demand in 2024, 2030, 2040 and 2050. Demand conditions for each model included average day and maximum day.

Demand curves were generated for each customer class for each scenario utilizing hourly reads of the same week sample periods used for customer usage and resulted in average and maximum demand curves for each meter.

The typical demand curves shown in **Figure IV-3: Max Day Demand Pattern** and **Figure IV-4: Average Day Demand Pattern** were applied to the respective scenarios to simulate conditions typical of Bryant for the given periods.

Once the overall usage for the demand periods was compiled, the data was converted from MGD demand values to an hourly peaking factor over the week which was utilized in the model as a demand pattern.

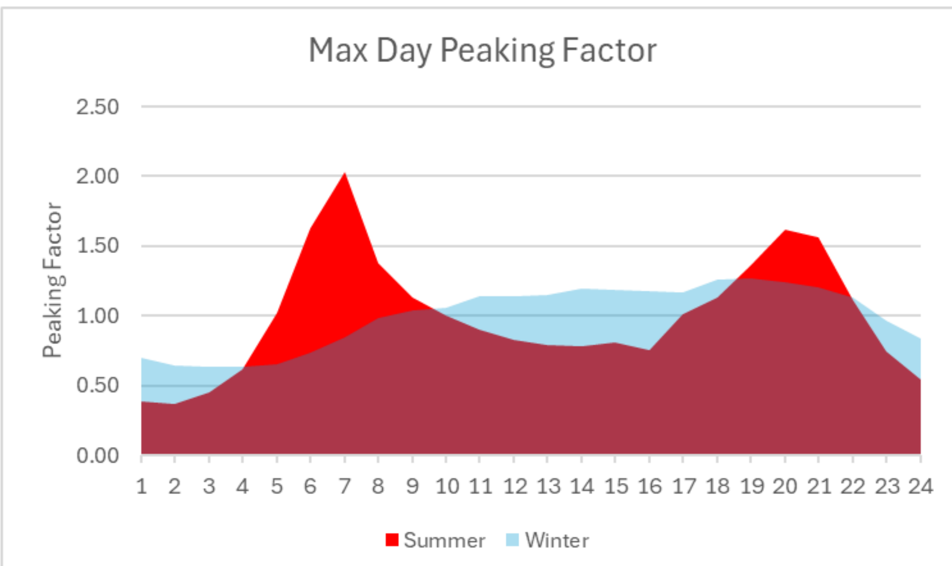


Figure IV-3: Max Day Demand Pattern

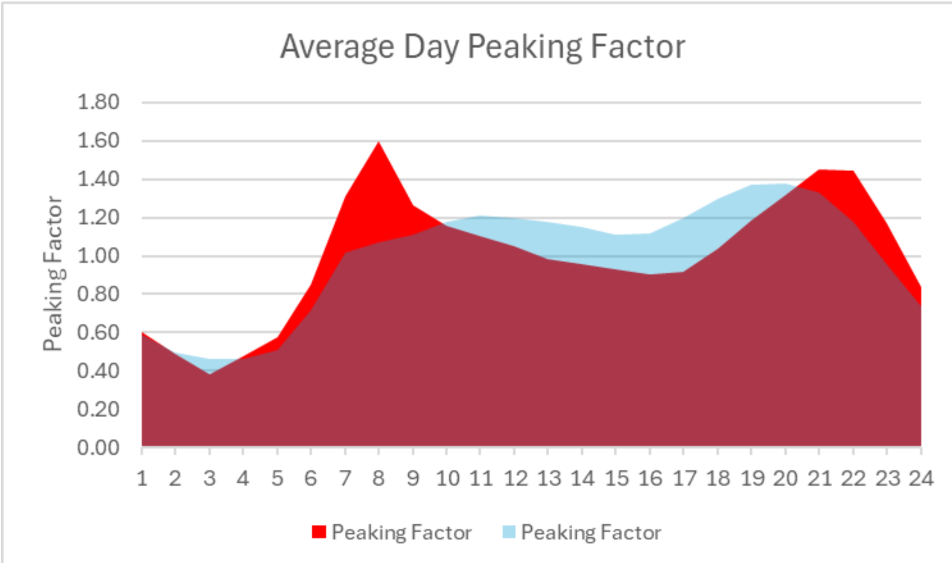


Figure IV-4: Average Day Demand Pattern

Woodland Hills is a customer of the City of Bryant through a master meter located along Shobe Road. Their demand was incorporated into the model using an intermittent 330 GPM flow rate as shown in **Figure IV-5: Woodland Hills Demand Pattern.**

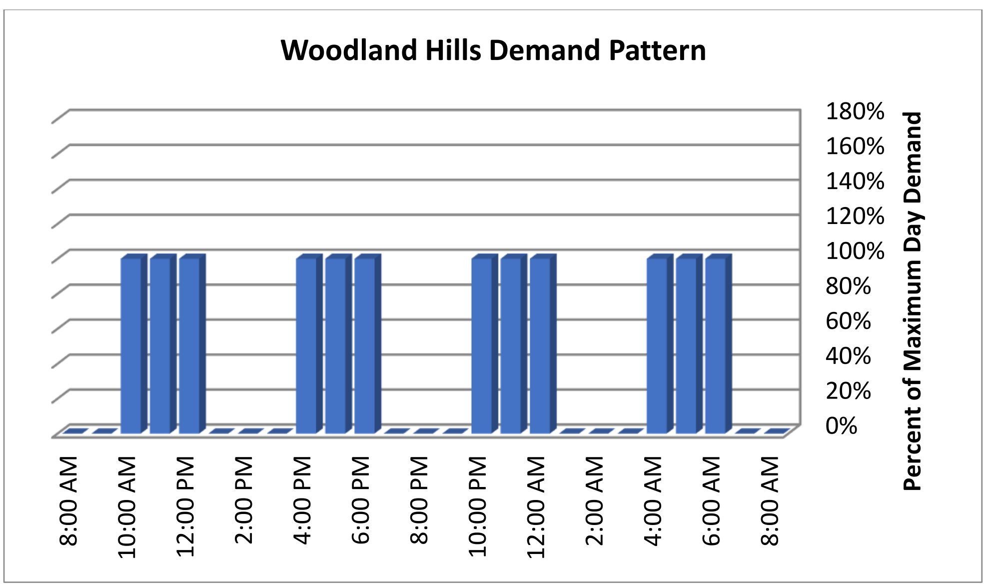


Figure IV-5: Woodland Hills Demand Pattern

C. DESIGN CRITERIA

An important factor within a water distribution system is service pressure. Service pressures within a distribution system in the range of 40 pounds per square inch (psi) to 80 psi are considered ideal. Pressures above 100 psi are not desirable because of the limitations of most common household appliances. The maximum pressure occurs when the system consumption is the lowest. Service pressures below 40 psi are undesirable, although occasional drops in isolated areas to as low as 20 psi (Arkansas Department of Health) can be tolerated. The proper use of pressure zones can help alleviate pressure problems.

Pressure fluctuation is the difference in pressure between maximum-hour and minimum-hour conditions at any location in the system. Large pressure fluctuations should be avoided to provide good service to the customers within the system. Fluctuations of 20-30 psi are considered acceptable. Head losses in distribution mains in the range of 2 to 5 feet per 1,000 feet of pipe are generally accepted. The maximum allowable velocity is most commonly 5 feet per second for pipes.

Fire flow simulations are made throughout the system to determine fire flow capabilities. Fire flow requirements are defined for different parts of the distribution system, such as 1,000 gpm for residential areas of the City and 2,000 gpm for commercial areas of the City. The computer model will simulate a fire at any user defined time of the simulation. For the purposes of this study, each fire flow was simulated at 100% of maximum day demand.

The above stated design criteria are used to determine the weaknesses in the current system and make improvements to correct them. Multiple options are simulated before a preferred option is chosen.

D. EXISTING SYSTEM SIMULATION

A 48-hour simulation based upon 2024 average day and maximum day demand conditions was initially made to determine deficiencies within the existing system. The simulation was based on a maximum day demand of 4.2 MGD as shown in **Table II-2: Water Demands**. The 2024 maximum day demand curve from the model is shown in **Figure IV-6: Maximum Day Demand**.

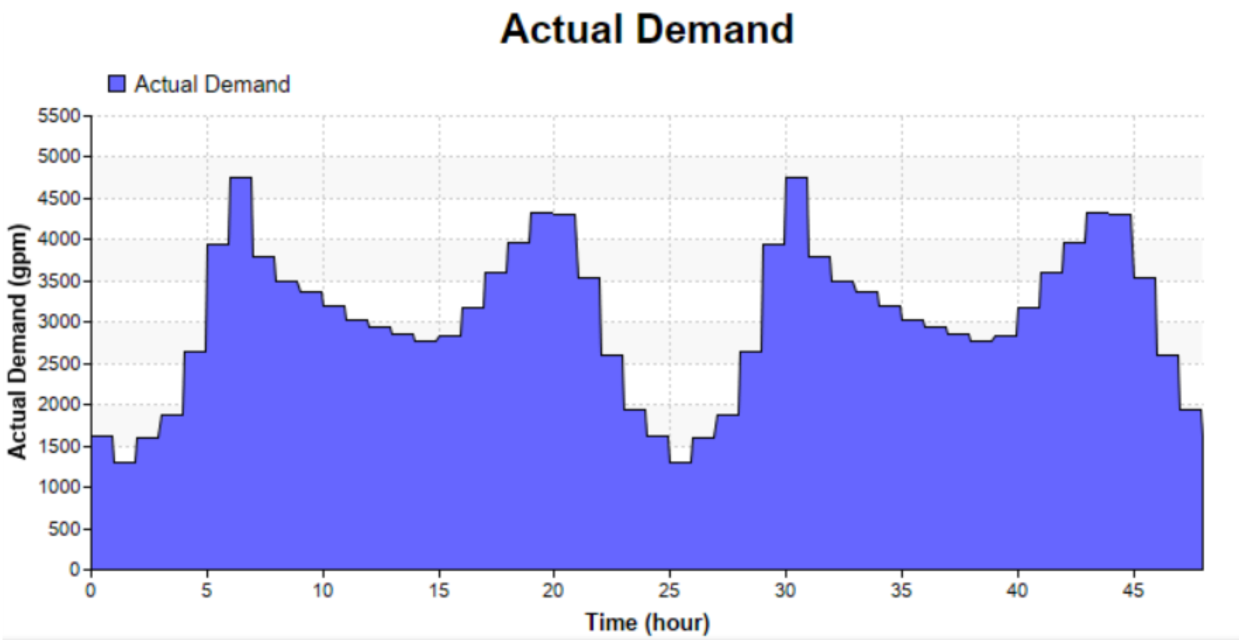


Figure IV-6: Maximum Day Demand

The model indicates that there are significant headloss problems in many parts of the system. This is a sign of a "bottleneck" problem where water lines are stressed with an overwhelming amount of flow. Velocities are also high in this area.

One such bottleneck in the system is the 8-inch water line along Highway 5 between Stoneybrook Drive and Market Place Avenue. This line experiences high velocities and high headloss and is contributing to the north tank's slow fill rate. This water line is connected to the 12-inch transmission main that runs along Highway 5 and turns north along Stoneybrook toward the north tank.

The results of the analysis of the existing system also indicated that the 8-inch transmission line along Woodland Drive from Prickett Road to the south 1-MG tank experiences high velocities and high headloss at times. This water line provides water to fill the south tank.

In addition, other various gaps in the distribution system were identified. These represent situations where the hydraulics could be improved with the installation of a short pipe connection. One such location is along Debswood Drive between South Shobe Road and Neal Street. This is an approximate 1,000 foot gap between the 6-inch water main along South Shobe Road and the 6-inch water main along Neal Street. This connection would ease water transmission through the distribution system from the north to the south.

Another location where a short connection could improve hydraulics is along Lowery Lane. Currently, there is no water line along Lowery Lane between Highway 5 and Robinwood Circle. Closure of this gap would increase water flow to and from the north tank. This connection would also increase fire flows in the area.

There is currently no water main along Sunset Meadows Drive between Highway 5 and Sunset Gardens. There is a 350 foot gap along Sunset Meadows Drive between an 8-inch water main along the north side of Highway 5 and a 6-inch water main at Sunset Gardens. This water line would increase fire flows in the area as well as provide another flow path for water to and from the north tank.

E. Fire Flow

Under maximum day demand conditions, an additional fire flow demand was applied at every junction that had a 6-inch or larger diameter pipe connected to it. This added fire flow demand simulates the water usage during the event of a fire. Fire flow simulations are typically used to pinpoint areas within a system that are subject to low volumes of available flow during a fire event.

Figure IV-7:Fire Hydrant

After reviewing the results of the available flow at each junction during a fire, the areas with poor available flows were identified. These areas were examined and compared with the low flow hydrants that had been previously identified by the Fire Department to confirm model accuracy and discover where loops could be added to improve the available flow.

Insurance Services Office (ISO) Commercial Risk Services, Inc. rates cities on their ability to provide fire protection services. Included in the rating process are the fire department's capabilities and the capability of the water system to deliver prescribed quantities of water to specific locations over a specific length of time. The current ISO rating criteria recommends the maximum needed fire flow cities should provide is 3,500 GPM for a duration of three hours dependent on the size and composition of the structure.

Figure IV-8: Fire Flows less than 1,500gpm shows areas were identified as not meeting the ISO requirements for the City's ISO 1 rating. The locations identified contain fire flows of 1,500 GPM or less.

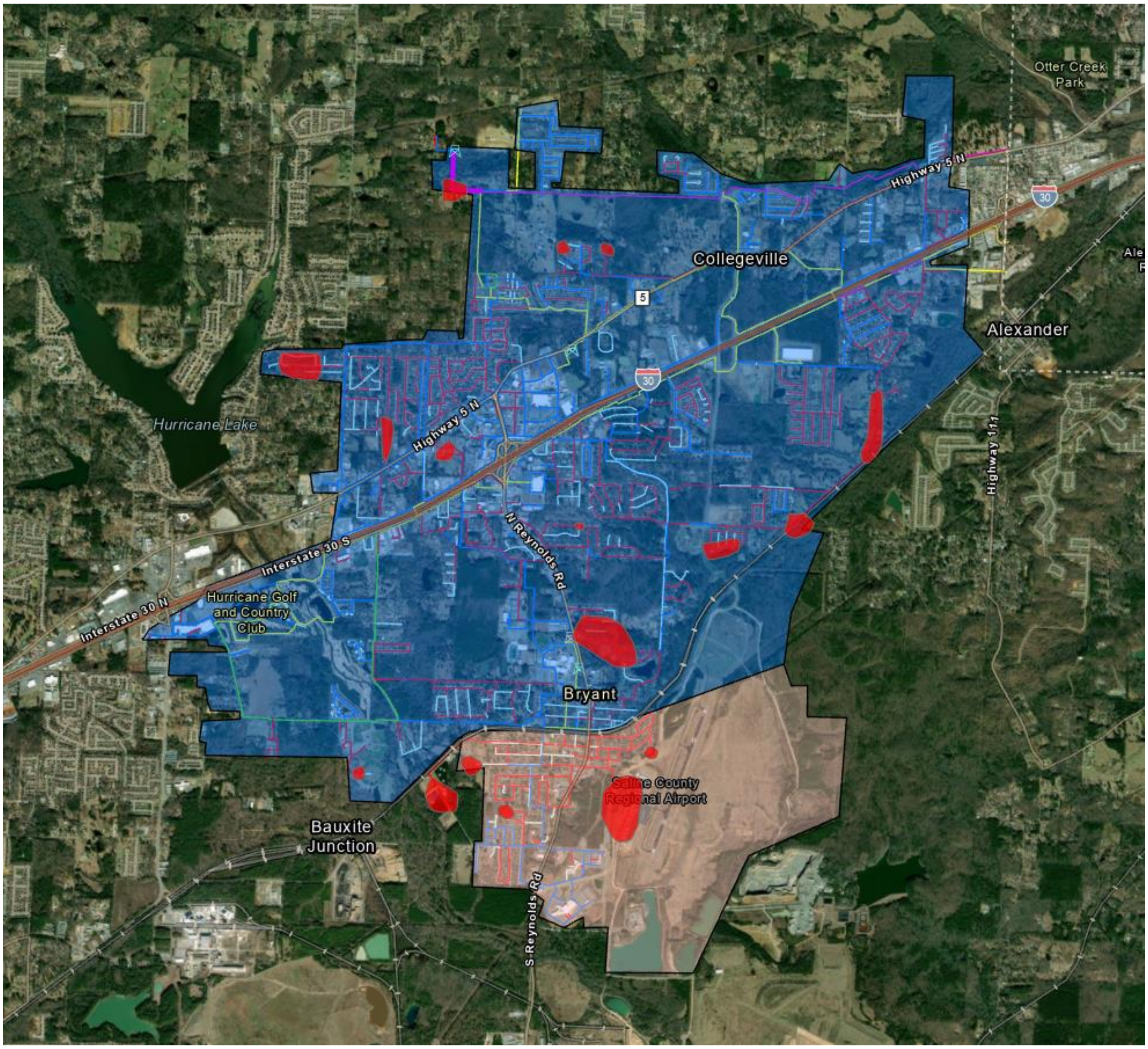


Figure IV-8: Fire Flows less than 1,500gpm

F. CAW and SRPWA Water Source Evaluation

Currently Bryant has an allocation of 4.0 MGD through CAW. This is not enough to meet the peak demands of Bryant, therefore more water allocation is recommended. For near term design, it will be assumed that the increase in water will be met through CAW. It is expected that by 2030, SRPWA's allotment of 2.0 MGD will be available, and based on preliminary engineering, a distribution tank site and transmission into Bryant via one of two proposed options are shown on **Figure IV-9: Potential SRPWA Connection** and **Figure IV-10: Pontential SRPWA Connection - Alternate**

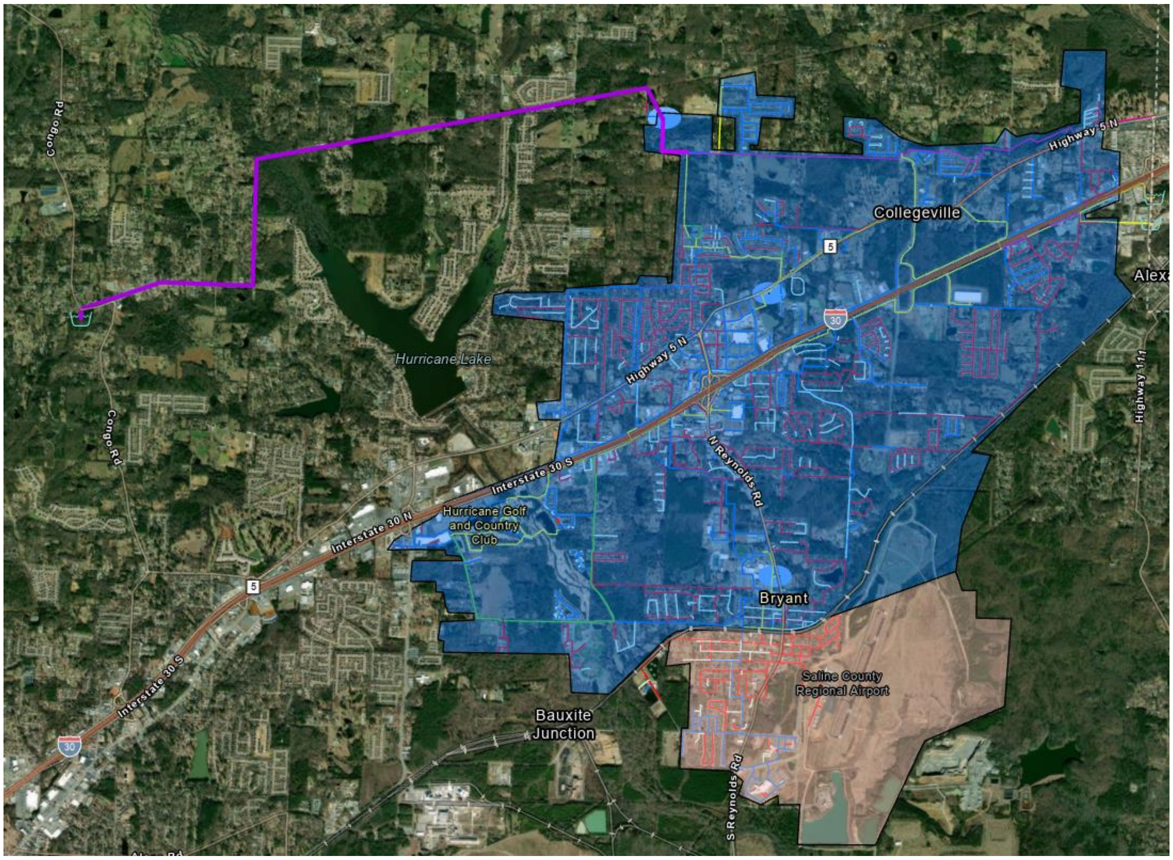


Figure IV-9: Potential SRPWA Connection

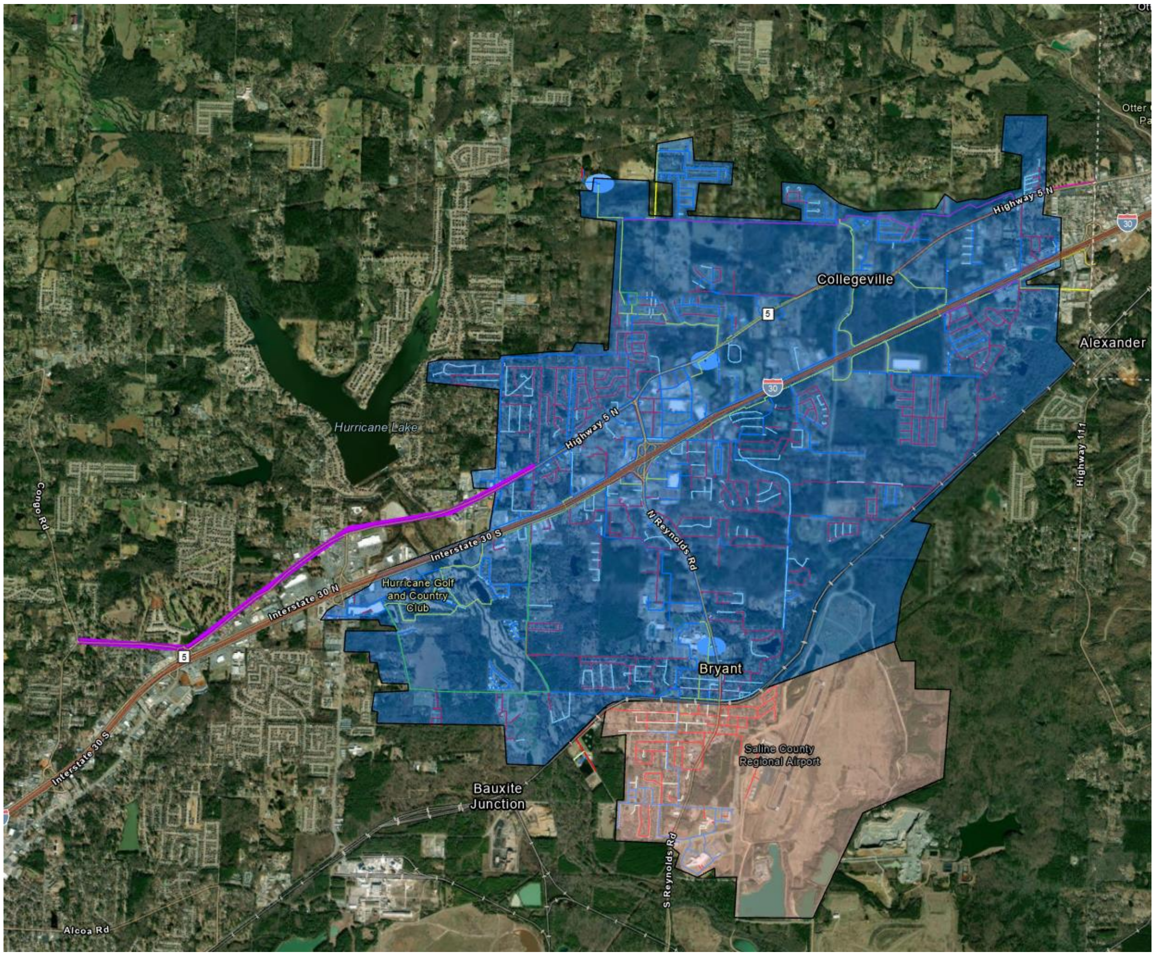


Figure IV-10: Pontential SRPWA Connection - Alternate

The assumptions made for modeling are that the CAW booster pump station will be capable of providing a maximum of 5.0 MGD to the system with the existing two pumps and distribution system, and 7.8 MGD if the pump station is expanded to three pumps and 12 inch lines downstream of the pump station are upsized to 16-inch lines to the tanks to allow for less head loss between the pump station and tanks.

The assumptions made for SRPWA water supply will be that the distribution tank will supply at 700 feet of head elevation and that the water will flow by gravity into Bryant's distribution system. In the event the capacity, pressure, or location of the SRPWA connection does not match the currently projected design, further evaluation will be required in the form of a Master Plan update.

1. CAW Only Scenario

In the scenario that CAW is the only source of water to Bryant, all water demands would need to be provided via the two existing meter locations. The existing pump station pumps would be capable of providing 5.0 MGD to the system continuously. An additional pump installed would allow for 6.7 MGD, and installing a parallel 16-inch waterline from the pump station to the 2-million gallon tank as well as an additional 12-inch waterline from the central tank to the south tank would provide the system with a 7.8 MGD Capacity. This would provide flows to the system into 2050.

2. SRPWA Only Scenario

In the scenario that Bryant receives all of its water supply from SRPWA, improvements would be required to allow for the water to flow from north to south or west to east, as currently the system is balanced flowing from east to west.

This would require large line upgrades of an 18-inch waterline from the North Tank at the SRPWA proposed water meter to the Highway 5 Tank and an additional 16-inch waterline from the Highway 5 Tank to the South Tank in order to balance flows across the system in the first SRPWA connection scenario.

With the alternate route for SRPWA connection, an 18- inch line would be required to extend from the connection site at Springhill and Highway 5 to the Highway 5 tank and a 12- inch extension from Highway 5 Tank to the South Tank as well as other improvements indicated in the improvements section along Springhill Road and along Boone Road. With these upgrades, the system would be capable of receiving up to 9 MGD from SRPWA continuously.

3. SRPWA Average Demand with CAW Peak Capacity

The third scenario involves receiving a base flow from SRPWA of 2 MGD in 2030, to 4 MGD in 2050. Any additional water needed would involve utilizing the existing booster pump station at CAW meter to supplement the system. This would still require line upgrades in 2040 in order to exceed 3 MGD, those being an additional waterline from the north tank to the central tank, and an additional water line from the central tank to the south tank. Utilizing both water supplies would allow for water to balance head across the system and CAW meter station at 5 MGD plus 4 MGD from SRPWA would be capable of providing the system water beyond 2050. This scenario would result in the best system hydraulics long-term therefore is the recommended scenario to pursue.

4. Wheeling Wholesale Water to Consecutive Systems

The proposed plan for SRPWA connection includes a potential necessity of Bryant to provide water to additional customers via wheeling water through its system to the other utilities. Currently Bryant provides wholesale water to Woodland Hills. Additional connections to the Shannon Hills and East End systems would be required to provide water to those communities from SRPWA. SRPWA would bear the cost of any improvements needed to convey water through Bryant and to these communities.

a) Woodland Hills

Bryant currently provides water to Woodland Hills and would not require any additional infrastructure to accommodate the water to Woodland Hills at the expected demand of 100,000 to 150,000 gallons per day.

b) Shannon Hills

Shannon Hills is located East of Bryant. Shannon Hills has an expected demand of 500,000 to 750,000 gallons per day. An extension from the 12-inch waterline along I-30 near Millbrook Dr to Shannon Hills would be required in order to provide water to Shannon Hills. There is currently sufficient infrastructure within Bryant to provide water to the 12-inch connection location.

c) East End

East End is located south-east of Bryant. East End has agreed to water in the amount of 850,000 to 1,275,000 gallons per day from SRPWA. An extension from Bryant near South Reynolds Rd and Hill Farm Rd to East End via Sardis Rd would be required to provide water to East End. Within Bryant water system, a 12-inch waterline extension from the 12-inch along Renyolds Rd and Rich St to the connection point at South Reynolds Rd and Hill Farm Rd would be required to allow demands to be met within the system. The 16-inch extension recommended from Highway 5 Tank to the new South Tank would also be required to meet the full demands of Bryant and East End combined.

V. System Improvements

The system improvements were evaluated based on hydraulic modeling of average and maximum day demands for the current system, and the system demands in years 2030, 2040, and 2050. Based on these scenarios, improvements were developed and separated in near, mid, and long term improvements. Near-term improvements are improvements that are most needed to meet the needs of the system within 0 – 10 years. Mid-term improvements look at improvements that will be needed to meet system demands in the 10 – 20 year range. Long-term improvements look at improvements needed to meet the 20+ year range of demands and are based on service to customers, reliability, and fire flow demands. The improvement timeframe recommendations can change based on new construction, street projects, and other system changes that may require long term improvements to become higher priority.

A. Near-Term Improvements

1. 609 Pressure Zone Expansion / Removal of South Pressure Zone

Several customers within the South Pressure Zone have experienced low pressure issues, specifically at the Hill Farm Elementary. In a review of the system service elevations, current customers within the South Pressure Zone have similar service elevations to the lower elevations within the North Pressure Zone. Replacing the South tank (540 overflow elevation) with a tank at elevation 609 feet to match the North Pressure Zone would result in an increase of approximately 30 psi. This pressure increase would result in pressures up to 120 psi within the South Pressure Zone and is within allowable working pressures of the existing system infrastructure. One issue that could arise from this conversion is ensuring customers do have pressure reducing valves on their service lines prior to increasing pressure to ensure the pressure is within acceptable limits for fixtures and faucets. Below is a list of the improvements needed to complete the pressure zone conversion.

a) Improvement1: 1.5 Million Gallon Tank @ N. Reynolds / High School

Removal of the 1.1 million gallon South Tank and replacement with a 1.5 million gallon composite elevated tank at service elevation 609' with a head range of 45 feet to match the existing 2.5 million gallon tank on Highway 5. The 1.5-million-gallon sizing of an elevated tank would equate to approximately 1,000,000 gallons in additional useful storage, allowing for sufficient storage for the future while converting the entire system to 1 pressure zone and resolving low pressure issues within the South Pressure Zone.

b) Improvement 2: Boone Road 12-inch Extension

Once the South Pressure Zone is brought to match the overflow elevation of the North Pressure Zone pressures, a connection can be made between the 12 inch on Boone Road with the 10 inch waterlines on Woodland Park Road and Boone Road. This 5,000 foot extension would allow for more flow into the south area of Bryant and allow the Highway 5 Tank and new South Tank to better float together.

2. System Fireflow and Reliability Improvements

a) Improvement 3: Springhill South of I30 to Highway 5 – 16-inch Extension

Bryant currently has three crossings along Interstate 30; an 8-inch near Hunter Lee Pkwy, a 16-inch at Market Place Ave, and a 12-inch near Prickett Rd. There is not an interstate crossing on the west side of Bryant, and it is recommended that a 16-inch be installed across I-30 to connect the 12-inch south of I-30 to the 8-inch waterlines along Highway 5 for a total length of 2,100 feet. The recommended line sizing of 16- inch is to better prepare for future line improvements needed for when SRPWA begins to provide water to Bryant.

b) Improvement 4: Woodland Hills Metron Meter and Vault

Currently, the Woodland Hills wholesale connection utilizes a meter owned by Woodland Hills and is not metered via an advanced meter capable of recording water usage through WaterScope. It is recommended that Bryant install an Advanced Metering Infrastructure (AMI) meter to be capable of recording usage data on this meter, allowing better information on flows to Woodland Hills.

c) Improvement 5: Airport Road to Hill Road – 8 inch Extension

Airport Rd currently does not have sufficient fireflow to meet system demands. Hill Rd currently has low pressure during maximum day demands. Looping these two lines via an 8-inch 900 ft extension would both increase pressure to the schools at Hill Rd and allow for better fireflow at the Airport.

d) Improvement 6: Bryant Pkwy, Raymar Rd to Johnsonwood – 8-inch Extension

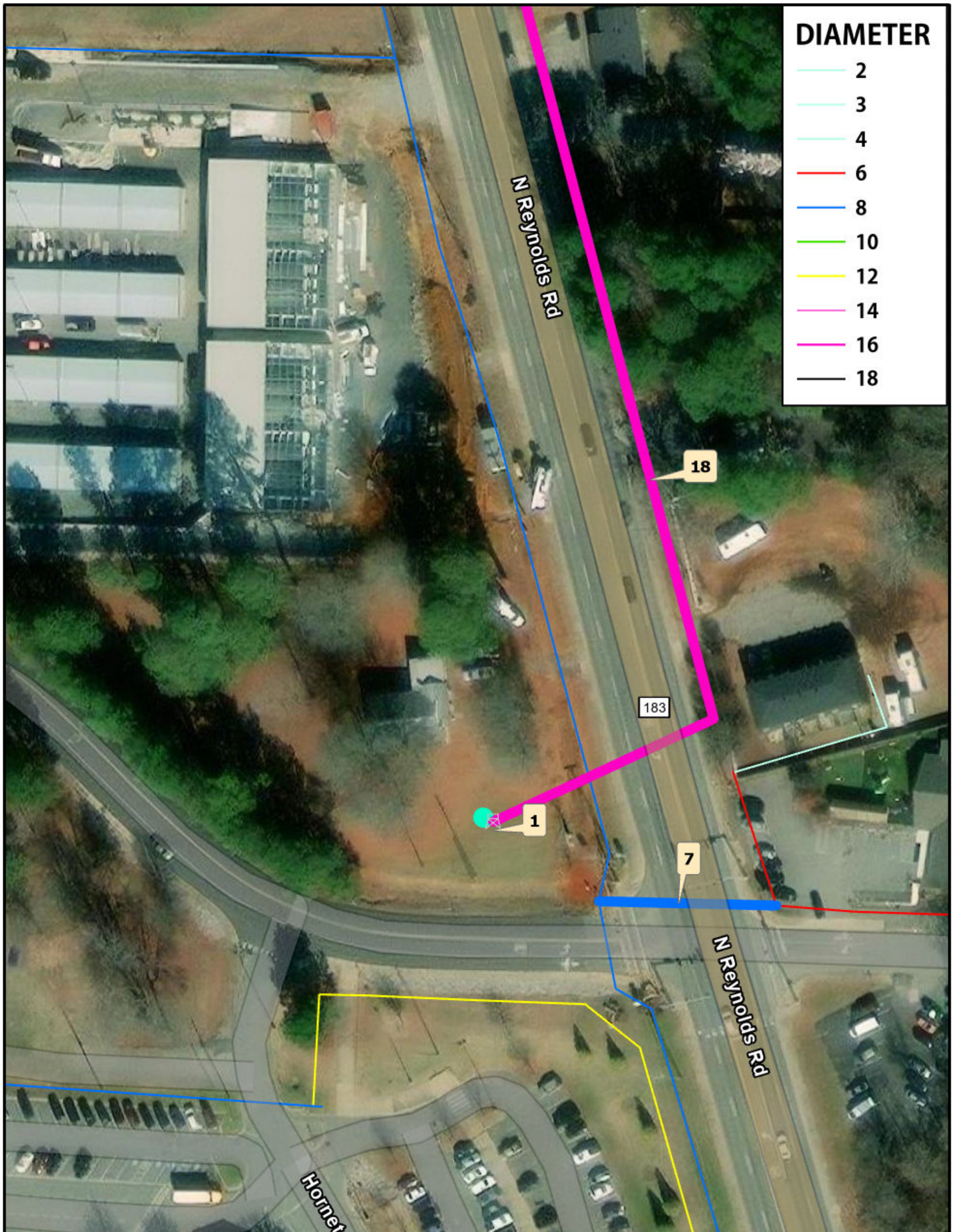
Currently Bryant does not have a waterline extending along Bryant Pkwy. An 3,700 ft extension along Bryant Pkwy would improve fireflows along Shobe Rd and Cherry Creek Cir, where fireflow was noted to be less than 1,000 gpm in some areas. This would also allow for better flows into the Woodland Hills wholesale meter.

e) Improvement 7: North Reynolds Rd at Rogers Rd – 8-inch Connection

Low fireflows and an extended dead end area were indicated by Bryant staff at Rogers Rd and Bristol Dr. These findings concurred with results shown by the model. A 100 ft 8-inch extension across N. Reynolds Road would allow for this section of the system to become looped. This would both improve fireflow in the Rogers Rd area and allow for the closing of valves in the area while maintaining water to customers in the event of a main break.

f) Improvement 8: Woody Dr to Steeplechase Cir – 8-inch Connection

Insufficient fireflows and an extended dead end area were indicated by the model along Woody Dr. A 400 ft 8-inch extension from Steeplechase Dr to Woody Dr would allow for this section of the system to become looped, improving reliability and fireflow.



DISTRIBUTION SYSTEM - IMPROVEMENT #1

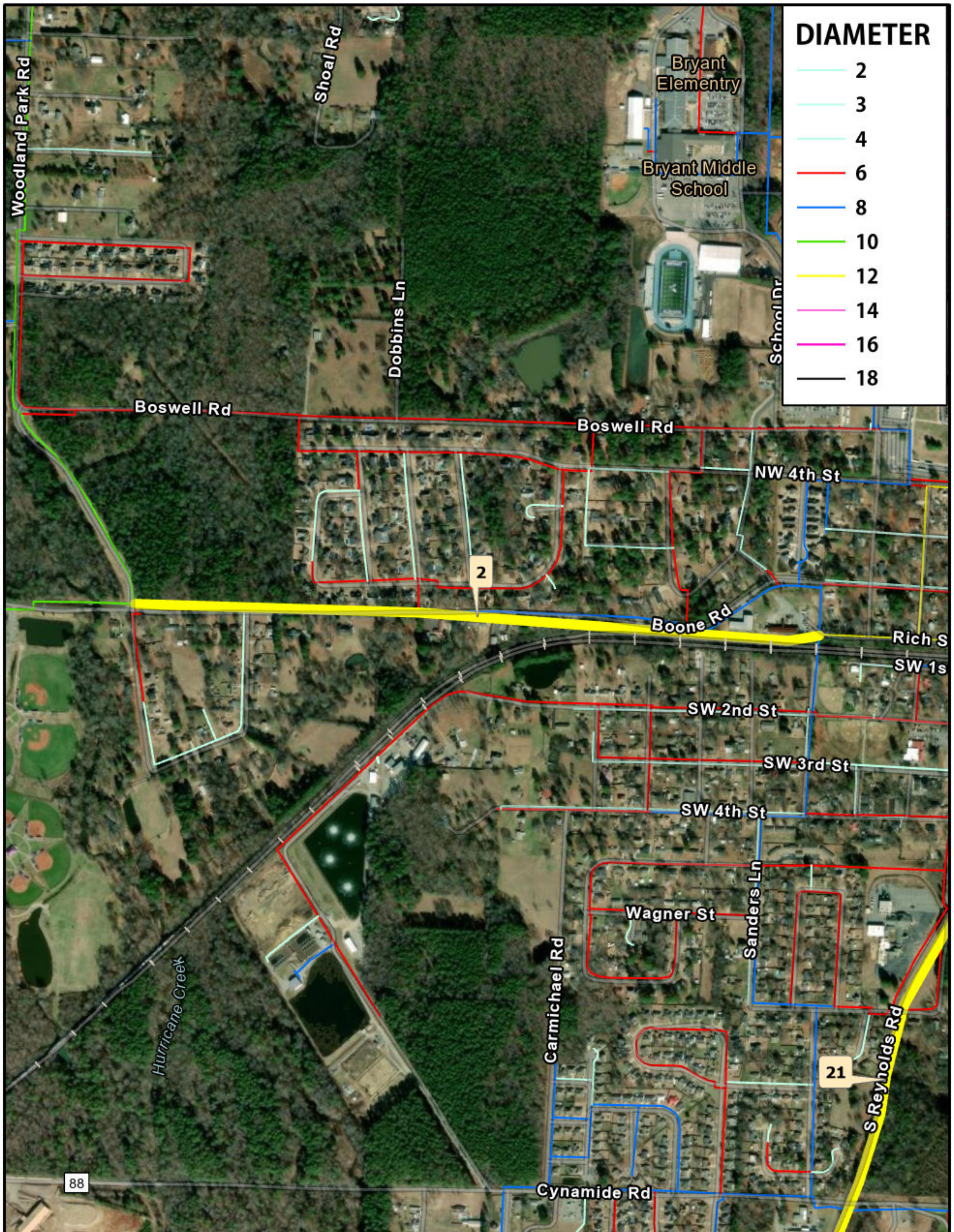
1,500,000 GALLON TANK @ N. REYNOLDS ROAD

CITY OF BRYANT, AR

0 35 70 140
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #2

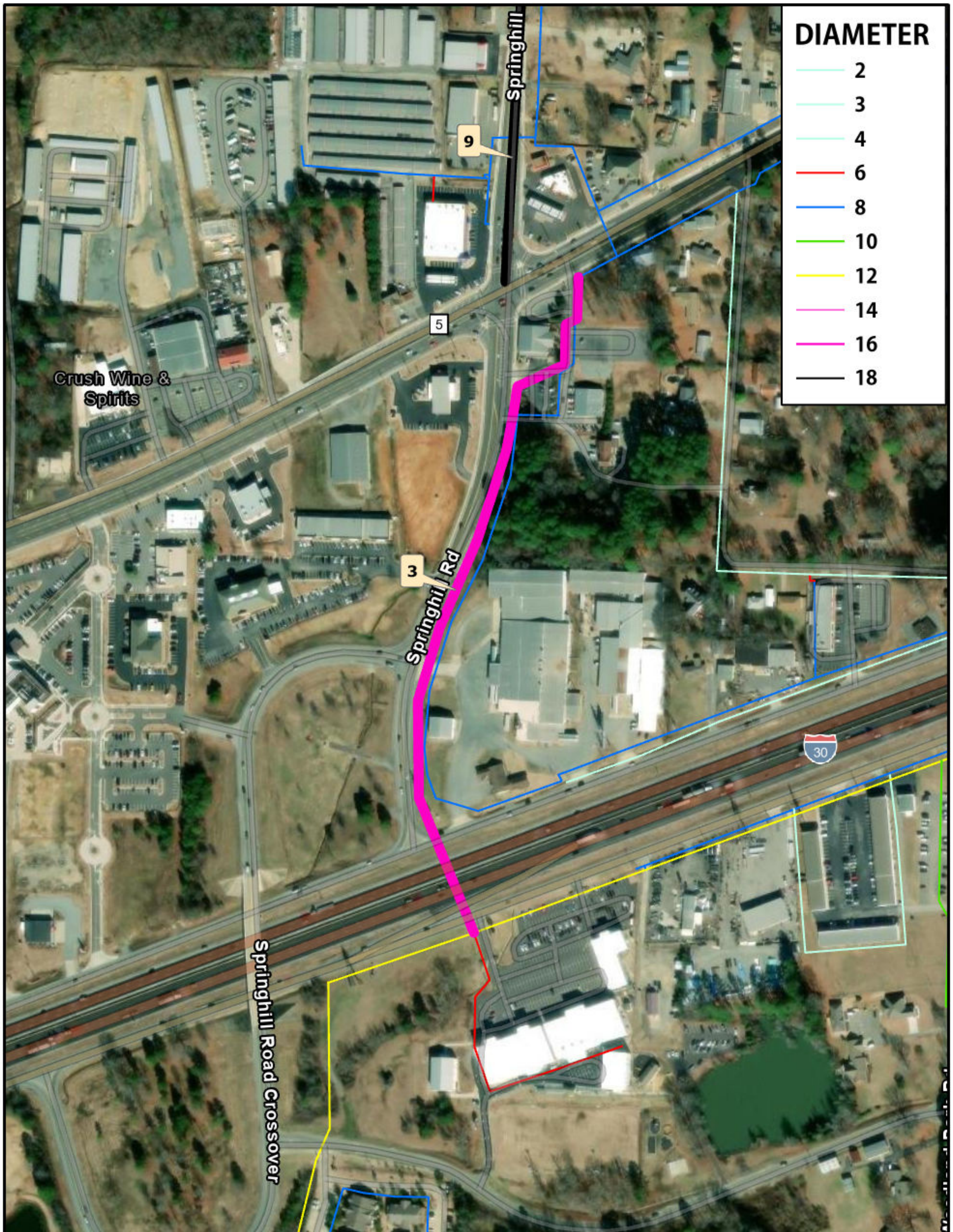
BOONE ROAD IMPROVEMENT

CITY OF BRYANT, AR

0 350 700 1,400
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #3

SPRINGHILL, I30 TO HIGHWAY 5 N

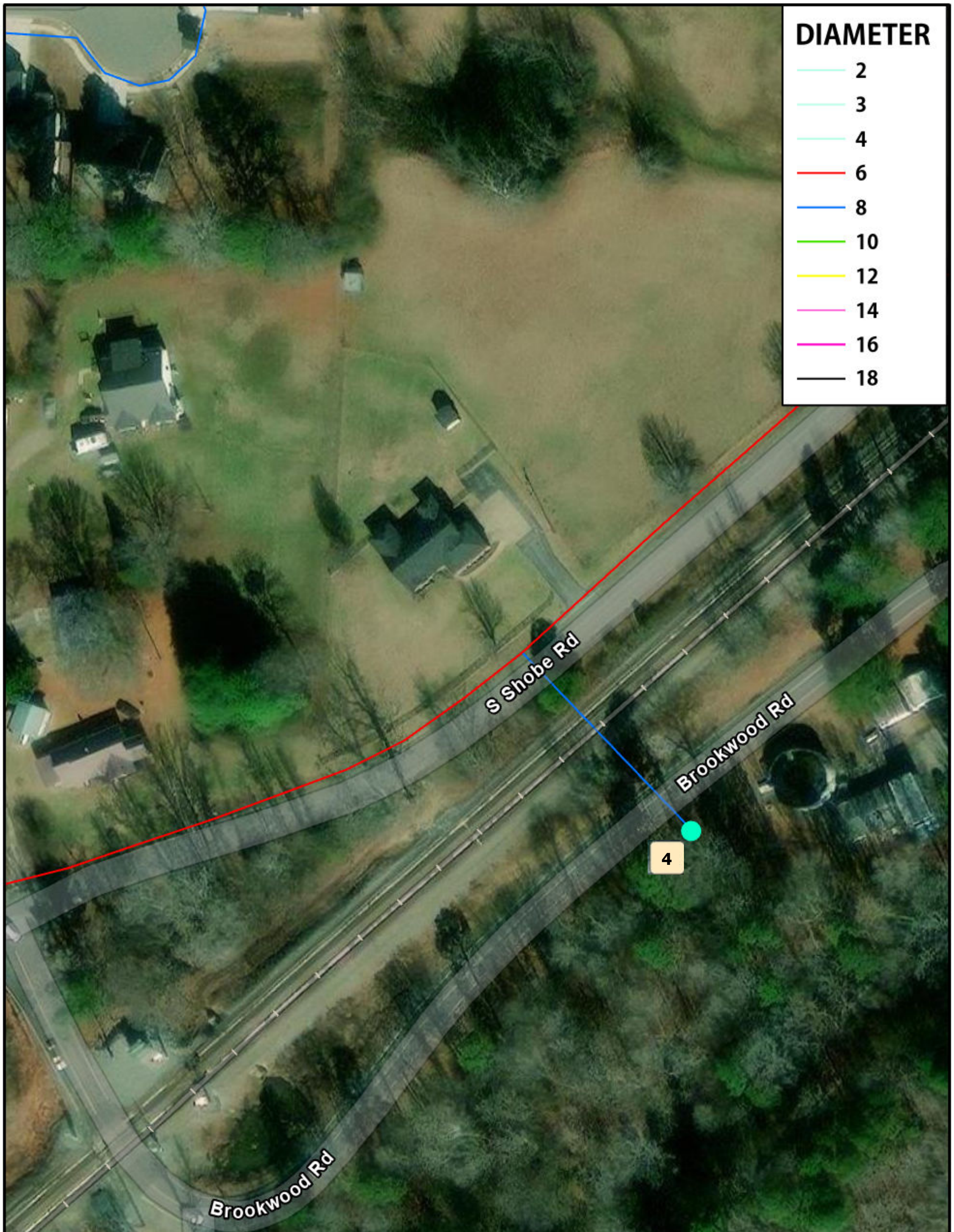
CITY OF BRYANT, AR

0 140 280 560
Feet

CRIST ENGINEERS, INC.

CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #4

WOODLAND HILLS METRON METER AND VAULT

CITY OF BRYANT, AR

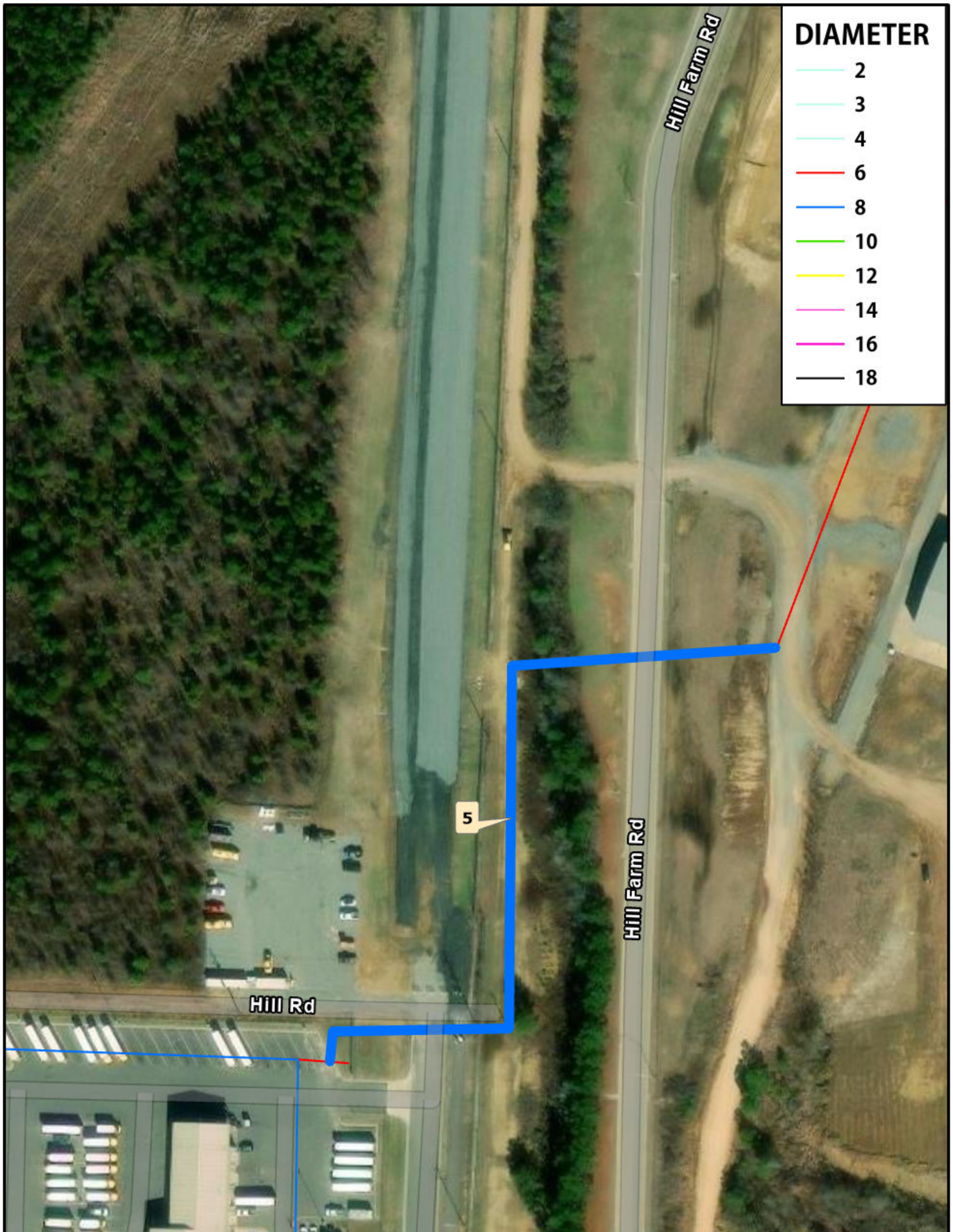
0 35 70 140

Feet

CRIST ENGINEERS, INC.

CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #5

AIRPORT TO HILL ROAD

CITY OF BRYANT, AR

0 50 100 200
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024

DISTRIBUTION SYSTEM - IMPROVEMENT #6

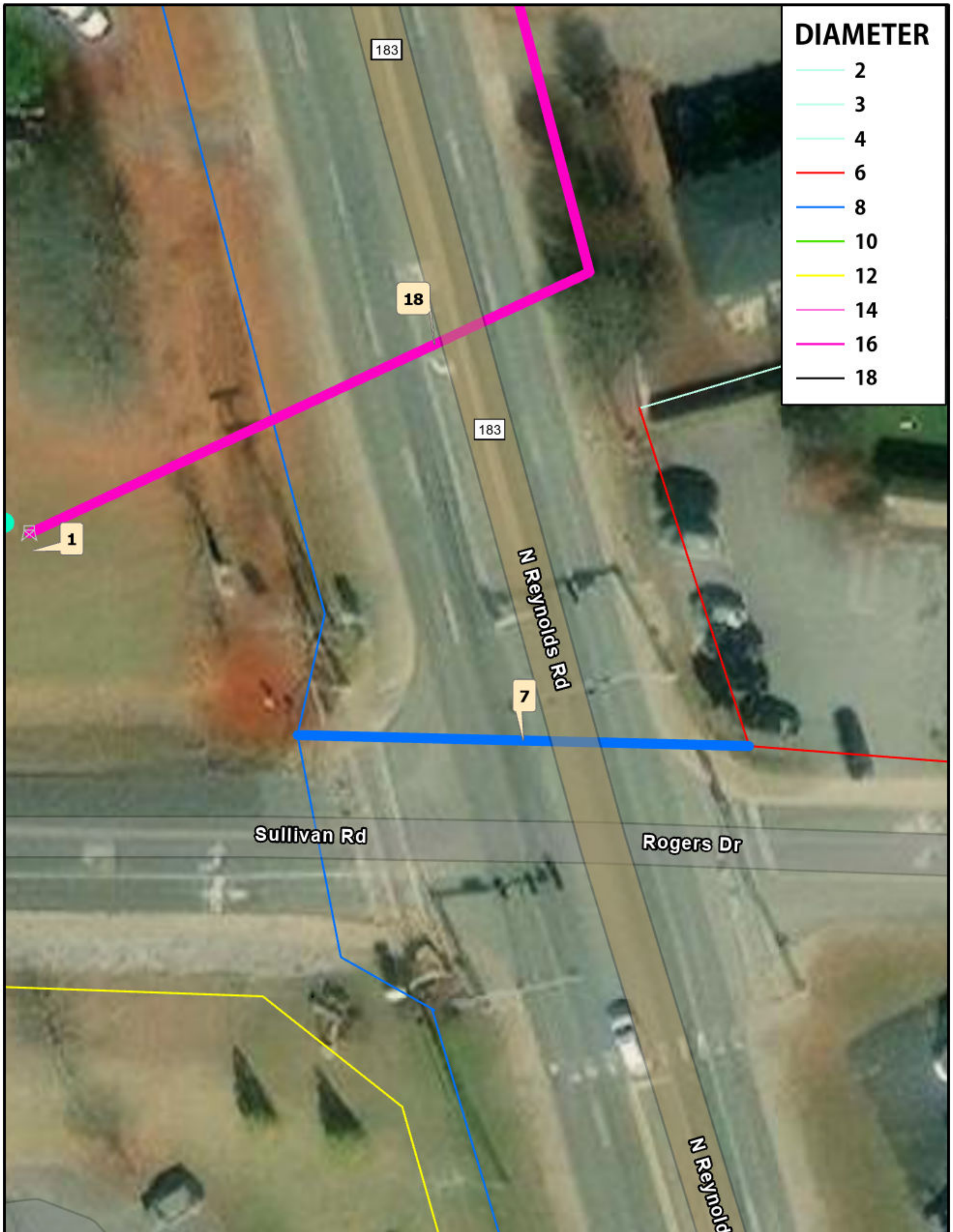
BRYANT PKWY I30 TO JOHNSWOOD

CITY OF BRYANT, AR

0 180 360 720
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #7

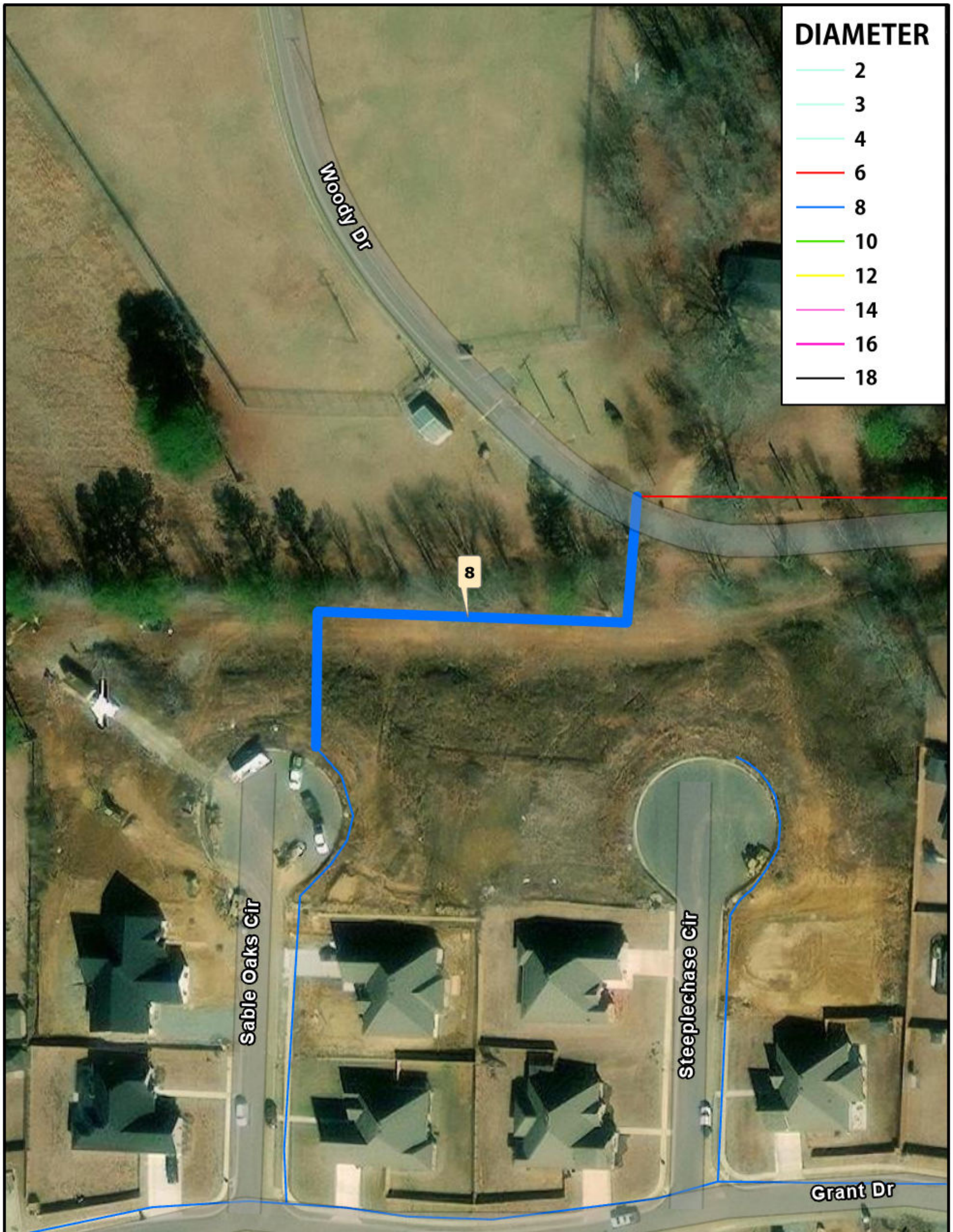
N. REYNOLDS RD AT ROGERS DR

CITY OF BRYANT, AR

0 13 25 50
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #8

WOODY DR TO STEEPLECHASE CIR

CITY OF BRYANT, AR

0 35 70 140
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024

B. Mid-Term System Improvements

1. SRPWA Connection Improvements

When Bryant begins receiving water from SRPWA, improvements will be required to allow the water coming into the system to be transmitted throughout the system equally. This is discussed under IV.F CAW and SRPWA Water Source Evaluation on page 33. Improvements will also be required to allow the tanks to float along similar head ranges when water is received from the west or north.

a) Extension from SRPWA Connection to Hwy 5 Tank

This improvement involves one of two improvement depending on the SRPWA Connection Site.

i) Improvement 9: North Tank to Hwy 5 Tank

In the case the SRPWA water connection point is adjacent to the North Tank, an 18-inch waterline extension of 10,000 feet is required to allow the water incoming to fill the Hwy 5 tank via gravity.

ii) Improvement 9A: Springhill Rd to Hwy 5 Tank

In the alternate scenario that SRPWA water is provided along Hwy 5 at Springhill Rd, an 18-inch 12,000 ft extension is required from the meter to the Highway 5 Tank following Springhill Road and Cedar Dr is required to allow Highway 5 Tank to fill via gravity from SRPWA.

b) Improvement 10: Connection of Services Before CAW Pump Station along I-30

Currently, there are services that receive water from Bryant prior to the booster pump station at I-30 when receiving water from CAW. These services must be tied into the system or after the booster pump station or ensuring a means to bypass the pump station to ensure water is provided to these customers in the event the CAW meter is closed.

2. System Fireflow and Reliability Improvements

a) Improvement 11: Chlorination upgrades at CAW Booster Pump Station

The Booster Pump Station that allows water provided from CAW to fill the North Pressure Zone has concerns with its chlorination unit. The chlorination unit currently leaks which has caused corrosion to components inside the chemical room. It is recommended that the chlorination system be replaced in order to prevent further damage to the booster pump station structure in the event chlorine boosting is required on water received from CAW.

b) Improvement 12: Forest Dr and Highway 5 – 8-inch Interconnect 350

Two 8-inch waterlines currently dead end at Forest Dr and Highway 5. This improvement would connect the two dead end waterlines with the 8-inch waterline on the west side of Forrest Drive. This improvement would result in increasing available capacity to the area as well as reduce dead ends in the system, improving water quality.

c) Improvement 13: Debswood to Carywood Dr – 6-inch Loop

Model indicated deficient fireflows are located at the end of Neal St. Looping Carywood Dr and with Debswood Dr and Neal St with an 800 ft 6-inch extension would allow for fireflow demands to be met on Neal St. This would also improve system resiliency in the event of a main break, reducing the number of customers out along Debswood Dr and Neal St.

d) Improvement 14: Highway 5 to Lowery Ln – 8-inch Extension

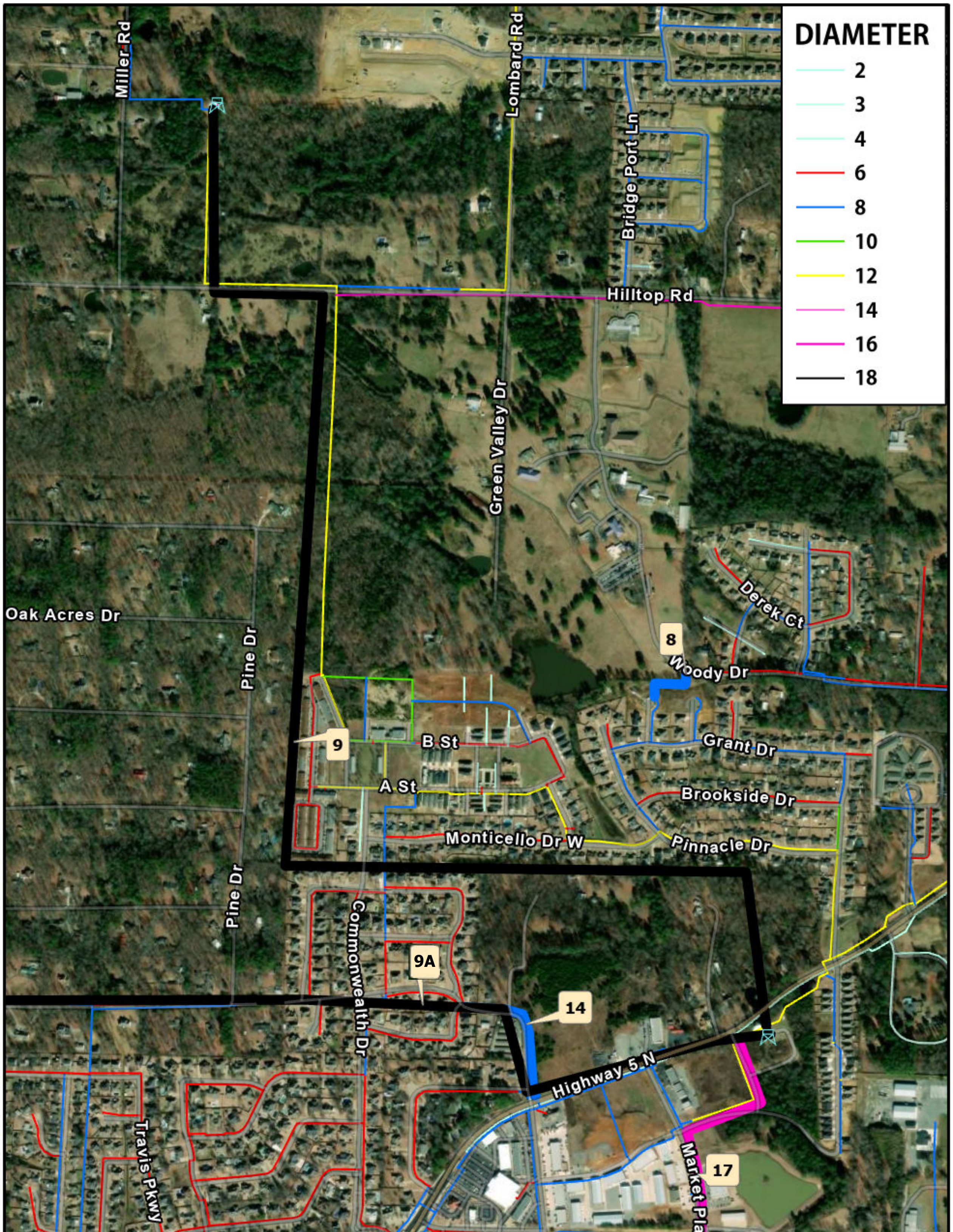
Highway 5 and Lowery Ln currently connect via a 2-inch waterline along Lowery Ln. It is recommended to install a 1,000 ft 8-inch waterline extension to connect Lowery Ln and Highway 5. This would provide a looped connection between Highway 5 and Lowery Ln.

e) Improvement 15: Sunset Meadows Dr – 8-inch Extension

This improvement involves installing a 350 ft 8-inch loop connecting Sunset Meadows Dr with Highway 5. This improvement is recommended for water quality on Sunset Gardens Dr as well as to increase reliability within the system by looping an existing dead-end waterline.

f) Improvement 16: Ward Dr – 6-inch Extension

Insufficient fireflows along Stivers Blvd and Ward Dr were indicated by hydraulic modeling. Extending the 6-inch along Ward Dr to Springhill Road would allow for a looped connection along these roadways. This extension involves 1,200 feet of 6- inch waterline to improve fireflows.



DISTRIBUTION SYSTEM - IMPROVEMENT #9

SRWRPA EXTENSION NORTH TANK TO HWY 5 TANK

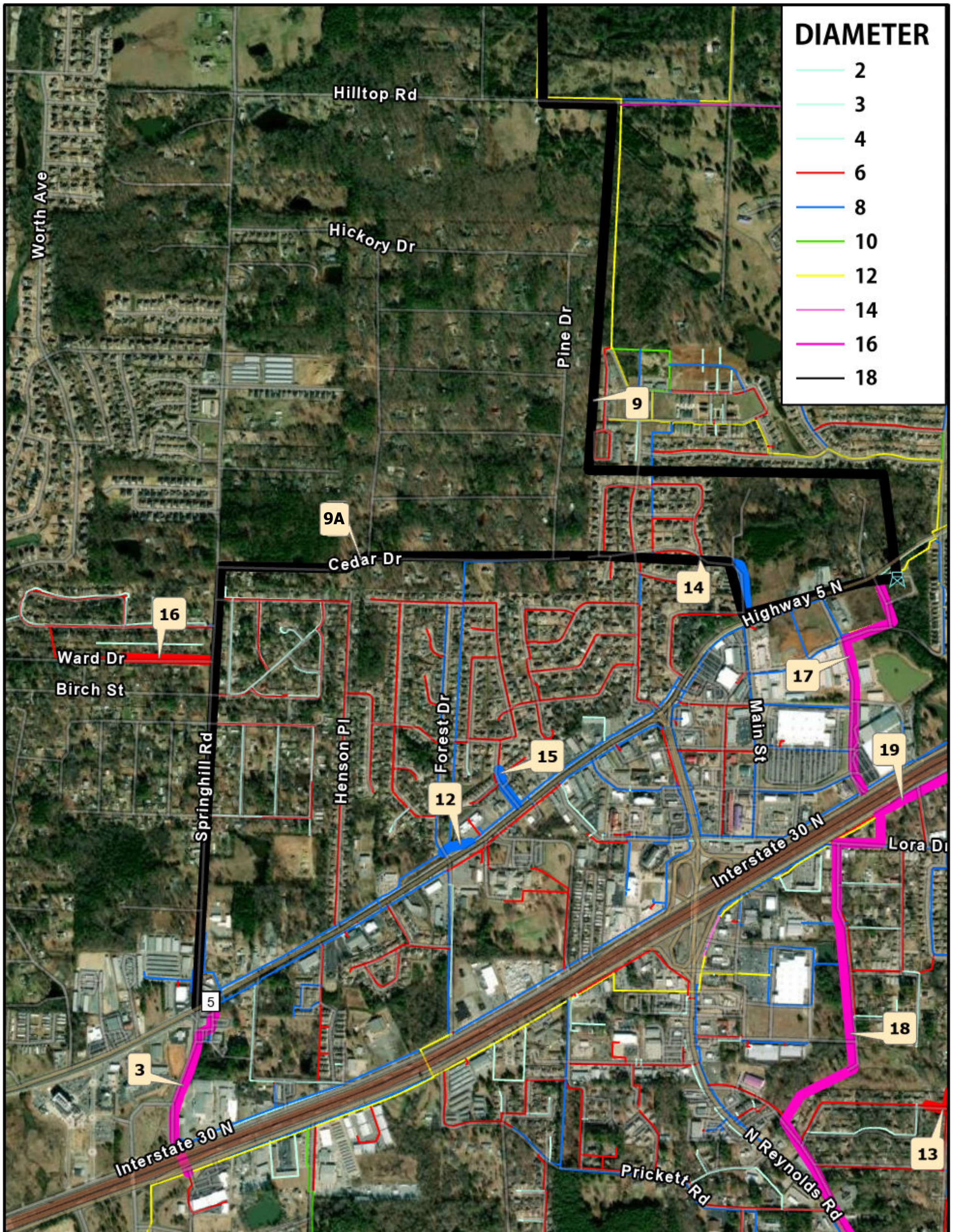
CITY OF BRYANT, AR

0 350 700 1,400
Feet

CRIST ENGINEERS, INC.

CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #9A

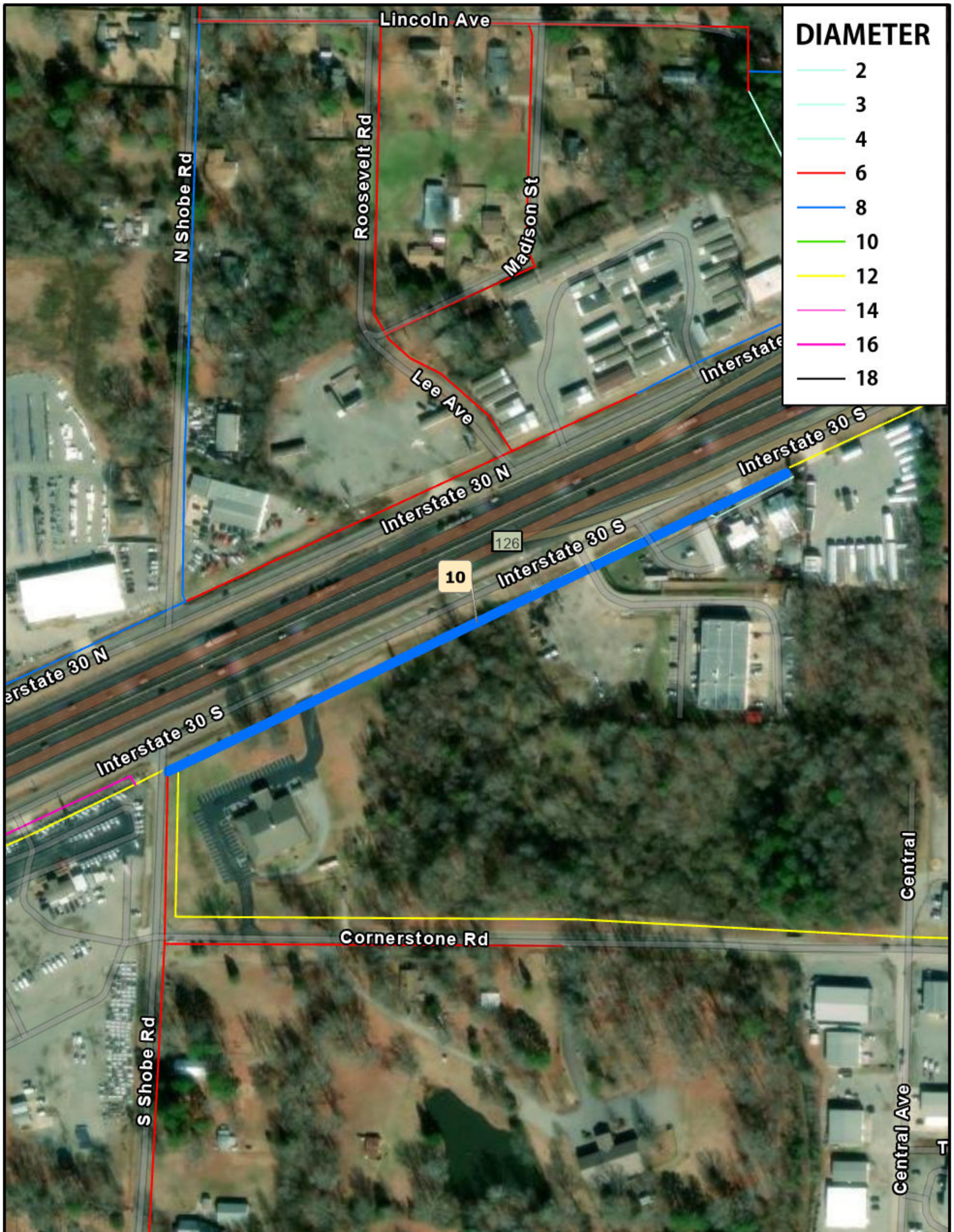
ALTERNATE SRPWA EXTENSION TO HWY 5 TANK

CITY OF BRYANT, AR

0 500 1,000 2,000
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #10

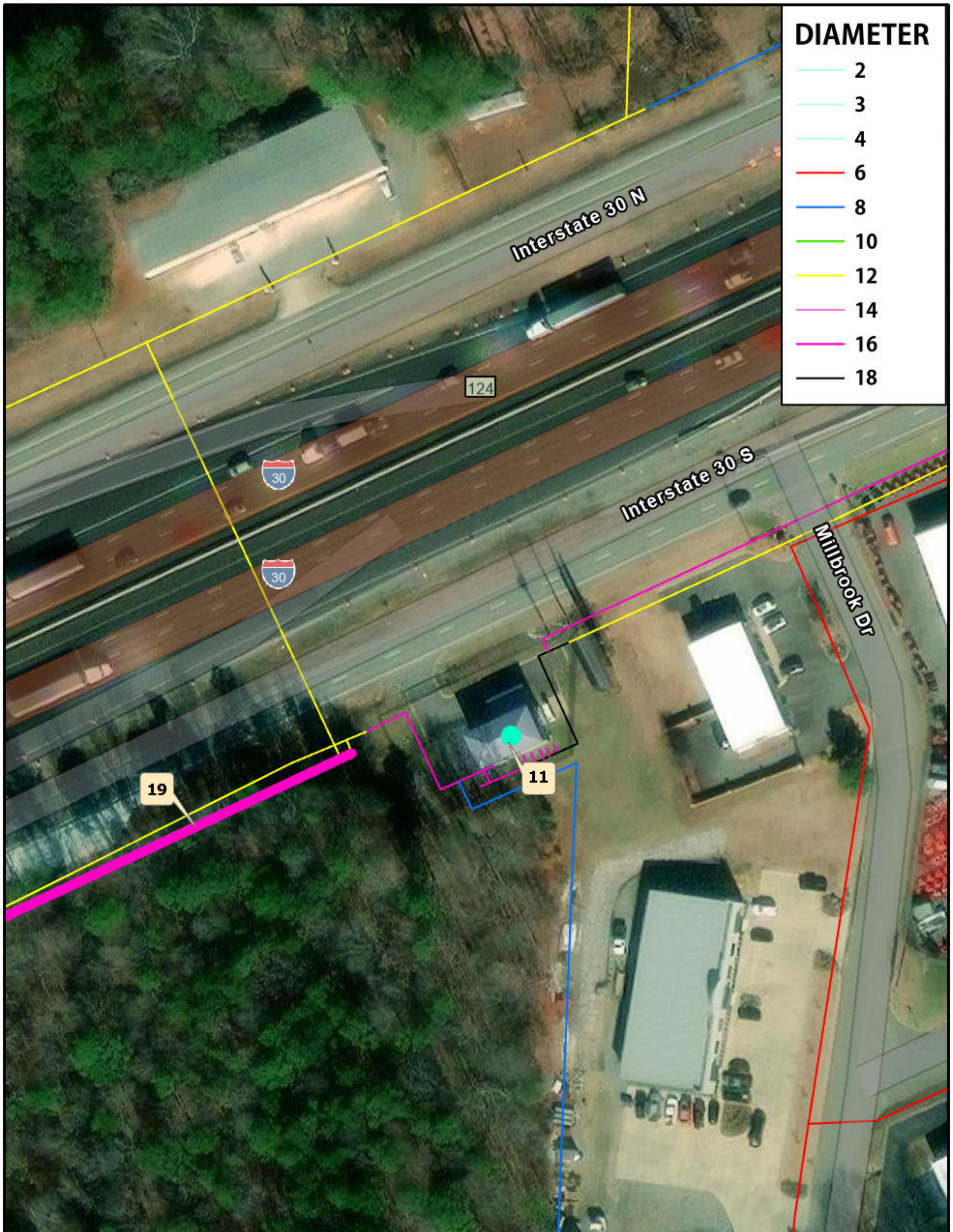
CONNECT SERVICES BEFORE CAW PUMP STATION ALONG I30

CITY OF BRYANT, AR

0 105 210 420
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #11

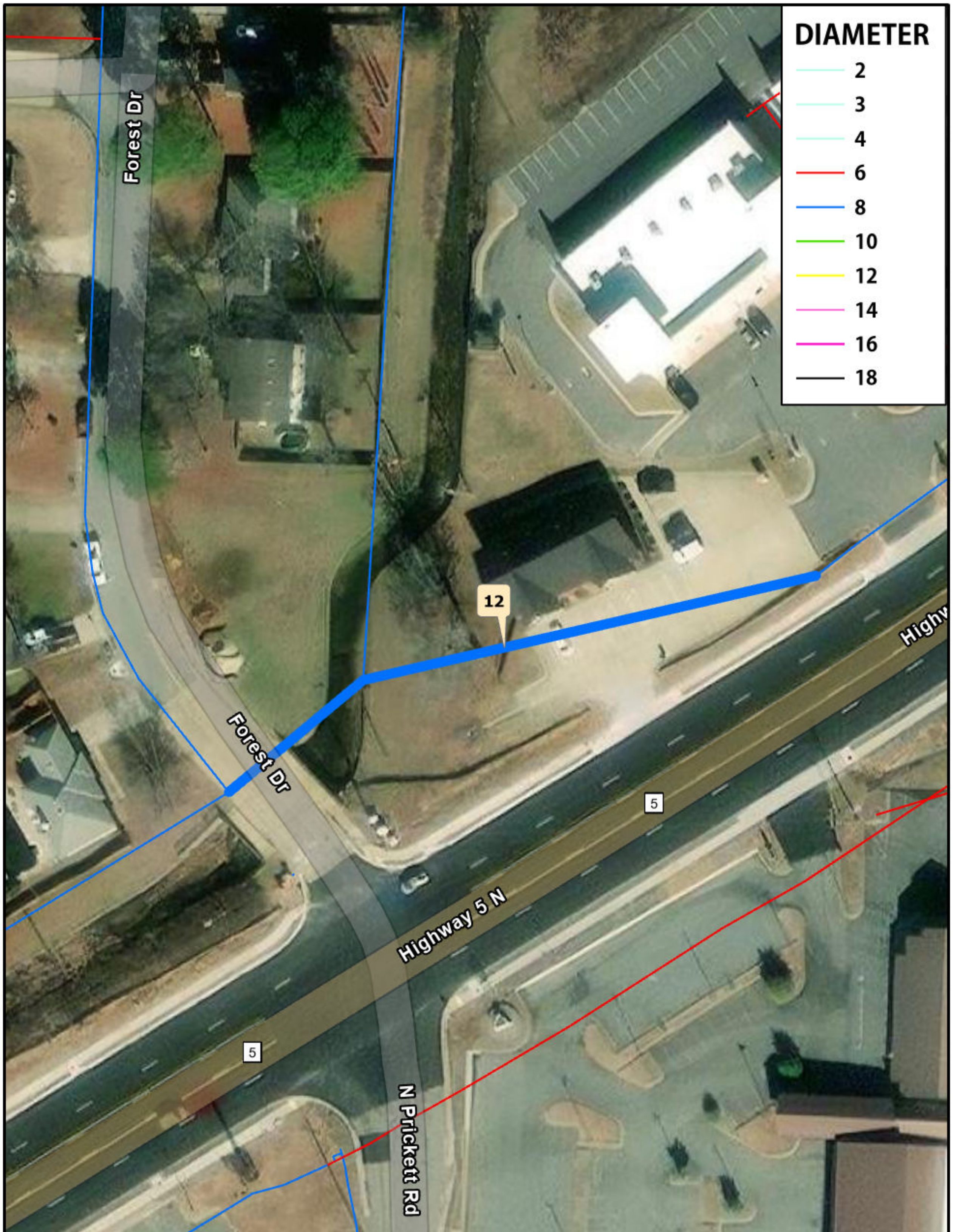
CHLORINATION UPGRADES AT BOOSTER PUMP STATION

CITY OF BRYANT, AR

0 35 70 140
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #12

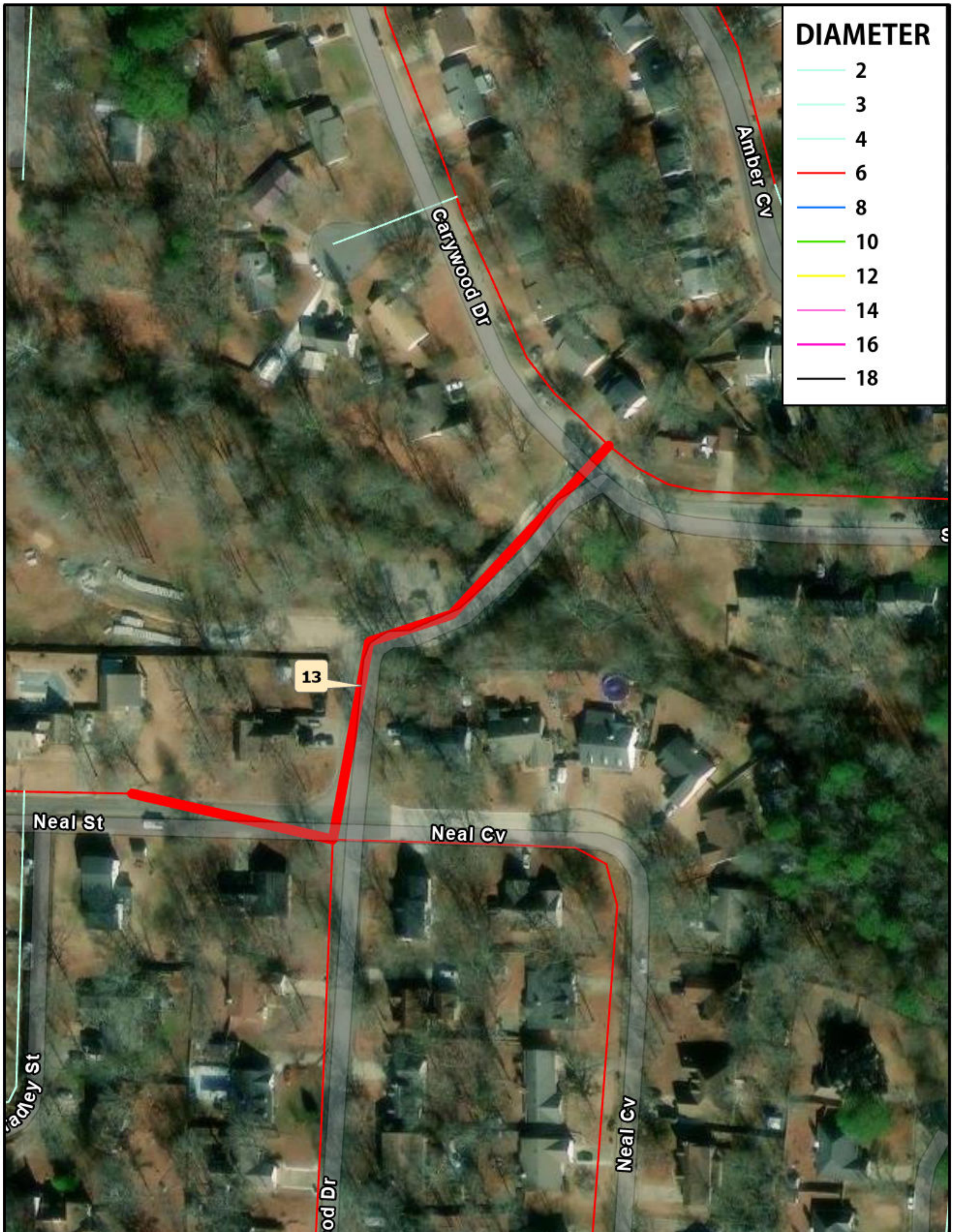
FOREST DR AND HIGHWAY 5 N INTERCONNECT

CITY OF BRYANT, AR

0 25 50 100
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #13

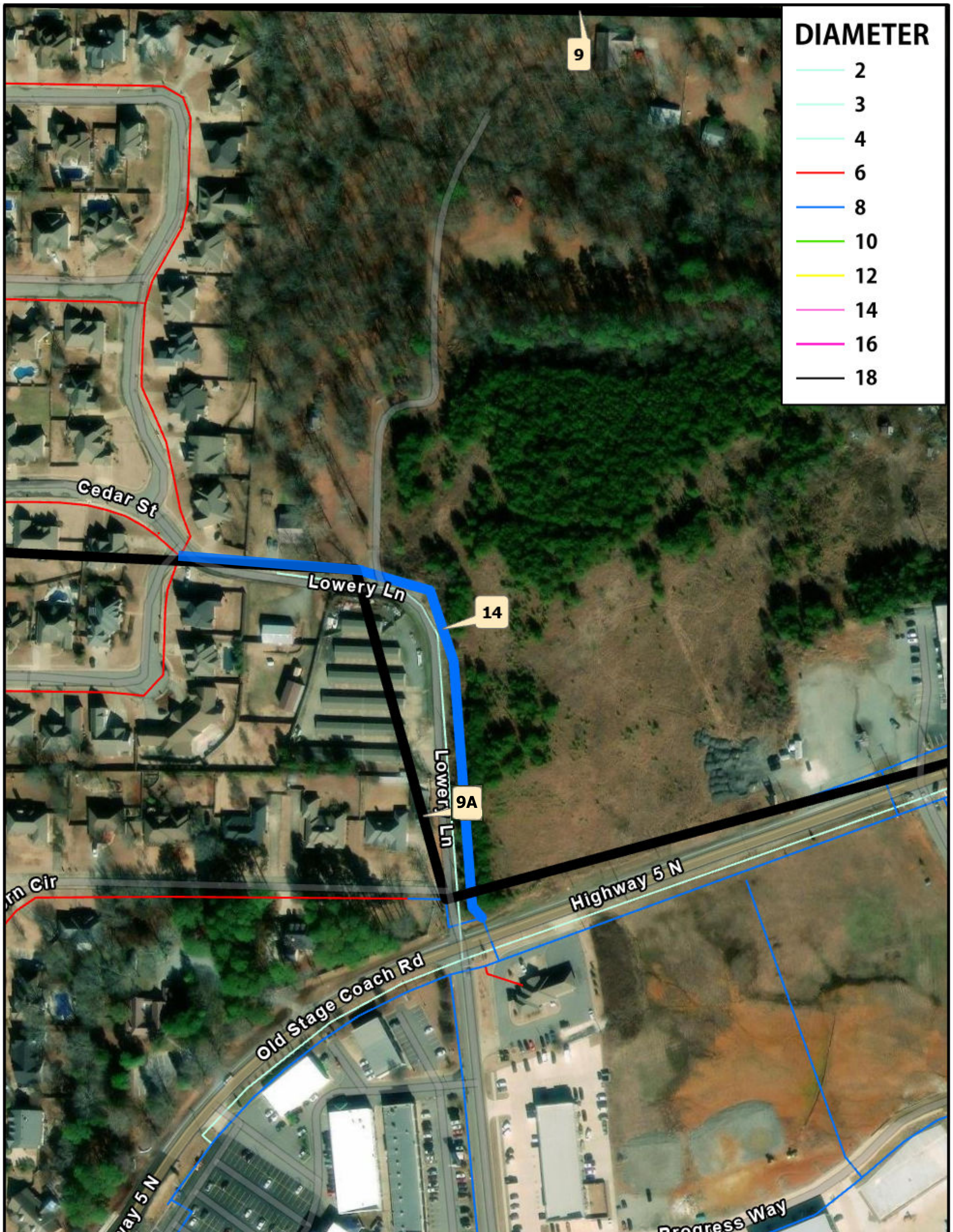
DEBSWOOD TO CARYWOOD DR

CITY OF BRYANT, AR

0 50 100 200
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #14

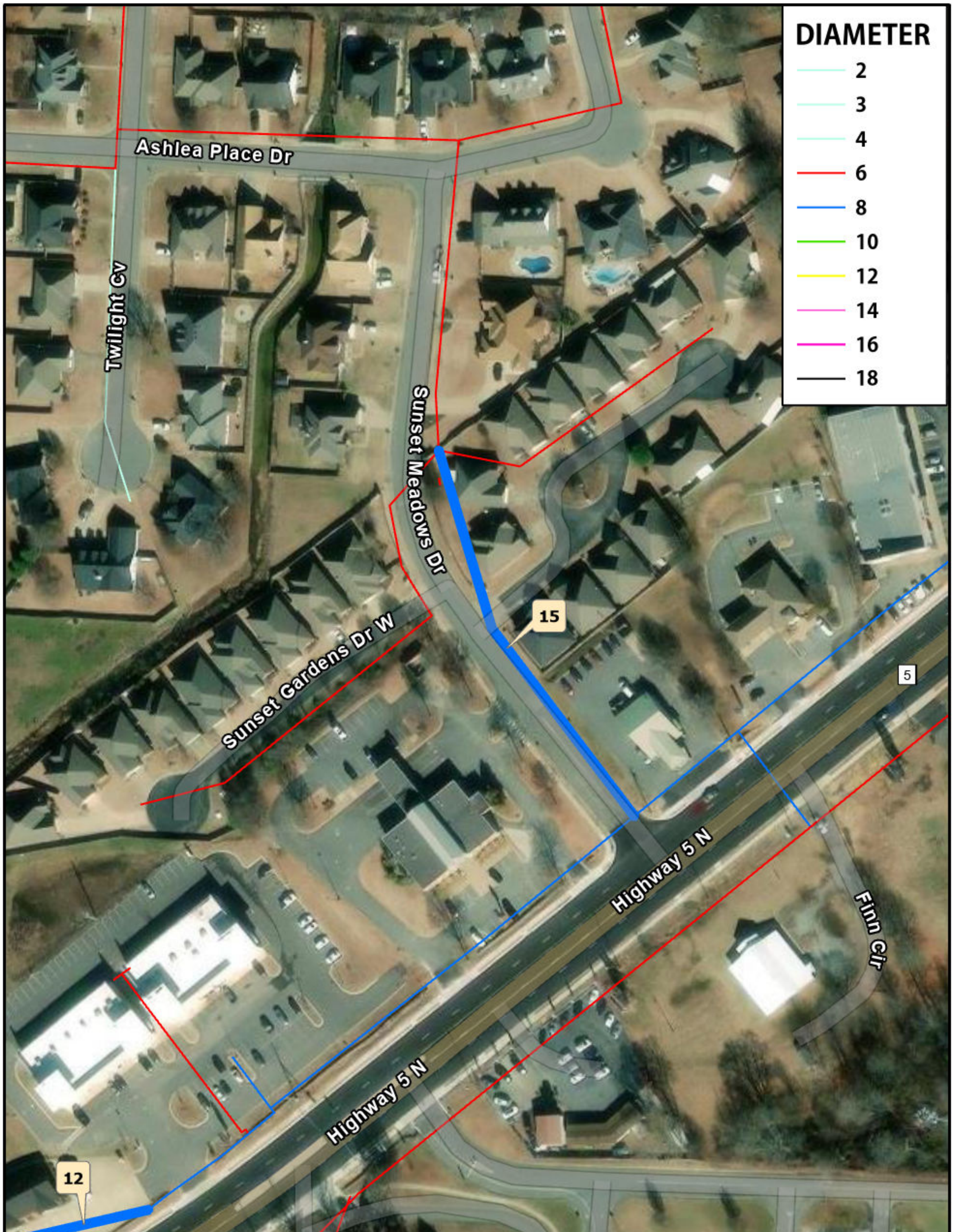
HIGHWAY 5 EXTENSION TO LOWERY LANE

CITY OF BRYANT, AR

0 90 180 360
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #15

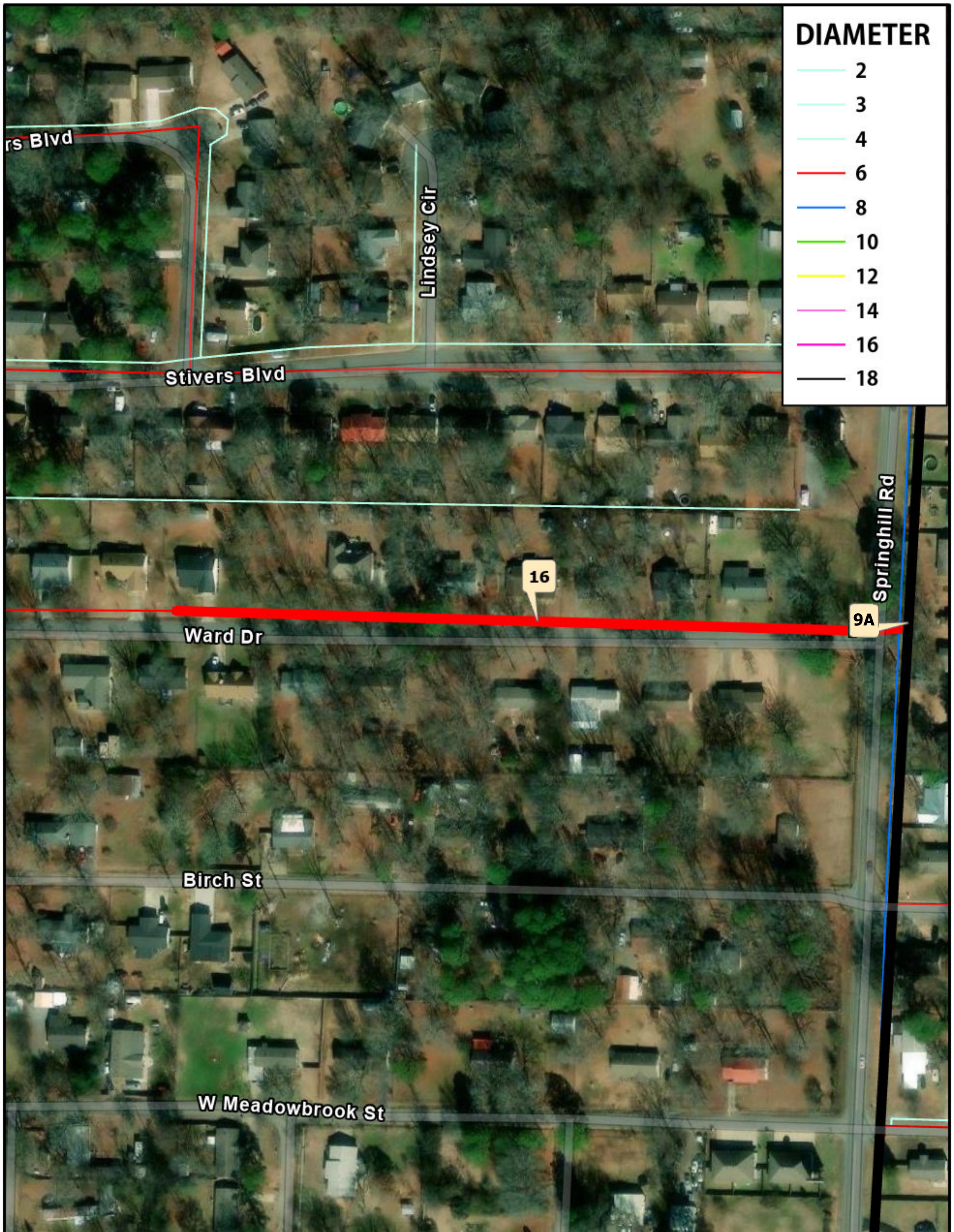
SUNSET MEADOWS EXTENSION

CITY OF BRYANT, AR

0 50 100 200
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #16

WARD DR EXTENSION

CITY OF BRYANT, AR

0 70 140 280
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024

C. Long-Term System Improvements

1. System Transmission Improvements

In order to meet Long Term Maximum Day Demands in Bryant's southern area as well as allow the Highway 5 and South tanks better match head and float together, improvements must be made to convey water between the Highway 5 Tank and South Tank.

a) Improvement 17: Hwy 5 Tank to south I-30 – 16-inch Transmission

This transmission improvement involves connecting Highway 5 Tank with the existing 12-inch waterline along Interstate 30 at Lora Drive. This 3,000 foot 16-inch transmission inclucing boring across I-30 would allow for more flow to be provided to the system south of Interstate 30.

b) Improvement 18: South Tank to I-30 – 16-inch Transmission

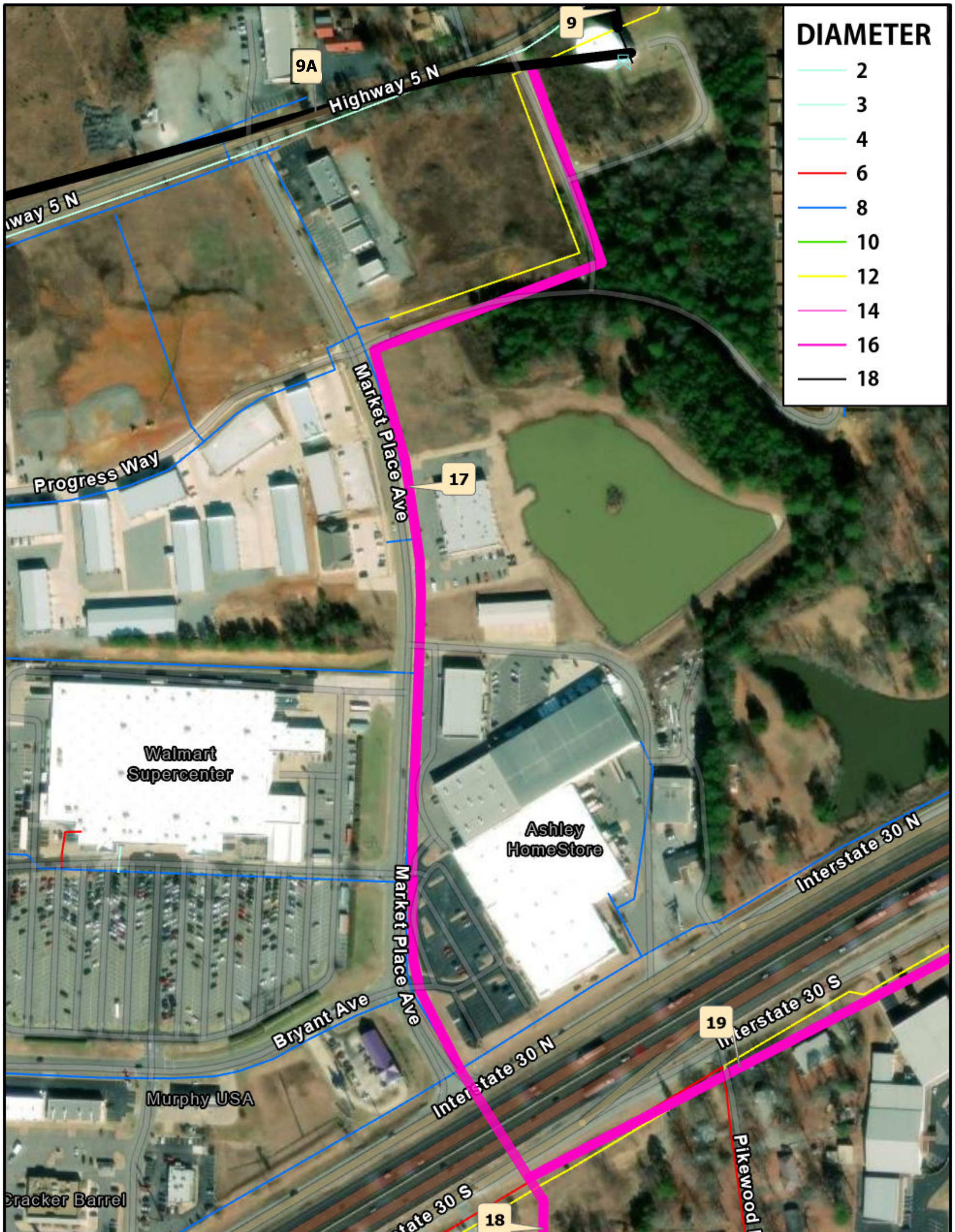
This transmission improvements involves extending the 16-inch transmission installed in the Hwy 5 Tank to south I-30 improvement to the South Tank. This connection would be required to meet long term demands within the south system and new demands brought on by connections to Shannon Hills and East End systems.

2. CAW Water Supply Improvements

In the event Bryant requires greater than 5.0 MGD from CAW, improvements must be made to increase flows from the booster pump station to provide water to the city. These improvements include installing a 10,000 ft 16-inch transmission line from the booster pump station to the new 16-inch transmission line installed at I-30 between the Highway 5 Tank and South Tank as well as installing a new pump within the booster pump station.

a) Improvement 19: Booster Pump Station to I-30 at Pikewood – 16-inch Transmission

b) Improvement 20: 75 HP Pump at Booster Pump Station



DISTRIBUTION SYSTEM - IMPROVEMENT #17

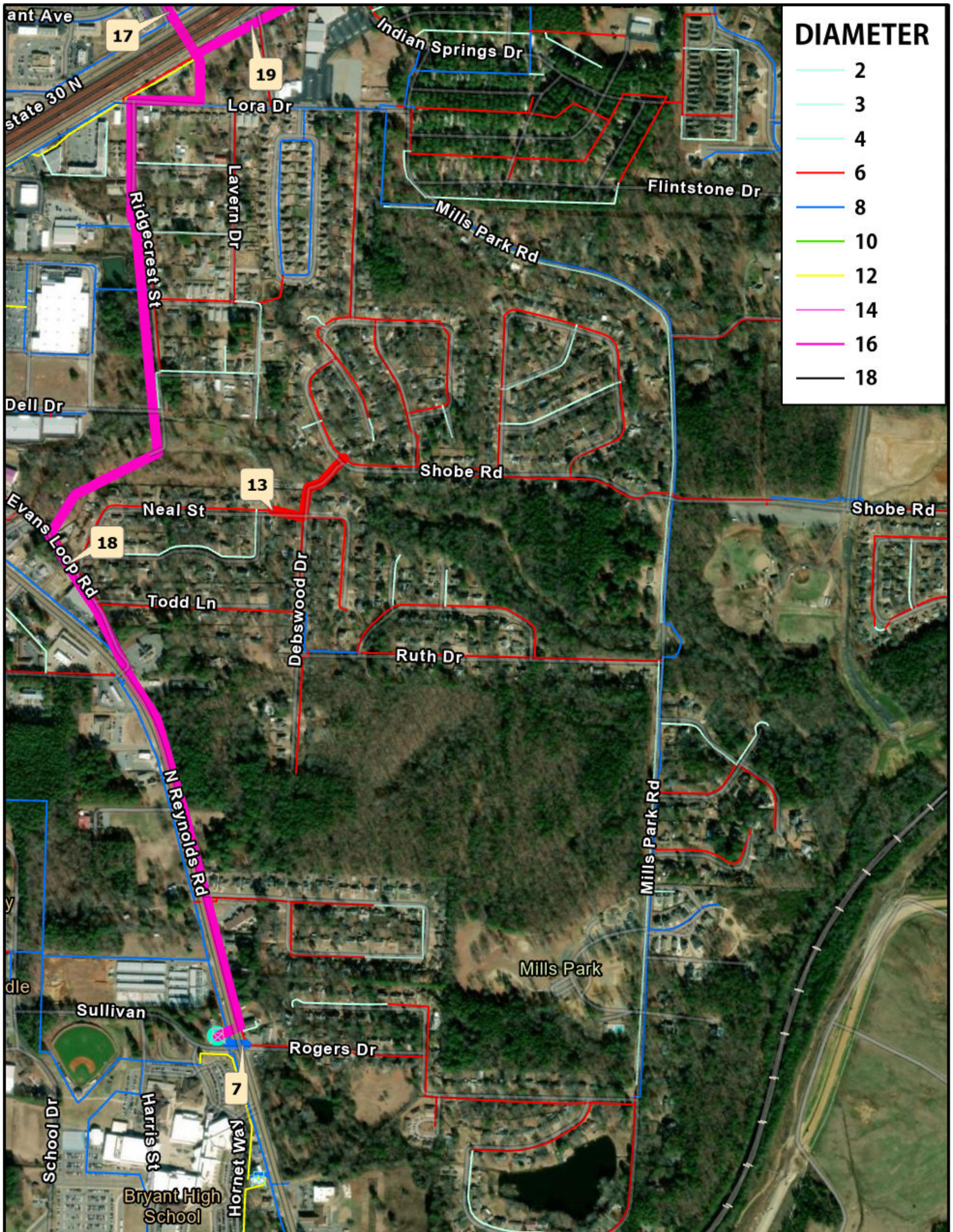
HWY 5 TANK TO I-30 CROSSING

CITY OF BRYANT, AR

0 115 230 460
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #18

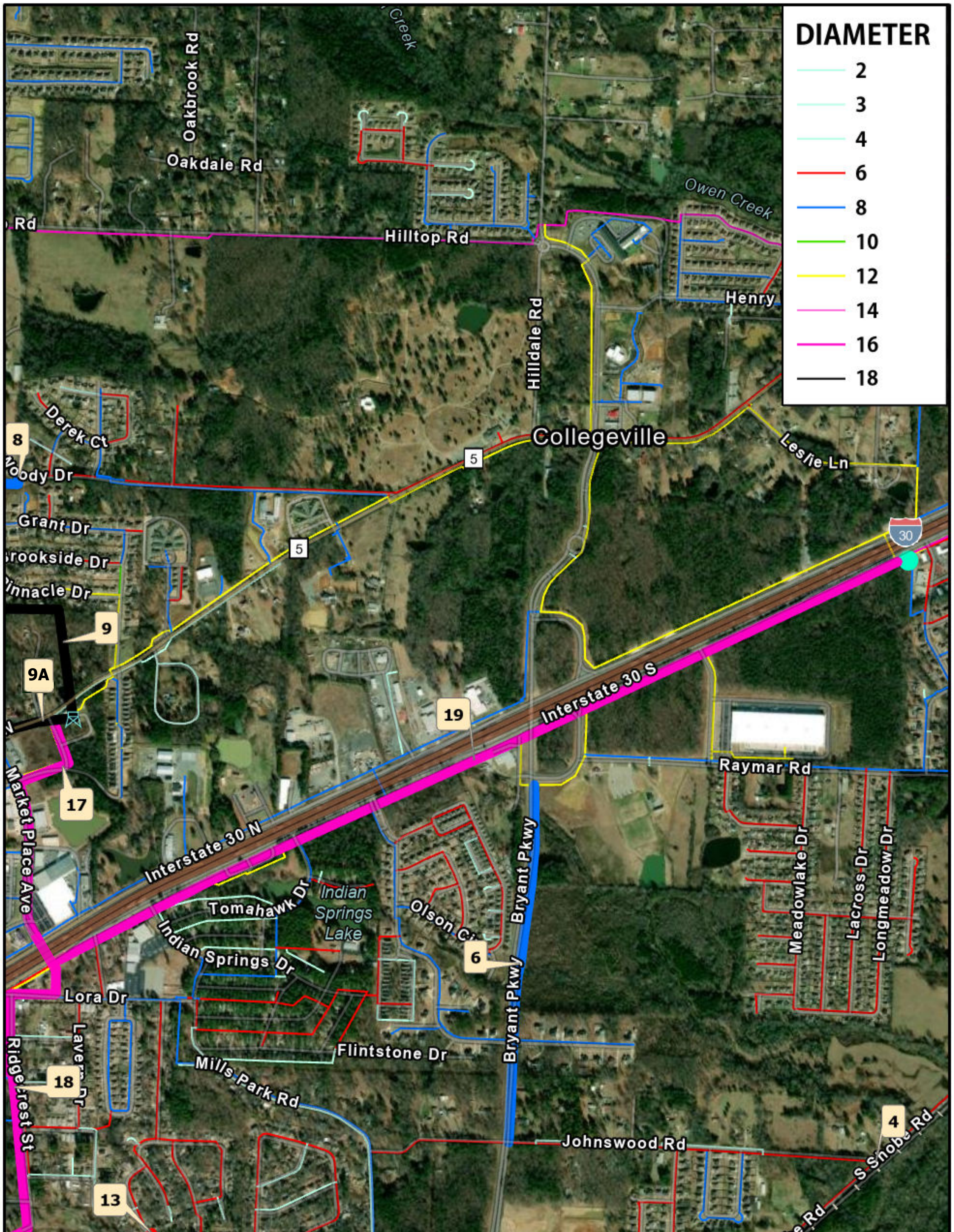
I-30 TO SOUTH TANK CONNECTION

CITY OF BRYANT, AR

0 350 700 1,400
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #19

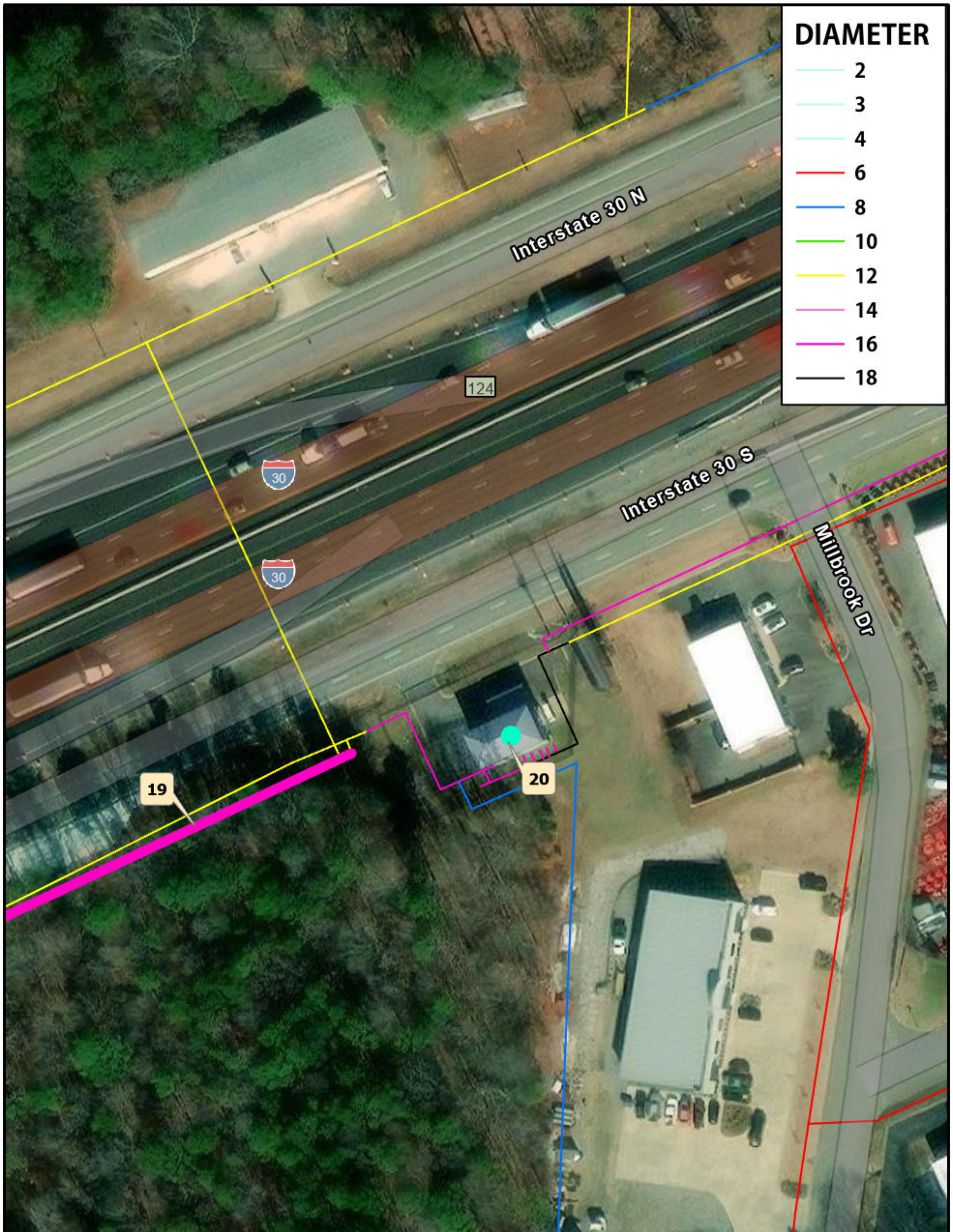
BOOSTER PUMP STATION TO I30 AT PIKEWOOD

CITY OF BRYANT, AR

0 500 1,000 2,000
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024



DISTRIBUTION SYSTEM - IMPROVEMENT #20

BOOSTER PUMP STATION - NEW 75 HP GOULDS PUMP

CITY OF BRYANT, AR

0 35 70 140
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024

D. SRPWA Wholesale to Consecutive Systems

SRPWA improvements indicate Bryant will be needed to wheel water to consecutive systems in order to provide water to these systems without the need for dedicated transmission mains from SRPWA to each individual entity. Improvements will be required in order to provide these systems with the indicated demands. These improvements involve both lines within Bryant to meet the required demands, as well as transmission lines from the extent of Bryant water system to the connecting utility. All improvements associated with providing water to these entities will be paid for by SRPWA.

1. Shannon Hills

In order for SRPWA to convey water through Bryant to Shannon Hills, an extension from the 12-inch waterline along I-30 near Millbrook Dr to Shannon Hills would be required. There is currently sufficient infrastructure within Bryant to provide water to the 12-inch connection location.

2. East End (Improvement 21)

In order for SRPWA to convey water through Bryant to East End, a 12 -inch extension from Bryant near South Reynolds Rd to East End generally along Sardis Rd would be required. Within Bryant water system, a 12-inch extension from the 12-inch along Renyolds Rd and Rich St to the connection point at South Reynolds Rd and Hill Farm Rd would be required to allow demands to be met within the system. Depending on the total flow requirements of East End, the 16-inch improvements recommended from Highway 5 Tank to the new South Tank would also be required to meet the full demands of Bryant and East End combined.

DISTRIBUTION SYSTEM - IMPROVEMENT #21

SRPWA EXTENSION FOR EAST END

CITY OF BRYANT, AR

0 240 480 960
Feet

CRIST ENGINEERS, INC.
CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS

JUL 2024

VI. Capital Improvement Plan

This section presents the recommended Capital Improvement Plan (CIP) for the City of Hot Springs water system. The plan is based on the evaluation of the water supply, treatment, and distribution system, and on the recommended projects described in the previous sections. The CIP has been prepared to assist the City in planning and constructing the water system improvements in the future. The improvements should be implemented by the City as funding is available. The CIP for the improvements identified by this Master Plan are presented under separate bound cover.

A. Cost Estimating Criteria

The cost estimates presented in this study are opinions developed from bid tabulations, cost curves, information obtained from previous studies, and experience on other projects. The costs estimated for each recommended improvement are opinions included in the CIP developed with this study.

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as: preliminary alignments generation, investigation of alternative routings, and detailed utility and topography surveys.

Costs developed for this study should be considered "order of magnitude" and have an expected accuracy range of +40 percent to -30 percent.

1. Land Acquisition Costs

Acquisition of property, easements, and right-of-way (ROW) will be required for some of the recommended projects, particularly new pump stations and tank facilities. Additionally, the capital costs do not include pipeline corridor purchases or easement costs because it was assumed that public ROW will be utilized wherever possible. Land costs are not easily determined, particularly in the master planning phase, and variables affecting properties can result in widely varying land prices. Since land acquisition costs are not included in this master plan, the final capital costs may vary from the estimates presented herein.

2. Estimated Construction Costs

Since knowledge about site-specific conditions of each proposed project is limited at the master planning stage, a 20 percent contingency was applied to the Construction Cost to account for unforeseen events and unknown conditions.

In addition, a 20 percent contingency was added for each recommended improvement to account for other project costs such as engineering fees, legal fees, administration fees, environmental fees and other miscellaneous fees that may be required for implementation of the project.

The Capital Improvement Cost, in dollars, for each proposed improvement is the total of the Estimated Construction Cost (including contingency) plus the other costs discussed in the previous paragraph.

B. Capital Improvement Plan

The CIP projects are prioritized based on their urgency to mitigate existing deficiencies and for servicing anticipated growth. It is recommended that improvements to mitigate existing deficiencies be constructed as soon as possible. The deficiencies in the future system have a significant total capital cost that is best distributed based on the order in which the City will develop. It is assumed that any replacement pipes will be in the same alignment and at the same slope as the existing pipe. However, this study recommends an investigation of the alignment during the pre-design stage of each project.

CITY OF BRYANT WATER UTILITIES
WATER SYSTEM MASTER PLAN
CAPITAL IMPROVEMENT PLAN

Legend
Added to model
Exhibit Complete
Not in model

No.	Type	Description	Diameter	Length	Cost Estimate ($)	CAPITAL IMPROVEMENT PLAN Near Term ($)	Mid Term ($)	Long Term ($)	CIP Exhibit
Water System Improvements - Distribution System - Near Term Improvements									
1	609 PZ Expansion	1,500,000 Gallon Tank @ N. Reynolds / High School	-	-	$ 9,000,000	$9,000,000			
2	609 PZ Expansion	12 inch extension Boon Road	12	5,000	$ 1,300,000	$1,300,000			
3	609 PZ Expansion	Springhill, I30 to Highway 5 N	16	2,100	$ 1,000,000	$1,000,000			
4	Improvement	Woodland Hills Metron Meter and Vault	-	-	$ 60,000	$60,000			
5	FF	Airport to Hill Road	8	900	$ 180,000	$180,000			
6	FF	Bryant Pkwy I30 to Johnswood	8	3,700	$ 740,000	$740,000			
7	FF	N Reynolds Road at Rogers Road Crossing	8	100	$ 40,000	$40,000			
8	ff/loop	Woody Dr to Steeplechase Cir	8	400	$ 80,000	$80,000			
Water System Improvements - Distribution System - Mid-Term Improvements									
9	SRPWA	SRWRPA Extension North tank to Hwy 5 Tank	18	10,000	$ 3,500,000		$3,500,000		
9A	SRPWA	Highway 5 at Springhill to Highway 5 Tank - SRPWA Connection	18	12,000	$ 4,000,000		$4,000,000		
10	SRPWA	Connect Services Before CAW Pump Station along I30	8	1,400	$ 192,000		$192,000		
11	Pump Station	Chlorination upgrades at CAW Booster Pump Station	-	-	Awaiting Pricing		Awaiting Pricing		
12	ff/loop	Forest Dr and Highway 5 N Interconnect	8	350	$ 52,500		$52,500		
13	FF/loop	Debswood to Carywood Dr	6	800	$ 150,000		$150,000		
14	FF/loop	Highway 5 Extension to Lowery Lane	8	2,000	$ 420,000		$420,000		
15	FF/loop	Sunset Meadows Extension	8	350	$ 100,000		$100,000		
16	FF/loop	Ward Dr Extension	6	1,200	$ 216,000		$216,000		
Water System Improvements - Distribution System - Long Term Improvements									
17	2050 Improvement	Hwy 5 Tank to I-30 Crossing	16	3,000	$ 1,600,000			$1,600,000	
18	2050 Improvement	I30 to South Tank	16	8,000	$ 3,000,000			$3,000,000	
19	CAW	Booster Pump Station to I 30 at Pikewood	16	11,000	$ 3,500,000			$3,500,000	
20	CAW	New 75 HP Goulds Pump	-	-	$ 200,000			$200,00	
21	SRPWA	SRPWA Extension for East End			$	-		$0	
				TOTALS	**$ 29,330,500.00**	**$12,400,000**	**$8,630,500**	**$8,300,000**	

* Cost estimates determined in July 2024 include construction costs, contingency, and other project costs for engineering, legal, environmental, etc.

Project No. 24005