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Water Utility Master Plan

Report

Town of Bargersville,IN

October 2018

STRAND ASSOCIATES®

Report for

Town of Bargersville, IN

Water Utility Master Plan

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EXECUTIVE SUMMARY

INTRODUCTION

This Water Utility Master Plan (Master Plan) is an evaluation of the existing facilities and infrastructure and identification of potential capital improvement needs over a 20-year planning period for the Town of Bargersville, Indiana (Town). Meeting with the Town established goals of 55 psi of service connections and future fire flow improvements when practical.

The existing water utility facilities and infrastructure included water treatment plants (WTPs), wells, distribution piping, elevated water storage tanks, and a booster pumping station.

The evaluation included the condition of existing structures, equipment, and piping, capacity of the facilities and infrastructure compared to current needs and projected 20-year needs considering compliance with current and potential future regulatory requirements.

In addition, the Town's hydraulic model was used to both aid the evaluation of the water distribution system and identify potential capital improvement needs. The model will continue to be a useful tool for the Town beyond this Master Plan.

This plan is intended to serve as a guidance document to the Town for budgeting and implementing capital improvement projects over the next 20 years. It identifies needs, budgetary cost opinions, recommended priorities and schedules, and provides a framework for decision making.

COMMUNITY DATA

Since the Town serves an area much larger than the Town limits, the population projection was based on three factors. The first was the Environmental Protection Agency (EPA) Water System source that indicated the water system served 26,665 people in 2010. The second was Indiana Stats. The water utility primally serves people in two Johnson County Townships, White River and Union. Additional customers are served in Franklin Township and Morgan County.This results in the water system serving approximately 2,024 people in Union Township and 24,641 people in White River Township as of 2010. The White River Township population served is approximately 58 percent of the Townships population. Based on the growth that has occurred in each Township between 2010 and 2017, the population served in 2017 would be approximately 29,748. The third factor was an indication from the Town that it could be assumed that population growth will continue as it has over the past 7 years for the duration of the planning period. Using the 2010 to 2017 linear projection, the predicted water system population in 2038 is 38,772, or approximately 39,000.

EXISTING WATER UTILITY FACILITIES

The water utility system includes seven supply wells, two WTPs, and a distribution system with one booster station and six water storage tanks.

A. Water Supply

There are currently seven supply wells located in two separate wellfields. The wellfield that supplies WTP No. 1 consists of 4 wells with a firm capacity of 6.0 million gallons per day (mgd) during a

20 hour day. The wellfield that supplies WTP No. 2 consists of three wells with a firm capacity of 4.8 mgd over a 20 hour day.

B. Water Treatment

The Town operates two WTPs. The rated treatment capacity of WTP No. 1 is 5.4 mgd, and the rated treatment capacity for WTP No. 2 is 6.0 mgd. WTP No. 1 has 1.25 million gallons of clearwell volume, while WTP No. 2 has 2 million gallons of clearwell volume.

WTP No. 1 was constructed in 1977 and last had major renovations in 1994, when seven new filters and three new fluidized bed reactors were installed inside the facility. Following those renovations, the WTP had a 5.4 mgd peak design flow with nine filters in operation and the tenth filter cell out of service. The process consists of softening via fluidized bed reactors, pH adjustment with recarbonation, gravity sand filtration, intermediate pumps, clearwells, and high service pumps. The filter backwash process uses a water backwash method for filters 1 to 3 and an air scouring method for filters 4 to 10 with backwash water being discharged to a recycle tank, and the waste products are pumped to lagoons. The chemicals used include chlorine, fluoride, and caustic soda.

WTP No. 2 was constructed in 2012, and it uses the same process as WTP No. 1. Each of the four filters at WTP No. 2 use an air scouring method for filter backwash. The rated capacity for WTP No. 2 is 6 mgd. Additionally, polymer is added at WTP No. 2 to aid with iron removal at the filters.

C. Water Distribution and Storage

The water distribution system contains approximately 1.3 million feet of water main. The existing system is comprised of piping that ranges primarily between 1- and 24-inch-diameter piping. In addition to the piping, the distribution system contains six water storage tanks and one booster station. The water storage tanks have a total volume of 3.15 million gallons, but the overall reliable volume of water in the system is approximately 2.4 million gallons. The booster station has a firm capacity of 2,000 gallons per minute (gpm) and it serves Bargersville Water Tank.

WATER UTILITY ANALYSIS

A. Water Pumping and Meter Use Records

The pumping and meter use records were reviewed to establish existing water demands. Future projections for water demand and water supply were then completed. Using production and sales data, it was also determined that the Town experiences approximately 11 percent of its water being produced but not sold. This is considered nonrevenue water. Based on these factors, in 2038 it is proposed that an average daily water production will be 4.3 mgd; an average summer day water production will be 6.7 mgd; and the peak daily water production will be approximately 10.6 mgd.

B. Water Supply Analysis

The analysis includes the recommended improvements at both wellfields. At the WTP No. 1 wellfield, additional wells are being recommended, and at the WTP No. 2 wellfield new motor starters are being recommended. These improvements will allow for more flexibility while operating each wellfield.

C. Water Treatment Plant Analysis

Both WTPs were reviewed according to their age, condition, and according to its suitability to meet future needs. The tanks, pumps, piping, chemical feed systems, along with ancillary processes were reviewed.

D. Water Distribution System Analysis

Using the water distribution system model, a capacity evaluation was completed to review the elevated water storage and booster pumping station capacity requirements to meet peak day demand requirements as well as fire flow requirements. Alternatives were modeled to achieve a system hydraulic grade so that the Town could maintain an approximate minimum water pressure of 55 pounds per square inch (psi).

In addition to storage and pumping, the distribution system piping was evaluated and alternatives were reviewed using the model. Critical raw water and finished water transmission main needs were identified. Specific projects were also identified to improve fire flow capabilities and provide future residential and commercial development.

WATER UTILITY PROPOSED CAPITAL IMPROVEMENTS

A. Recommended Improvements

1. Water Supply Wells

The Town should consider the construction of two new production wells at the WTP No. 1 wellfield. At the WTP No. 2 wellfied, the Town should consider replacing the existing motor starters for each well with variable frequency drives (VFDs).

2. WTPs

The WTP projects consist of making improvements at both WTP Nos. 1 and 2.

As outlined in Section 4, there is a significant number of projects that are recommended to be completed at WTP No. 1 to increase production capacity. These projects include the expansion of the detention tank, installing a 2.0 mg clearwell and a new fluidized bed reactor, rehabilitation of filters and existing fluidized bed reactors, modifying the existing backwash and existing chemical and chlorine rooms, replacing all high service pumps and intermediate pumps, as well as, the construction of an additional 1,000 square feet (sq ft) on the west side of the existing WTP No. 1 to house the new and relocated FBRs and the expansion to the recarbonation basin. It is also recommended that the Town consider replacing all heating, ventilation, air conditioning (HVAC), electrical control systems, and various piping and valves systems. Additional site work will be required for office space atheistic improvements and the expansion to the building. The WTP No. 1 improvement project is recommended to be completed in 2024.

The improvements required at WTP No. 2 are not recommended until 2033, since WTP No. 2 was constructed in 2012, and none of the existing equipment has reached the expected service life at this time. The improvements recommended at WTP No. 2 are mainly common maintenance items and the replacement of chemical feed equipment and filter media that will have exceeded their estimated 20-year effective service life by the end of this planning period. It is recommended that the third clearwell be installed during this planning period to help the utility limit staffing requirements on the weekends during the summer months.

3. Water Distribution System

The proposed water distribution system improvements will include projects affecting the water storage, a booster station, and piping.

a. Water Storage

The recommended water utility water storage solution involves the installation of a new raised 1.0 mg tank in the northeast part of the distribution system that will serve as the new Stones Crossing Tank. This proposed tank will replace the existing Curry and Stones Crossing Tanks and these tanks will be demolished. It is proposed that the overflow elevation of this tank match the Bargersville Tank in the southern part of the system at a level of 960 feet.

b. Booster Station

The proposed booster station improvements include the installation of a new Critchfield Booster Station. This new booster station will transport stored water from the northwestern pressure zone to the southern pressure zone, by drawing from Critchfield Tank, which is supplied by WTP No. 1. This proposed Critchfield Booster Station would be capable of pumping 2,250 gpm to the southern section of the system and supplying the proposed Stones Crossing and Bargersville Tank.

c. Distribution System Piping

The Town needs to consider two types of water main projects going forward. The first group are those projects related to water transmission. The second group is related to improving fire flow service.

B. Recommended Water System Studies

The Town should consider completing multiple studies for its water system over the 20-year planning period. These studies will occur at regular intervals and will place the Town in the best position for the preparation for future development and the needs at each WTP. Table ES-1 outlines the approximate cost of each of these studies as well as the approximate time they should occur within the planning period.

Year	Study	Cost[1]
2019	Asset Management Plan	$40,000 – $50,000
2019	Rate Study	$20,000 – $30,000
2019	North Wellfield Evaluation	$15,000 – $25,000
2020	Tank Observation Study	$10,000 – $20,000
2020	Water System PER	$30,000 – $40,000
2021	Operational Needs Review–WTP No. 1	$70,000 – $80,000
2022	WTP No. 1 PER	$30,000 – $40,000
2023	Hydraulic Model Update	$10,000 – $15,000
2023	Rate Study	$20,000 – $30,000
2024	Asset Management Plan Update	$10,000 – $20,000
2025	Tank Observation Study	$10,000 – $20,000
2026	Unidirectional Flushing Plan	$70,000 – $80,000
2027	Master Plan Update	$30,000 – $40,000
2027	Rate Study	$20,000 – $30,000
2028	Hydraulic Model Update	$10,000 – $15,000
2029	New Asset Management Plan	$40,000 – $50,000
2030	Tank Observation Study	$10,000 – $20,000
2031	Operational Needs Review–WTP No. 2	$70,000 – $80,000
2031	Rate Study	$20,000 – $30,000
2032	WTP No. 2 PER	$30,000 – $40,000
2033	Hydraulic Model Update	$10,000 – $15,000
2034	Asset Management Plan Update	$10,000 – $20,000
2035	Tank Observation Study	$10,000 – $20,000
2035	Rate Study	$20,000 – $30,000
2038	Update Hydraulic Model	$10,000 – $15,000
2038	New Master Plan	$65,000 – $75,000
	Total	**$690,000 – $930,000**

[1]Costs are 3rd quarter 2018 dollars

Table ES-1 Recommended 20-Year Water System Studies

C. Recommended 5 Year Improvements

Based on the needs of the system, it is anticipated that the water utility will need to strengthen the northern part of the distribution system storage and piping, as well as the water supply capabilities for both WTPs, before water treatment improvements are completed. Table ES-2 shows the proposed projects for the next 5 years in the order that they would occur.

Construction Year	Project	Total Project Cost[1]
2020	Well No. 13 Installation at Northern Wellfield	$ 540,000
2020	Central Neighborhoods Fire Flow Projects	$ 2,875,000
2021	12-IN Transmission Main SR 135–South	$ 2,700,000
2022	12-IN Transmission Main W 300 N–Phase 1	$ 1,940,000
2022	WTP No. 2 New Well VFDs	$ 270,000
2022	8-IN Water Mains on Aldersgate Drive and Northern 625 W	$ 610,000
2023	New Stones Crossing Tank	$ 3,660,000
2023	Transmission Mains on Critchfield/Eagle Subdivision/North 135	$ 2,080,000
	Total	**$ 14,753,000**

[1]Cost are 3rd quarter 2018 dollars

Table ES-2 Recommended 5-Year Improvements

D. Recommended 10-Year Improvements

Once the initial water distribution and storage system improvements have been completed the Town can proceed to start the water treatment improvement projects along with an additional raw water supply project to provide redundancy across an interstate. During this five-year window, the Town should start the improvements to WTP No. 1 that have been recommended. Table ES-3 shows the recommended projects within 5 to 10 years, in the order that they are proposed to occur.

Construction Year	Project	Total Project Cost[1]
2024	Critchfield Booster Station	$ 1,013,000
2024	Pressure Zone Changeover	N/A
2025	Update WTP No. 1	$ 13,449,000
2026	Additional 16-IN Raw Water Transmission Main	$ 1,688,000
2028	Repaint 1 mg Clearwell	$ 400,000
	Total	**$ 16,550,000**

[1]Cost are 3rd quarter 2018 dollars

Table ES-3 Recommended 10-Year Improvements

E. Recommended 20 Year Improvements

After the WTP No. 1 projects have been completed, it is recommended that the Town proceed with a more intensified water main replacement program and water transmission main installment on the southern section of the system. Based off these recommendations the Town will have an increased rate of feet of pipe installed each year, in addition to fire flow improvement projects. The completion of these water mains recommended for the next 10-20 years of the planning period will be based on future development schedules, however a predicted outline is shown in Table 5.05-1. Toward the end of this period, the Town should continue to investigate the installation of additional wells to supply WTP No. 1 and WTP No. 2.

Construction Year	Project	Total Project Cost[1]
2029[2]	SR 37 Crossings	$ 3,510,000
2030	12-IN Transmission Main Whiteland Road–Phase 1	$ 945,000
2030	12-IN Transmission Main W 300 N–Phase 2	$ 1,010,000
2030	Bargersville Tank Painting	$ 475,000
2031	Well No. 14 Installation at Northern Wellfield	$ 540,000
2032	12-IN Transmission Main N CR 400 W	$ 450,000
2032	Old Town Fire Flow Projects	$ 946,000
2033	8-IN Water Main CR 625 W–South	$ 945,000
2034	Update WTP No. 2	$ 3,551,000
2035	12-IN Transmission Main Whiteland Road–Phase 2	$ 975,000
2036	8-IN Transmission Main CR 600 W	$ 625,000
2037	Water Mains on W CR 100 N/CR 125 W	$ 1,888,000
2038	Orchard Hill Tank Painting	$ 475,000
	Total	**$ 16,335,000**

[1]Costs are 3rd quarter 2018 dollars
[2]Projected time, dependent upon I-69 requirements

Table ES-4 Recommended 20-Year Improvements

F. Additional Recommendations

The following items are also recommended:

- Investigate property and easement acquisition to enable the recommended projects.

SECTION 1
INTRODUCTION

This section describes the purpose and scope of the report and the location of the study area. A list of abbreviations and definitions is provided as an aid to the reader.

1.01 GOALS AND OBJECTIVES

This Water Utility Master Plan is an evaluation of the existing facilities and infrastructure and identification of potential capital improvement needs over a 20-year planning period. Strand met with a group of Town officials and Water Utility staff during the planning process. The Town identified goals of pursuing a minimum distribution system pressure of 55psi and fire flows of 500gpm or greater for residential areas.

The existing water utility facilities and infrastructure include wells, water treatment plants, distribution system piping, elevated water storage tanks, and booster pumping stations.

The evaluation included the condition of existing structures, equipment, and piping, capacity of the facilities and infrastructure compared to current needs and projected 20-year needs considering compliance with current and potential future regulatory requirements.

In addition, the hydraulic model was updated for the water distribution system that aided the evaluation and identification of potential capital improvement needs. The model will continue to be a useful tool for the Town of Bargersville (Town) beyond this Master Plan.

This plan is intended to serve as a guidance document to the Town for budgeting for and implementing capital improvement projects over the next 20 years. It identifies needs, budgetary cost opinions, and recommended priorities and schedules, providing a framework for decision-making.

1.02 LOCATION OF STUDY

The Town of Bargersville is located in Johnson County, Indiana approximately 17 miles south of Indianapolis along State Road 135. The Town area is generally bordered by County Road (CR) 300 N on the south, Stone's Crossing Road on the north, Banta Road on the west, and SR 135/CR 200 W on the east.

See Section 2 for discussion of the service areas for the water utility, planning areas, environmental resources and physical features, and land use.

1.03 ABBREVIATIONS AND DEFINITIONS

DNR	Department of Natural Resources
ft	feet
GIS	geographical information system
gpm	gallons per minute
IDEM	Indiana Department of Environmental Management
in	inch
mgd	million gallons per day

mg/L	milligrams per liter
PVC	polyvinyl chloride
sq ft	square feet
SR	State Road
SWD	side water depth
USEPA	United States Environmental Protection Agency
VFD	variable frequency drives
WTP	water treatment plant
CR	County Road
SR	State Road
msl	mean sea level
gpd	gallons per day
gcd	gallons per customer per day

SECTION 2
COMMUNITY DATA

Various community data was obtained and reviewed in the development of this report, including political boundaries, physical features, land use, existing reports, and utilities.

2.01 PROJECT PLANNING AREA AND STUDY PERIOD

The project planning area was developed based on the Town's geographical information system (GIS) system with its identified water system boundaries and input from the Town. The water utility system boundary includes outside the existing corporate boundaries over which the Town has indicated to plan for water supply.

The study period for this report is 20 years for the water analysis, so the planning year is 2038.

2.02 ENVIRONMENTAL RESOURCES AND PHYSICAL FEATURES

Environmental resources and physical features include topography, transportation, streams, floodways, and wetlands. These features are considered in the master planning process because development within the planning area is dependent upon the various physical features. Physical features are also important to consider in the planning process because extending utility service under a major stream or roadway can be expensive and challenging from a permitting perspective.

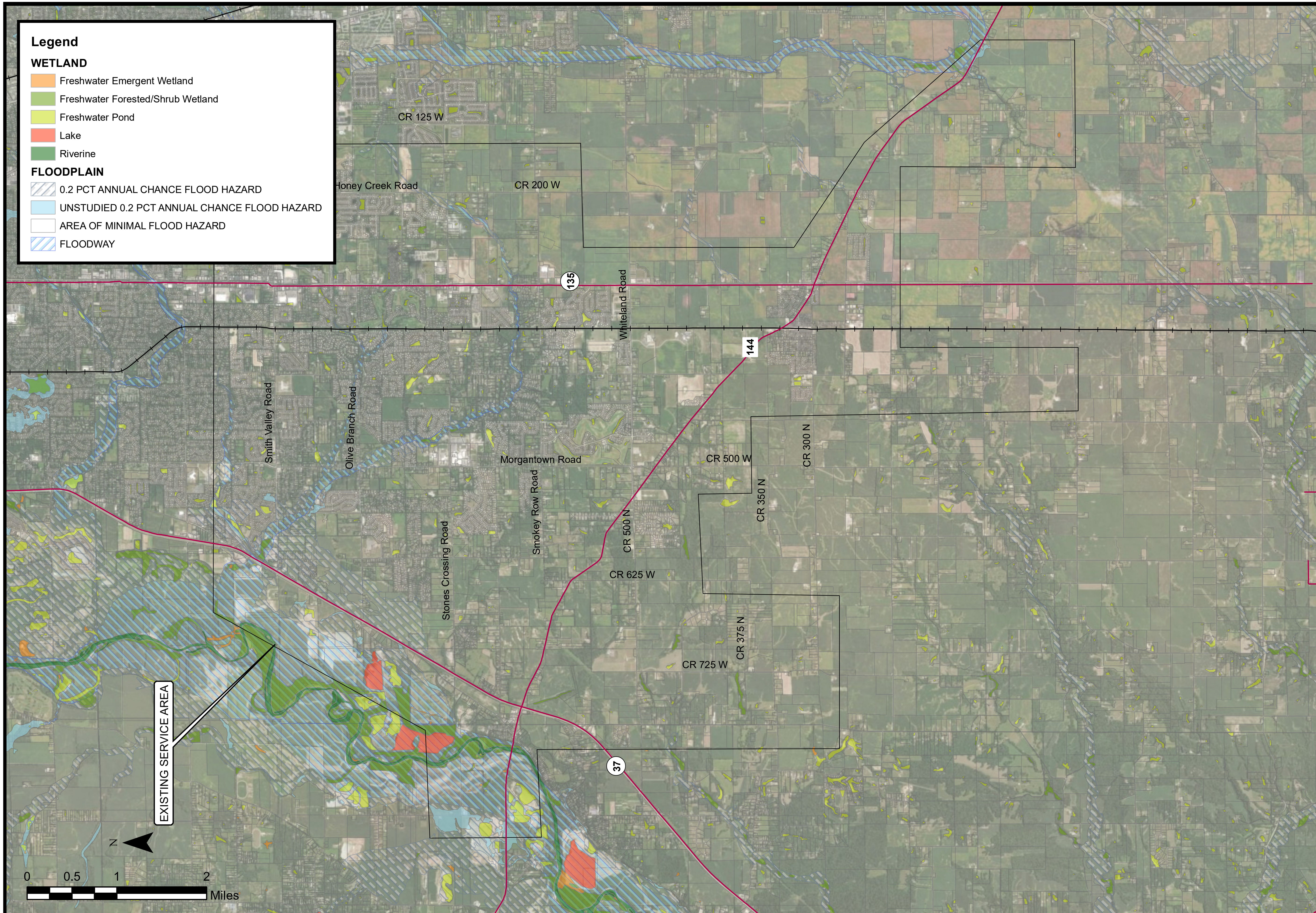
Figure 2.02-1 shows the locations of streams, floodways, and wetlands within the planning area. The West Fork of the White River is parallel to the entire western edge of the water system. Significant development in the floodway and wetland areas is unlikely. However, there is potential for development in the floodplain areas.

Figure 2.02-2 shows the general topography for the water service area. Generally, the lowest areas in the system are to the northwest, with elevations below 700 feet mean sea level (ft. msl). Locations east of SR 135 and south to the Old Town are generally above 800 ft. msl. The highest elevation within the service area is a small area just west of the Old Town of Bargersville with an elevation above 850 ft. msl. This area is south of the new Walnut Grove Elementary School, north of CR 300, west of the Old Town area and east of Morgantown Road.

Figure 2.02-3 shows major roadways and railroads in the project planning area. The major roadways in the Town and planning area include SR 135, SR 37, and CR 144. The Louisville & Indiana Railroad runs north and south through the downtown area of Town and runs north and south through the entire eastern portion of the identified planning area.

2.03 LAND USE

Based on discussions with the Town, it was determined that residential properties would primarily be developed along CR 144, north of CR 300, and to Banta Road to the west. Commercial properties will likely continue to be developed along SR 135 and along CR 144 near SR 37. Finally, a limited amount of light industrial and commercial growth may occur around the Old Town area as well.



ENVIRONMENTAL CONDITIONS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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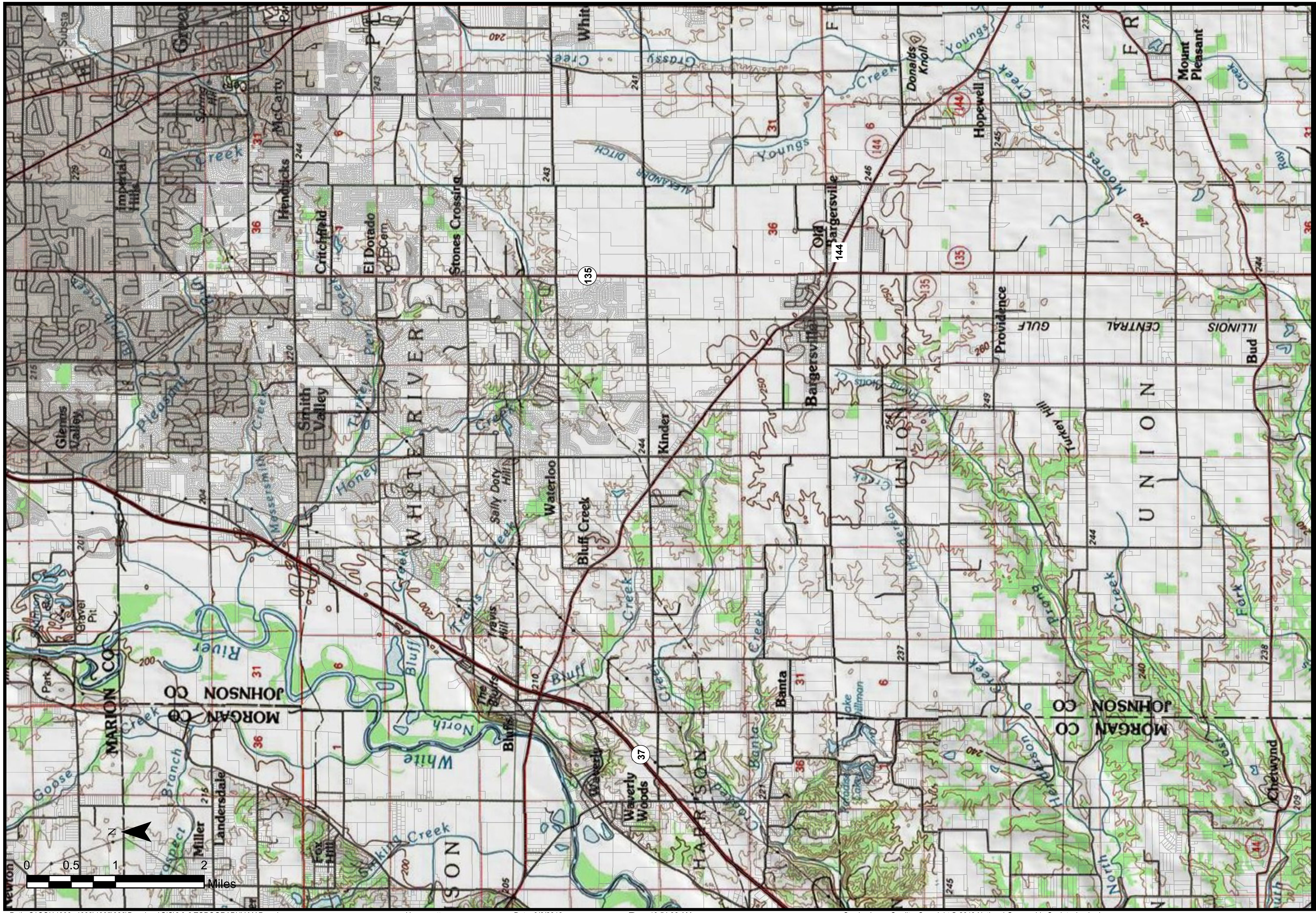
FIGURE 2.02-1
4005.086

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\2.02-1 ENVIRONMENTAL CONDITIONS.mxd User: scottw Date: 9/20/2018 Time: 4:22:12 PM Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



TOPOGRAPHY MAP

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 2.02-2
4005.086

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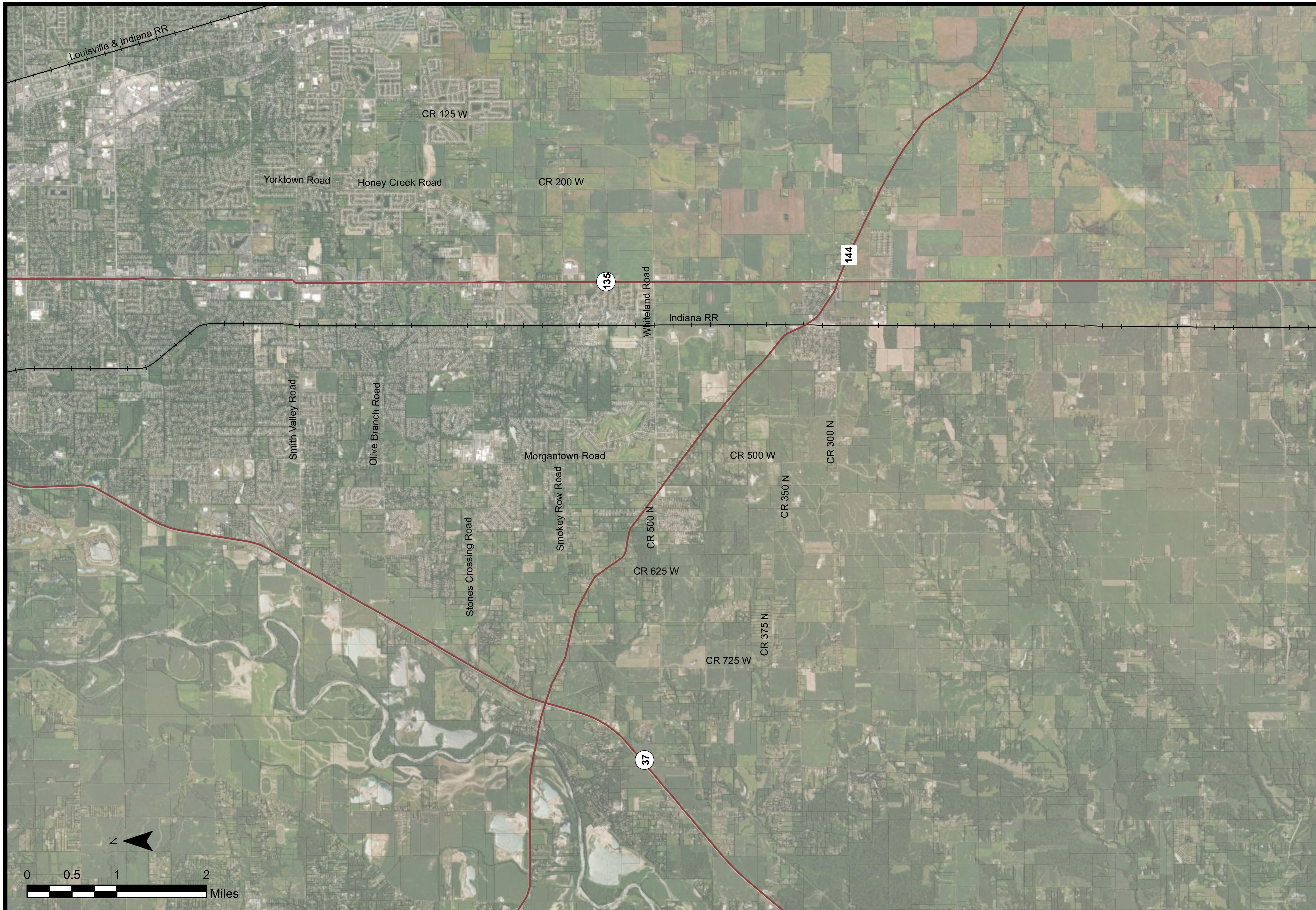

MAJOR ROADWAY AND RAILROAD

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 2.02-3
4005.086

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\2.02-3 MAJOR ROAD AND RAILROAD.mxd User: scottw Date: 9/20/2018 Time: 4:21:37 PM Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

With the future development of SR 37 into I-69, the Town anticipates that population growth will continue to occur throughout the area water service. The northern zone of the system has already been built out over the years and it is not anticipated that a great deal of growth will continue in this area.

2.04 REVIEW OF WATER SYSTEM

This subsection provides a general overview of the Town's Water System. Sections 3 through 5 will provide further discussion on the Water Utility facilities and needs. The Water Utility system consists of seven supply wells, two WTPs, and a distribution system with one booster stations and six water storage tanks. The system has two pressure zones. The static hydraulic grades for the northern pressure zone is approximately 905 ft. msl and for the southern pressure zone is approximately 955 ft. msl.

A. Water Supply

Figure 2.04-1 presents a map showing the locations of the seven supply wells. These wells are located in two separate wellfields. The northern wellfield consists of three wells that supply WTP No. 1 as well as a single well on the WTP site. The firm capacity of the northern wellfields is approximately 7.2 million gallons per day (mgd). The southern wellfield consists of three wells that supply WTP No. 2. The firm capacity of the southern wellfield is approximately 5.8 mgd.

B. Water Treatment

Figure 2.04-1 also shows the locations of the WTPs that are operated by the Town. The rated treatment capacity of WTP No. 1 is 5.4 mgd, and the rated treatment capacity for WTP No. 2 is 6 mgd. WTP No. 1 has 1.25 million gallons of clearwell volume, while WTP No. 2 has 2 million gallons of clearwell volume.

C. Water Distribution and Storage

Figure 2.04-2 presents a map showing the distribution system for the Town's water utility. The system is comprised of nearly 240 miles of pipe. The pipe ranges between 1- and 24-inches in diameters for the treated water piping. The oldest pipe in the system was installed approximately 80 years ago. In addition to the piping, the distribution system contains six water storage tanks and one active booster stations (two inactive). The water storage tanks have a total volume of approximately 3 million gallons. The booster station has a firm capacity of 2,000 gallons per minute (gpm), and it distributes water from Kinder Tank to Bargersville Tank.

2.05 POPULATION DATA

A. Historical Population

Table 2.05-1 presents historical population data for the Town, Union Township, White River Township, and Johnson County from Census data. The table also includes yearly population estimates from 2010 to 2017, which are from STATS Indiana, a statistical data utility for the State of Indiana, developed and maintained by the Indiana Business Research Center at Indiana University's Kelley School of Business. In 2010 and 2011, the Town annexed additional areas into the Town limits, which accounts for the large increases in the Town population presented in the following.

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\2.04-1 WTP #1 & #2 Wells.mxd

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Date: 10/16/2018

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WTP #1 & #2 WELL LOCATIONS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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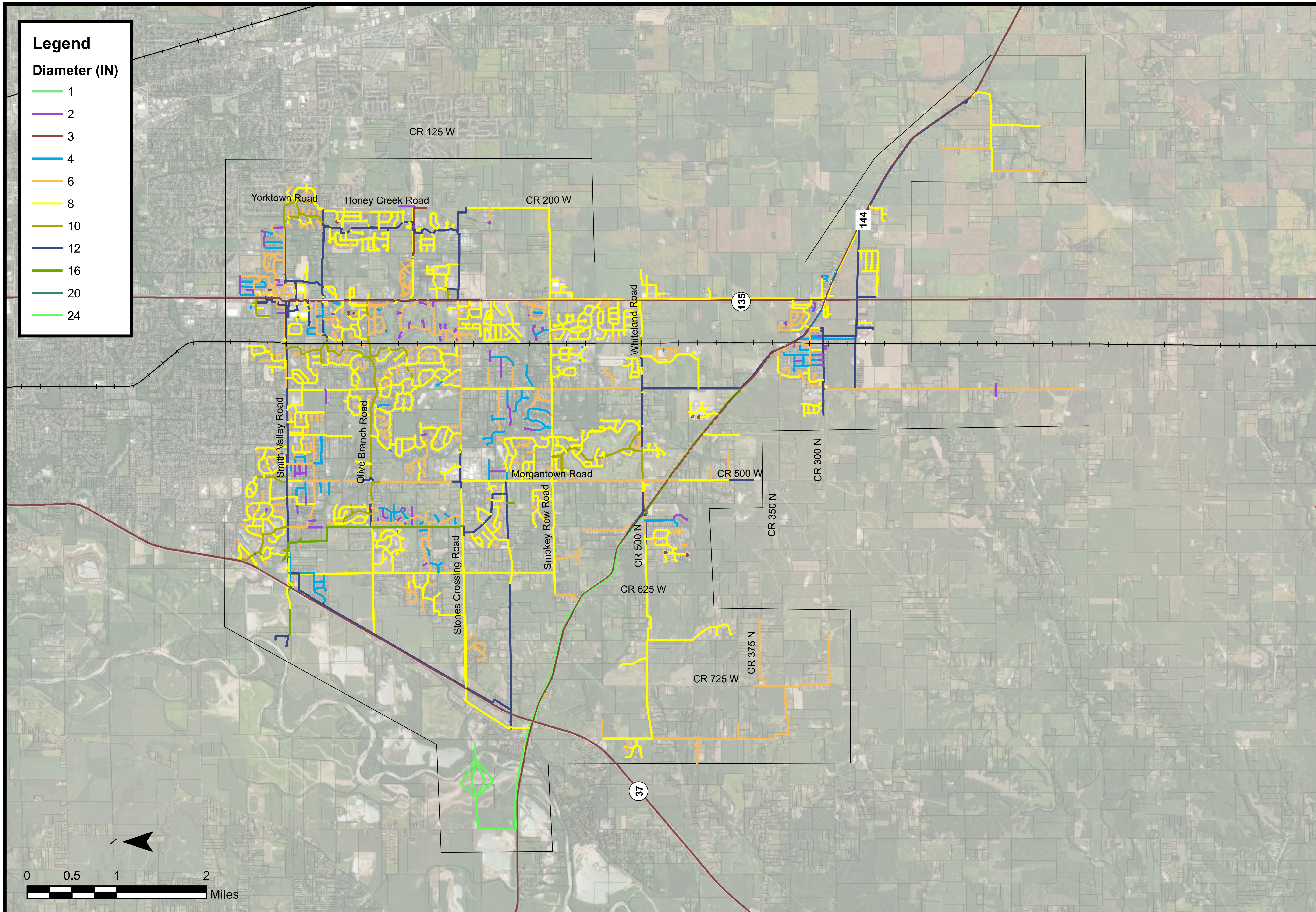
FIGURE 2.04-1
4005.086

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



EXISTING DISTRIBUTION SYSTEM

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 2.04-2
4005.086

	Town of Bargersville		Union Township		White River Township		Johnson County	
Year	Population	% Annual Change	Population	% Annual Change	Population	% Annual Change	Population	% Annual Change
1920	290		1,199		2,042		20,739	
1930	282	-0.3%	1,120	0.0%	2,060	0.1%	21,706	0.5%
1940	297	0.5%	1,112	-0.1%	2,024	-0.2%	22,493	0.4%
1950	413	3.9%	1,278	1.5%	2,832	4.0%	26,183	1.6%
1960	586	4.1%	1,336	0.5%	6,369	12.5%	43,704	6.7%
1970	873	4.9%	1,797	3.5%	10,740	6.9%	61,138	4.0%
1980	1,647	8.9%	2,023	1.3%	20,527	9.1%	77,240	2.6%
1990	1,681	0.2%	1,946	-0.4%	28,232	3.8%	88,109	1.4%
2000	2,120	2.6%	2,226	1.4%	35,539	2.6%	115,209	3.1%
2010	4,013	89%	2,689	2.1%	42,100	1.8%	139,654	2.1%
2011	6,231	55%	2,746	2.1%	42,873	1.8%	141,720	1.5%
2012	6,341	1.7%	2,784	1.4%	43,435	1.3%	143,442	1.2%
2013	6,511	2.6%	2,831	1.7%	44,090	1.5%	145,403	1.4%
2014	6,688	2.7%	2,877	1.6%	44,686	1.4%	147,017	1.1%
2015	6,900	3.2%	2,930	1.8%	45,387	1.6%	148,935	1.3%
2016	7,184	4.1%	3,000	2.4%	46,287	2.0%	151,543	1.8%
2017	7,457	3.8%	3,066	2.2%	47,115	1.8%	153,897	1.6%

Table 2.05-1 Historical Population for Town, Townships, and County

B. Population Projections

Since the Town serves an area much larger than the Town limits, the population projection was based on three factors. The first was the Environmental Protection Agency (EPA) Water System source that indicated the water system served 26,665 people in 2010. The second was Indiana Stats. The water utility primarily serves people in two Johnson County Townships, White River, and Union. Based on the mapping, it was projected that the Town serves approximately 75 percent of Union Township with the remainder of the water system serving White River Township. This results in the water system serving approximately 2,024 people in Union Township and 24,641 people in White River Township as of 2010. The White River Township population served is approximately 58 percent of the Townships population. Based on the growth that has occurred in each Township between 2010 and 2017, the population served in 2017 would be approximately 29,748. The third factor was an indication from the Town that it could be assumed that population growth will continue as it has over the past 7 years for the duration of the planning period. Using the 2010 to 2017 linear projection, the predicted water system population in 2038 is 38,772, or approximately 39,000. Figure 2.05-1 shows the linear projection and proposed future population.

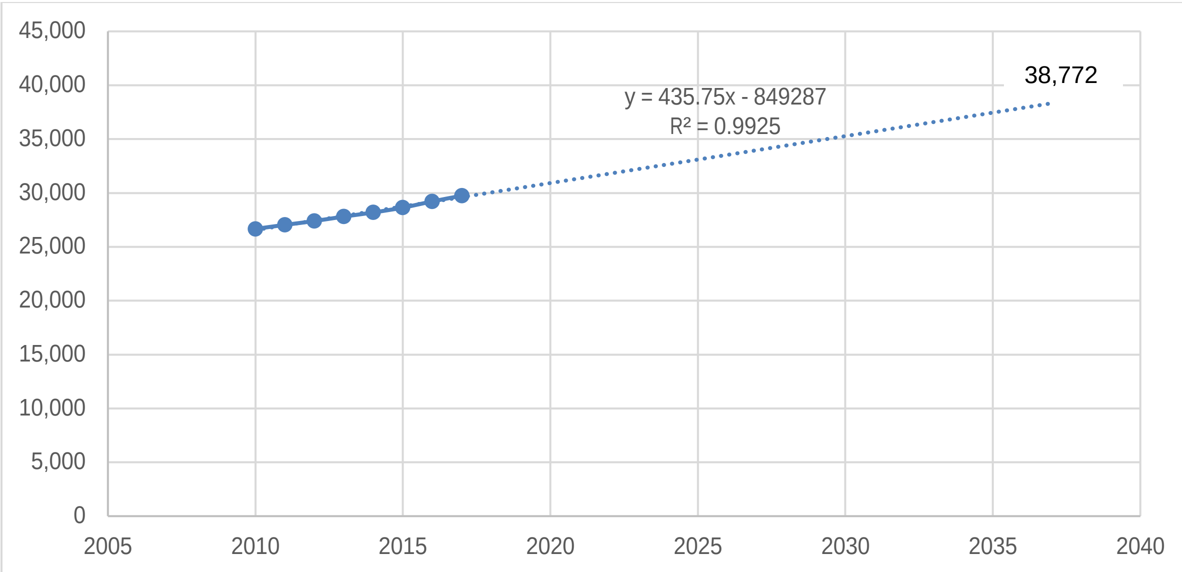


Figure 2.05-1 Bargersville Water Utility Population Served–2010 to 2038

2.06 CUSTOMER DATA

Customer data from 2013 to 2017 was used to provide an additional check with regard to the predicted population growth. At the end of 2017, the Town had approximately 11,705 water customers, approximately 78 percent of the total customers being residential customers. Figure 2.06-1 presents a breakdown showing the percentage of customers of each category and Figure 2.06-2 shows a breakdown of percent of gallons billed by customer type (residential, commercial/government/public, industrial, and residential irrigation).

While residential customers account for 78 percent of the total number of customers, the demand associated to residential accounts for approximately 51 to 66 percent of the total system demand depending on the time of year. This disparity is due to the large demands the system experiences for lawn irrigation. Residential irrigation customers account for 19 percent of the total number of customers. Commercial and Public (or Government) customers account for approximately 3 percent of the total number of customers.

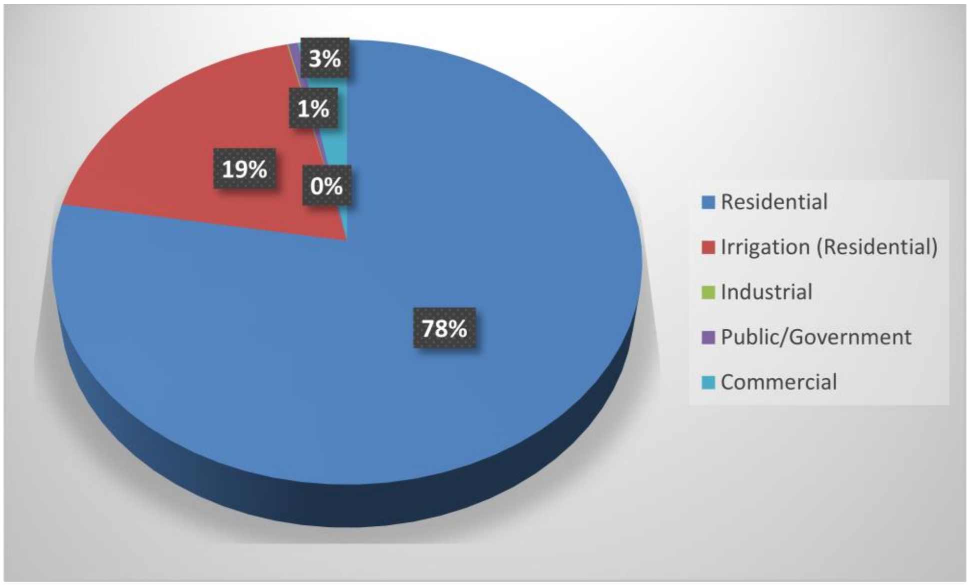


Figure 2.06-1 Percentage of Water Customers Breakdown

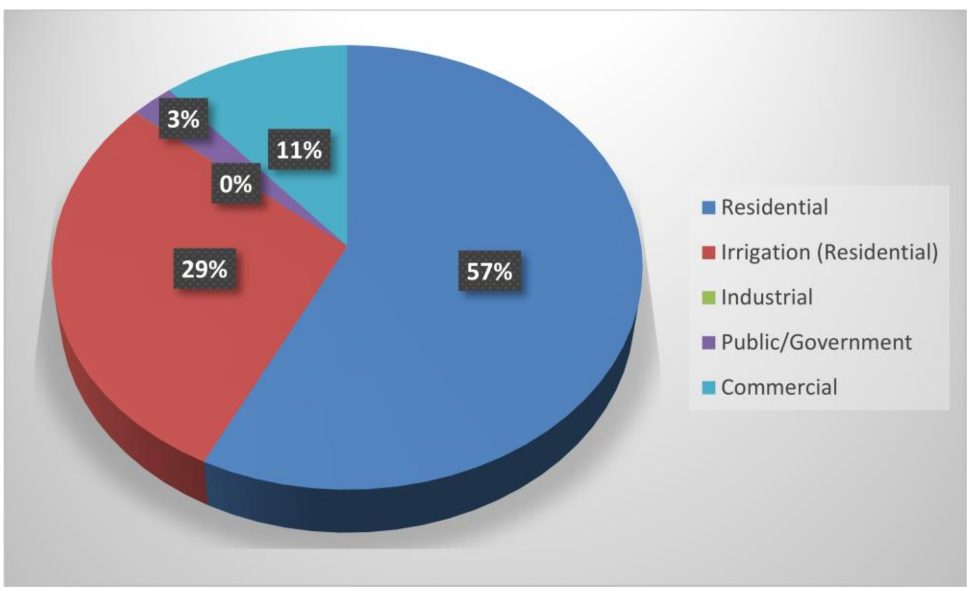


Figure 2.06-2 Percentage of Water Demand by Customer Type

Based on discussions with Town employees, it was determined that the appropriate increase in number of residential customers on an annual basis would be 175. In addition to this residential growth, the Town indicated that it would be appropriate to plan that 50 percent of new residential customers will have irrigation meters associated with the property. With the continued residential growth, the Town consensus was that commercial growth would continue as well with each new commercial property also including irrigation. This results in commercial growth of approximately 20 percent over the 20-year planning period. Table 2.06-1 shows the projected increases for each significant customer type.

Year	Total Customers	Residential Customers	Commercial Customers	Public/Government Customers	Residential Irrigation Customers[2]
2017	11,705	9,106	346	70	2,176
2038	17,033[1]	12,606[2]	418	73	3,926

[1]Customers based on projected residential, commercial, public/government, residential irrigation, and 10 industrial customers
[2]Customers based on Residential Customer Growth Rate

Table 2.06-1 Water Customer Projections

2.07 CURRENT RATES

The water utility operates with a rate system that includes a meter charge, a water use charge, and a fire protection charge. A full description of the water utility rates can be found in Chapter 52.02 of the Town of Bargersville, Indiana Code of Ordinances. The relevant ordinance can be found in Appendix A. Table 2.07-1 shows the monthly meter charge. All water consumed within the system is charged at $5.06 per 1,000 gallons. The monthly flat rate fire protection charge is $7.37. Based on the rate structure the Town uses, a residential customer that uses 5,000 gallons each month can expect to pay $38.63, which includes the fire protection fee.

Meter Size	Meter Charge
5/8 inch	$ 5.96
1 inch	$ 7.82
1 1/2 inch	$ 9.67
2 inch	$ 14.78
3 inch	$ 52.36
4 inch	$ 66.28
6 inch	$ 98.76
8 inch	$135.88
10 inch	$177.64

Table 2.07-1 Monthly Water Meter Charge as of July 2018

SECTION 3
EXISTING WATER UTILITY FACILITIES

3.01 EXISTING FACILITIES

The Town provides drinking water derived from groundwater sources to residences, businesses, and industries in and around the Town. The water utility facilities include production wells, WTPs, water mains, storage tanks, and booster pumping stations. The production wells are grouped in two well fields; the northern well field consists of four active wells with capacities that vary between 1,000 and 2,500 gpm; the southern well field consists of three wells with capacities that vary between 1,500 and 2,500 gpm. The north wellfield is located west of the intersection of Smith Valley Road and SR 37 and serves WTP No. 1. The south wellfield is located directly east of WTP No. 2, which it serves. The water utility operates two water treatment facilities. WTP No. 1 was first constructed in 1977 and later renovated in 1994. It has a capacity of approximately 5.4 mgd. WTP No. 2 was constructed in 2012 with a 6 mgd capacity. The water utility maintains approximately 240 miles of distribution pipe that ranges between 1- and 24-inch-diameter. The system also has one active booster pumping station with two pumps with each pump having an approximate capacity of 2,000 gpm. Finally, six water storage tanks exist in the distribution system with 3.15 million gallons of storage, but only 2.5 million gallons of useable storage. The remainder of this section will provide a more in-depth look at each of these aspects of the water utility.

3.02 WATER SUPPLY

In 2016, the combined well production totaled 1,058,500,000 gallons with a peak month of 126,900,000 gallons in June, which is typically the peak month as shown in Figures 3.02-1 and 3.02-2 representing 2014 and 2016 pumping. The total reported pumping in 2014 for all wells was 1,018,400,000 gallons with a peak month of 131,800,000 in July.

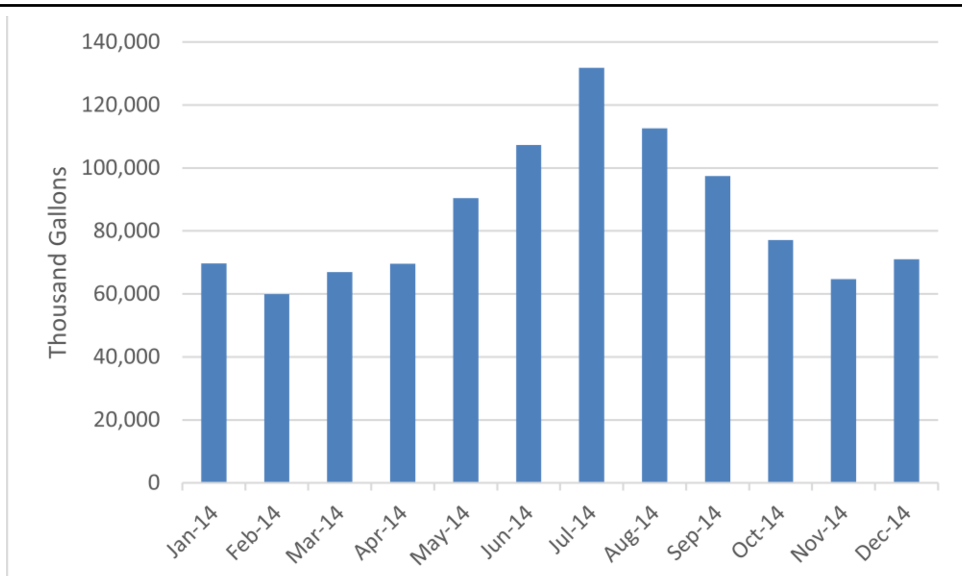


Figure 3.02-1 2014 Monthly Well Production

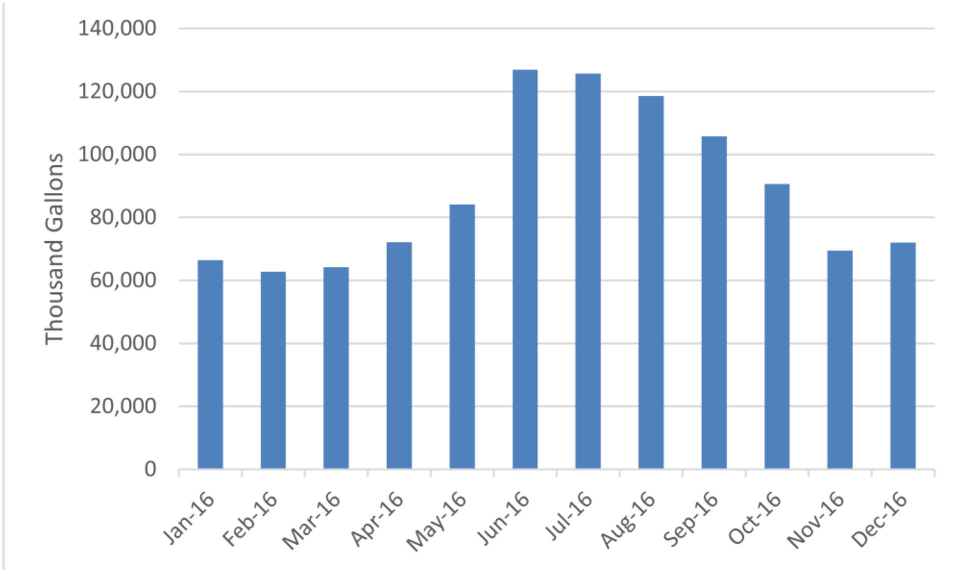


Figure 3.02-2 2016 Monthly Well Production

WTP No. 1 is the older of the two plants and is rated for 5.4 mgd and is supplied from four active wells both near the WTP and west of the intersection of Smith Valley Road and SR 37 as shown in Figure 2.04-1. The well number and current rated pumping capacity of each well is listed in Table 3.02-1.

Well	Depth	Capacity (gpm)	Year	2017 Specific Capacity (gpm/ft)
6	99	1,000	1985	54
7	85	2,000	1991	55
8	95	2,000	1991	40
9	93	2,400	2005	38
Total		7,400		

Table 3.02-1 WTP No. 1 Production Well Information

These wells are capable of supplying 8.9 mg to the WTP if all wells are operating 20 hours per day. The firm capacity with the largest well out of service is approximately 6 mg for 20 hours of operation. These well capacities were derived from utility records and discussions with the Town utility staff.

WTP No. 2 was constructed in 2012. The current WTP capacity is 6 mgd. This WTP is supplied by three total wells, which are shown in Figure 2.04-1. The 2017 well capacities, pumping rates, and year of construction are shown in Table 3.02-2.

Well	Depth	Capacity (gpm)	Year	2017 Specific Capacity (gpm/ft)
10	105	1,500	2013	37.5
11	105	2,500	2013	62.5
12	105	2,500	2013	62.5
Total		6,500		

Table 3.02-2 WTP No. 2 Production Well Information

These wells are capable of supplying 7.8 mg to the WTP if all wells are operating 20 hours per day. The firm capacity with the largest well out of service is approximately 4.8 mg for 20 hours of operation per day.

3.03 WATER TREATMENT

WTP No. 1 was constructed in 1977 and last had major renovations in 1994, when seven new filters and three new fluidized bed reactors were installed inside the facility. Following those renovations, the water treatment plant had a 5.4 mgd peak design flow with nine filters being operational, with the tenth filter cell out of service. The process consists of softening via fluidized bed reactors, pH adjustment with recarbonation, gravity sand filtration, intermediate pumps, clearwells, and high service pumps. The filter backwash process uses a water backwash method for filters 1 to 3 and an air scouring method for filters 4 to 10 with backwash water being discharged to a recycle tank from where water is recycled and the waste products are pumped to lagoons. The chemicals used include chlorine, fluoride, and caustic soda. WTP No. 2 was constructed in 2012, and it uses the same process as WTP No. 1. Each of the four filters at WTP No. 2 use an air scouring method for filter backwash. The rated capacity for WTP No. 2 is 6 mgd.

Appendix B presents a representation of the expected useful life expectancy for different portions of the process incorporated at these facilities. The figure in Appendix B represents what would be anticipated to be reasonable periods of time until processes would need to be scheduled for replacement. Those areas that are red would be areas where age would dictate that a replacement is likely necessary. Because of quality of construction, it is possible that portions of the existing facility may require attention before the time when it would typically be anticipated.

The following sections will further describe each of these processes.

1. Softening

WTP No. 1 consists of three 1,100 gpm fluidized bed reactors (FBR) and one 600 gpm FBR that are permanently installed inside the facility. A fourth 1,100 gpm FBR has been installed outside for additional softening treatment, if necessary. This additional FBR was necessary before WTP No. 2 was constructed. Since that time, the fourth FBR has not been necessary. The

600 gpm FBR was installed in 1977 when the WTP was initially constructed, and the remaining three indoor FBRs were installed during the 1994 project.

WTP No. 2 consists of four 1,100-gpm FBRs. The FBRs were all installed inside the facility when the WTP was constructed in 2012.

These softeners were constructed to aid in the removal of calcium hardness from the water. Hardness primarily consists of calcium and magnesium carbonates. The type of softening completed by the Town's process only removes the calcium hardness to noticeable levels. Sodium hydroxide (caustic soda) is added to the water when it enters each reactor to raise the pH and promote the precipitation of calcium carbonate. Each reactor has sand inside of it that aids in collecting the particles of calcium carbonate and by providing a catalyst for the calcium carbonate to precipitate. Once the particle size reaches a certain point, it settles to the bottom of the tank where it is "blown out" of the process on a periodic basis to a blowdown pit. The resulting blowdown with the sand and calcium is the waste product of the system. This product drains out by gravity. The resulting waste from the system is less then 10 percent of the waste that would be produced by a lime softening process that produces lime sludge. The sand that is blown down at the bottom is replaced with new sand at the top from a sand elevator and sand supply in the catalyst room.

2. Recarbonation Tank

The recarbonation tank for WTP No. 1 was constructed with the 1994 project. The tanks overall dimensions are approximately 55.25 feet long by 10 feet wide and a side water depth of 21.67 feet. The total volume of the tank is approximately 89,500 gallons. At the rated capacity of the WTP, this results in approximately 22 minutes of detention time.

The recarbonation tank for WTP No. 2 was constructed with the 2012 project. The tanks overall dimensions are 36 feet long by 20 feet wide by 23 feet side water depth. The total volume of the tank is approximately 116,000 gallons. At the rated capacity of the water plant, this results in a detention time of approximately 28 minutes.

The recarbonation tanks are used to adjust the pH down and stabilize the water. This is accomplished by adding carbon dioxide to the water. The pH of the water determines the amounts of bicarbonate, carbonate, and carbon dioxide in the water. When the pH is increased, the carbon dioxide is driven out of the water. By adding carbon dioxide back into the water, this serves to lower the pH to a point where carbon dioxide can be maintained within the water.

3. Filtration

The filters at WTP No. 1 were built in two phases. The 1977 project involved the construction of three 13 feet by 13 feet filter cells. These filters were constructed to use a surface wash during backwash of the filters. During the 1994 construction project, seven more 13 feet by 13 feet filters were constructed. Each of these newer filters use an air scour process to aid in the backwash process. The filters are all dual media filters with 15-inches anthracite above 15-inches sand and 12 inches gravel. The filter media for each of the filter cells has been in place since the 1990s.

The filters at WTP No. 2 were built with the 2012 construction project. The WTP has four filter cells that are each 22 feet by 22 feet arranged in a cluster filter format. This means that water enters the filters from a central box where the four filters are clustered around the box. The filters are backwashed using an air scour process. The new filters each have 12-inches anthracite above 18-inches silica sand, 3-inches torpedo sand, and 12-inches of gravel. Polymer is added prior to the filter at WTP No. 2 as an aid to iron removal.

The backwash process for both WTPs involves bringing water back from either the clearwells or the system to provide up to 15 gpm/sq.ft. The filters that use the air scour process receive their air from blowers that were designed to provide up to 3 cubic feet per minute (cfm)/sq.ft. of filter. For WTP No. 1, a blower capable of providing 507 cfm is required. For WTP No. 2, a blower capable of 1,452 cfm is provided for the air scour process. The backwash water is transferred to a recycle tank at each WTP. At WTP No. 1, this recycle tank has a capacity 94,000 gallons. At WTP No. 2, the recycle tank has a capacity of approximately 230,000 gallons.

Both recycle tanks are partially underground circular concrete structures with covers. The recycle tanks receive water by gravity from the filters during a backwash cycle. The tanks are covered to allow for the Town to recycle the backwash water; if they were not covered, the backwash water would be considered as being influenced by surface water because of the exposure to the elements. After the backwash cycle has completed for a filter cell, the water is allowed to settle out waste material from the filter media in the backwash tank. Once the waste material has settled, the Town is able to pump water by siphoning from the top of the tank back into the process. Once complete with the recycle, the waste material is pumped to the backwash lagoons. At the lagoons the water percolates back into the ground while the waste material (primarily iron precipitates) remain.

4. Clearwells

Each water treatment plant has two clearwells on-site. The total clearwell capacity at WTP No. 1 is 1.25 million gallons (MG). The original clearwell is 0.25 MG, with the newer clearwell having a capacity of 1.0 mg. The old 0.25 MG clearwell was constructed in the late 1950s when the original WTP, which has been effectively demolished, was constructed. The 1.0 MG clearwell was constructed in the mid 1980s. Both clearwells at WTP No. 1 are painted welded steel ground storage tanks. Each tank receives water from the filtration process via three intermediate pumps through a shared 16-inch water line that exits the north side of the facility. Both fluoride and chlorine are injected into the 16-inch water line that is between the filters and clearwells. The high service pumps pull water from each clearwell through a 20-inch water line. The purpose for the clearwells is to both provide contact time for chlorine disinfection and contribute to the overall system storage that the Town provides.

The total clearwell capacity at WTP No. 2 is 2.0 mg. The clearwells were both constructed in 2012 with each clearwell having an approximate capacity of 1.0 mg. Both clearwells at WTP No. 2 are glass-lined bolted steel tanks. Each tank receives water from the filtration process via three intermediate pumps through a shared 24-inch water line that exits the north side of the facility. Both fluoride and chlorine are injected into the 24-inch water line that is between the filters and clearwells. The high service pumps pull water from each clearwell through a 30-inch water line. The purpose for the clearwells is to both provide contact time for chlorine disinfection and contribute to the overall system storage that the Town provides.

5. Pumps

Each facility consists of three types of process pumps: recycle pumps, intermediate pumps, and high service pumps. The recycle pumps bring water from the backwash recycle tank back into the treatment process prior to the softening process. The recycle stream is to have a flow no greater than 10 percent of the raw water well pump flow coming into the WTP. The intermediate pumps transfer water from the intermediate wet well following the filters to the clearwells. The high service pumps pull water out of the clearwells and pumps it out into the water system for use by customers.

Each WTP uses centrifugal pumps for the recycle pumps and vertical turbine pumps for the intermediate and high service pumps. At WTP No. 1 the two recycle pumps each have a capacity of 350 gpm; the intermediate pumps consist of three pumps each with a 1,750 gpm capacities; the three high service pumps consist of one pump with a 1,250 gpm capacity and two pumps each with a capacity of 1,750 gpm. At WTP No. 2, the two recycle pumps each have a capacity of 416 gpm; the intermediate pumps consist of one pump with a 1,660 gpm capacity, and two pumps with 2,500 gpm capacities; the four high service pumps each have a capacity of 1,500 gpm.

6. Chemical Addition Processes

The WTP feeds chlorine, fluoride, caustic soda, and carbon dioxide into the water throughout the treatment process. Additionally, polymer is fed up at WTP No. 2. Each of these processes will be further discussed within this section.

a. Chlorine

Both WTPs use 150 pound chlorine gas cylinders as its chlorine supply. At WTP No. 1, chlorine is injected into two locations throughout the process. Those locations include: the filter effluent between filter cells and the clearwells, and finally the suction line for high service pumps 1 to 3. The typical finished chlorine dose is approximately 0.8 milligrams per liter (mg/L). The total concentration of chlorine injected before filtration should be sufficient to remove iron concentrations up to 1 mg/L. At WTP No. 2, chlorine is injected into three locations throughout the process. Those locations include: the pipe leading to the filters, the filter effluent between filter cells and the clearwells, and finally the suction line for high service pumps 1 to 3. The prefilter injection point is an extra barrier for the iron removal prior to the filters. The typical finished chlorine dose is approximately 0.9 mg/L. The total concentration of chlorine injected before filtration should be sufficient to remove iron concentrations up to 3 mg/L.

b. Fluoride

The WTP uses 23 percent hydrofluorosilicic acid as its source of fluoride for the system. The Town uses bulk and day tanks for the storage of the fluoride at both WTPs. Both WTPs inject fluoride the filters and the clearwells.

c. Caustic Soda

Both WTPs use caustic soda to aid in their softening process. The caustic soda solution is 50 percent and is kept in multiple bulk tanks at each WTP. Each bulk tank is approximately 7,000 gallons, allowing the utility to store one and a half tanker trucks to meet regulatory requirements. The bulk tanks are also heated because caustic soda needs to be maintained at a temperature above 50 Fahrenheit (F) to prevent the liquid from becoming unusable because of it changing from a liquid to more of a gel at this temperature. The day tank has a capacity of 600 gallons. Finally, the feed rate of the caustic soda is approximately 80 mg/L.

d. Carbon Dioxide

Both WTPs feed carbon dioxide for the purpose of lowering the pH of the water. Each WTP maintains a tank capable of containing approximately 34 tons of liquid carbon dioxide. The typical dose the Town feeds to the water for pH adjustment is approximately 45 mg/L.

e. Polymer

The Town feeds a high charge polyacrylamide polymer at WTP No. 2. The polymer is fed to aid the filters in iron removal. The Town feeds approximately 0.5 lbs/day of polymer.

3.04 WATER DISTRIBUTION SYSTEM

The water distribution system maintained by the Town consists of six water storage tanks, one active booster pumping stations, and approximately 1.3 million feet of water main. The system distributes water to approximately 12,000 customers with approximately 2,500 irrigation customers included in that quantity.

A. Water Storage

The water utility maintains six storage tanks within the distribution system. Table 3.04-1 shows the pertinent information for each tank maintained by the system. The total tank volume in the system is 3.15 MG, but the useable tank volume in the system is approximately 2.5 million gallons.

Tank Name	Type	Capacity	Year Built	Ground Elevation	Overflow Elevation	Rehabilitation Year
Orchard Hill	Ellipsoidal	500,000	1977	786	913	2015
Curry	Ellipsoidal	500,000	1991	800	905	2014
Bargersville	Ellipsoidal	500,000	1991	824	960	2012
Critchfield	Glass Lined Elevated	550,000	2005	776	905	N/A
Stone’s Crossing	Glass Lined Elevated	550,000	2005	800	914	N/A
Kinder	Glass Lined Elevated	550,000	2005	812	955	N/A

Table 3.04-1 Water Storage Tanks

B. Booster Stations

The existing water system has one operational booster station to pump water across the high pressure zone from the Kinder Water Tank to the Bargersville Water Tank. There are two additional booster stations that are not in service that were once used to pump water to the Bargersville Water Tank until WTP No. 2 became operational. The designs for the Kinder Booster Station was two 40 horsepower (HP) pumps that provide pumping capacities of 2,000 gpm at 59 feet total dynamic head (TDH) each. Kinder Booster Station is an aboveground package station manufactured by EFI. The station has a control valve to allow water to flow back to the suction side of the station if the Town chooses to allow for this to occur.

C. Pipe Distribution System

The water distribution system contains approximately 1.3 million feet of water main. The existing system is comprised of piping that ranges primarily between 1- and 24-inch-diameter piping. Table 3.04-2 shows the distribution of water main by size from 4 inches and larger. This table shows that the majority of the pipe in the system that is associated with distribution mains in neighborhoods are 6 and 8 inches in diameter. The majority of the transmission main piping is 12 inches but it does vary between 10 inches and up to 24 inches.

Pipe Diameter (in)	Pipe Length (ft)
4	73,200
6	288,500
8	580,300
10	55,700
12	171,200
16	28,100
24	36,900
Total	1,233,900

Table 3.04-2 Pipe Size and Quantity

Additionally, the majority of the pipe throughout the system is polyvinyl chloride (PVC) piping. Generally speaking, the piping that was installed around 1955 and since has been PVC while the piping installed prior to 1955 was cast iron piping. There are limited quantities of ductile iron and HDPE piping found throughout the system. Table 3.04-3 shows the types of piping that can be found throughout the system along with the approximate quantities of each type of piping. The difference in quantity between Tables 3.04-2 and 3.04-3 is due to piping that is smaller than 4 inches. The Town has approximately 40,000-ft of pipe primarily comprised of 2- and 3-inch pipe.

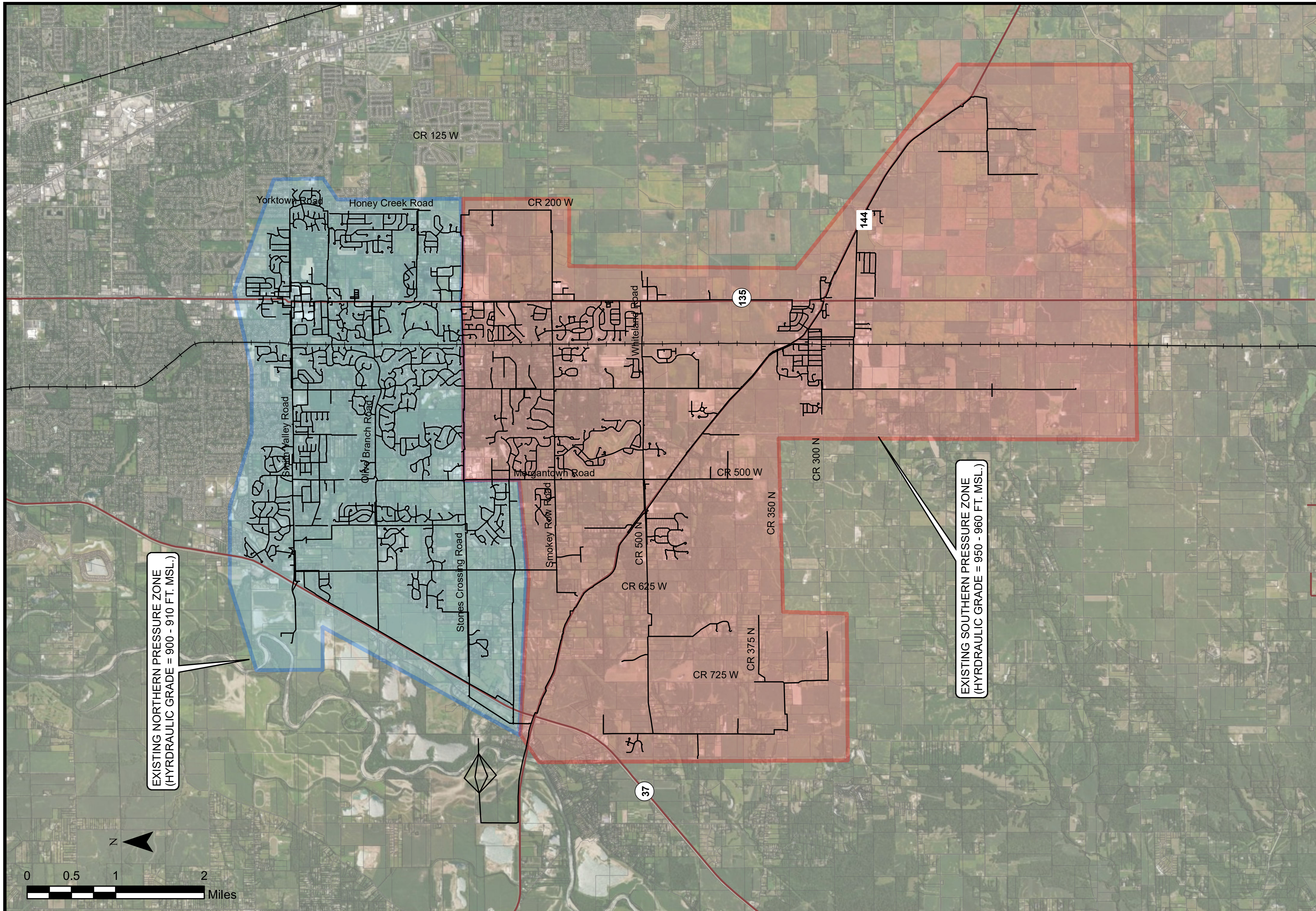
Pipe Type	Pipe Length (ft)
Cast Iron	81,400
Ductile Iron	12,300
PVC	1,179,900
HDPE	1,000
Total	1,274,600

Table 3.04-3 Identified Pipe Material

Figure 3.04-1 shows the current approximate pressure zone split between the low and high pressure zones that make up the system. The low pressure zone has a supplied static hydraulic grade of approximately 905 ft. msl. The high pressure zone has a supplied static hydraulic grade of approximately 955 ft. msl.

Figure 3.04-2 shows the existing minimum water pressures throughout the system. The existing system has minimum typical pressures of approximately 40 to 45 psi. The Town has stated that the desired minimum pressure that is supplied by the distribution should be approximately 55 psi. The distribution system improvements discussed in Section 4 of this Master Plan for the northeast portion of the system are those that are generally necessary to increase the pressure for the majority of customers to approximately 55 psi. Because of hydraulic grade limitations, the system will not be able to provide consistent water pressures above 55 psi, in the higher pressure zone, when the ground elevation exceeds 830 ft. msl. When the ground elevation exceeds 845 ft. msl., the Town will not be able supply pressures of more than 50 psi.

Figure 3.04-3 shows the calculated fire flow values for each node in the hydraulic model for the existing water system.



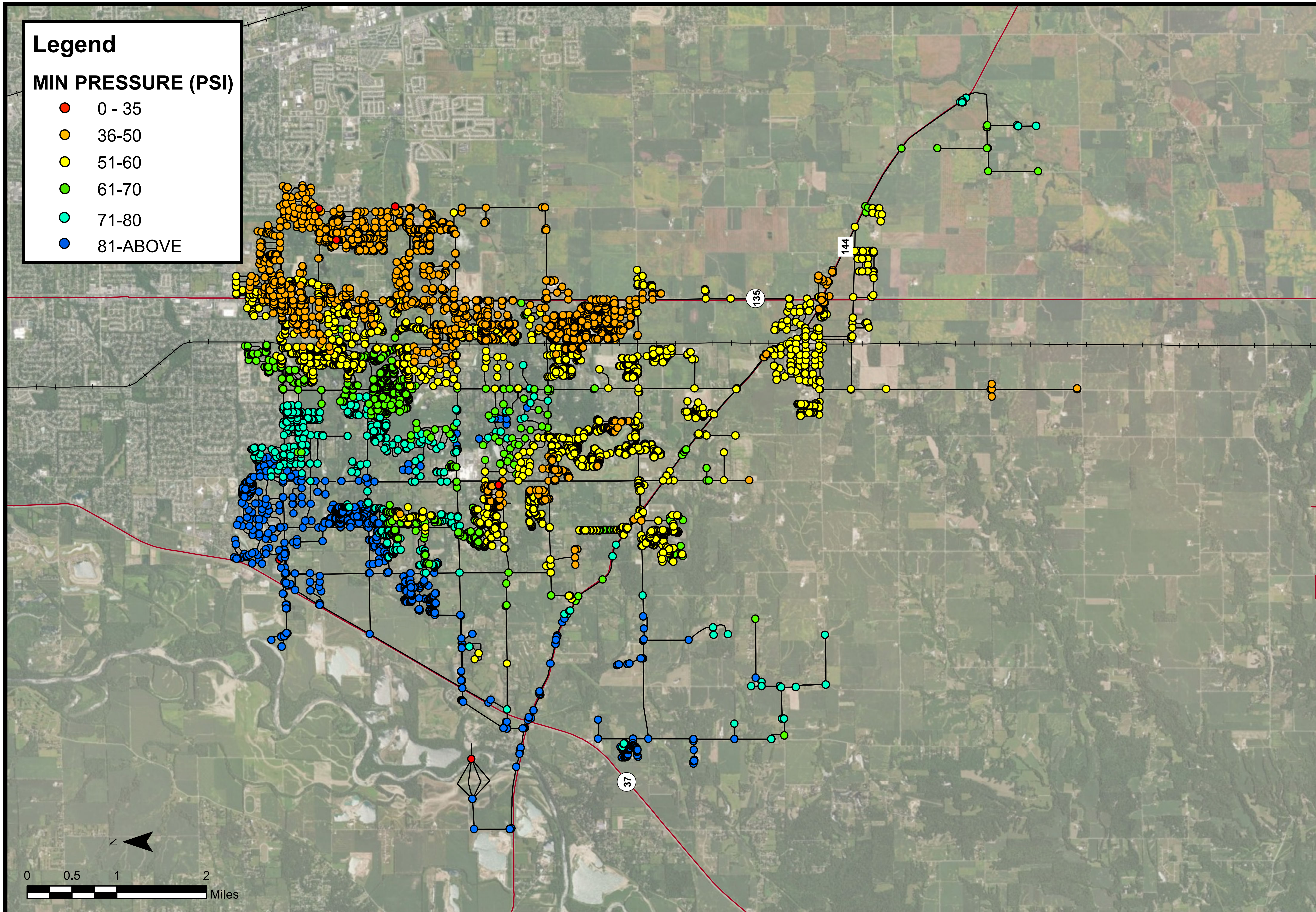
EXISTING PRESSURE ZONES

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 3.04-1
4005.086

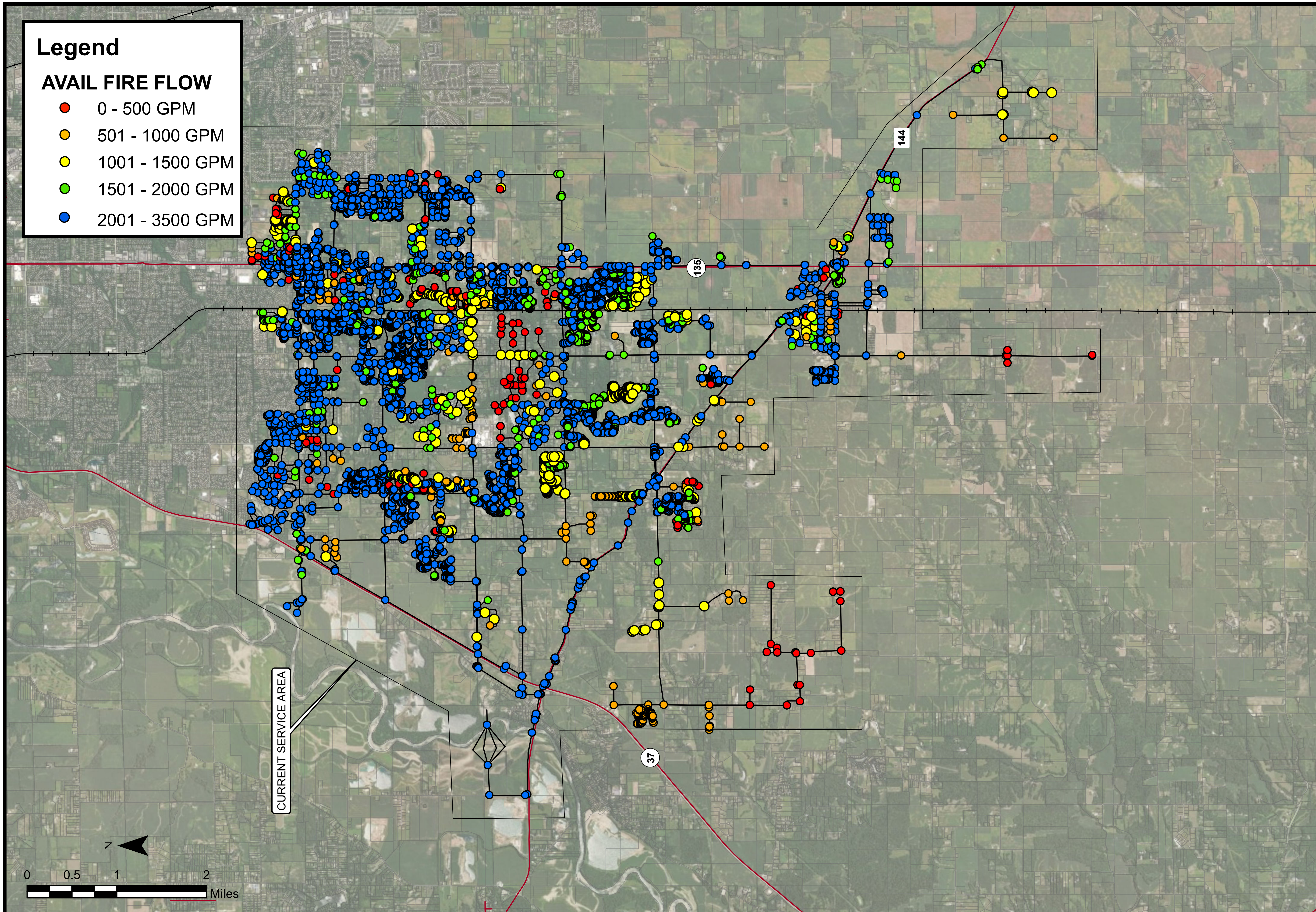
Path: S:\COL\4000--4099\4005\086\Drawings\GIS\3.04-1 EXISTING PRESSURE ZONE.mxd User: scottw Date: 10/16/2018 Time: 11:41:22 AM Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



EXISTING MINIMUM PRESSURE
PEAK 6.5 MGD FLOW
WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 3.04-2
4005.086



EXISTING FIRE FLOW CAPACITY
PEAK 6.5 MGD FLOW

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 3.04-3
4005.086

SECTION 4
WATER UTILITY ANALYSIS

4.01 WATER PUMPING AND METER USE RECORDS

Between 2013 and 2017, the water utility had an average daily production of approximately 2.9 mgd and an average daily demand of 2.6 mgd. Table 4.01-1 shows the annual water demand and production between 2013 and 2017. Data from 2014 was not available

Water	2013	2014	2015	2016	2017
Water Produced (x1,000 gallons)	1,050,673	N/A	1,009,219	1,059,038	1,103,551
Water Demanded (x1,000 gallons)	919,507	N/A	887,229	935,623	983,849
Percent Nonrevenue Water	12.5%	N/A	12.1%	11.7%	10.8%

Table 4.01-1 Annual Water Demands

Based on average and peak daily demands, along with the quantities of existing customers, an average gallons per day per customer class can be established for each of the customer groups. Additionally, the peaking factors between the annual demands and summer demands for each group of customers can be determined. Table 4.01-2 shows the average water demand both annually and summer months (June through September) between 2013 and 2017. Table 4.01-3 shows the gallons per day per customer (gcd) for each customer class.

Customer Class	Average 2017 Annual Daily Demand (gpd)	Average Summer Daily Demand (gpd)
Residential	1,552,000	2,197,000
Irrigation (Residential)	778,000	1,523,000
Industrial	1,000	1,000
Public/Government	70,000	129,000
Commercial	305,000	369,000
Total	2,706,000	4,219,000

Table 4.01-2 Daily Water Demands per Customer Class

Customer Class	Average Annual Daily Demand (gcd)	Average Summer Daily Demand (gcd)
Residential	172	241
Irrigation (Residential)	359	702
Industrial	63	63
Public/Government	1,065	1,842
Commercial	893	1,050

Table 4.01-3 Daily Water Demands per Customer

Future projections for water demand and water supply can be completed by several methods. The first method is based on population projections. As shown in Table 4.01-4, the Town's water usage has typically been between 85 and 91 gpd per person. Based on conversations with Town employees, it was determined that the population trend starting in 2010 should be used for the population projection going forward. This trend results in a population of approximately 39,000 people at the conclusion of the 20-year planning period. Figure 2.05-1 shows the population projections and trendline that were used to arrive at this projection. Based on Table 4.01-2, the summer water demand would be assumed to be 160 percent of the average water demand. Based on production history, the peak water demand would be assumed to be 250 percent. The demands would then be divided by the average revenue water (88.2 percent) to arrive at the required daily production values in 2038.

Year	Annual Water Demand (x1,000 gallons)	Population Served	Gallons Per Capita per Day
2013	919,507	27,810	91
2014	N/A	N/A	N/A
2015	887,229	28,640	85
2016	935,623	29,216	88
2017	983,849	29,748	91

Table 4.01-4 Daily Water Demands per Person

The second method uses the customer growth projections. This method matches the customer growth information found in Table 2.06-1 with the demands per customer found in Table 4.01-3. This method is able to project annual average daily flows and summer average daily flows, but it fails to be able to produce peak daily requirements since the flows used by customer class are presented in monthly data rather than daily data.

The third method is using production data to establish a trendline that is extended to 2038. Figure 4.01-1 shows the production data between 2013 and 2017 with its associated trendline. Using the trendline results in the projected annual average daily water production. Using historical production data indicates that the average summer daily flows are 152 percent that of the annual average daily flows. Finally, production data indicates that the peak daily flow was 257 percent the average annual daily flow.

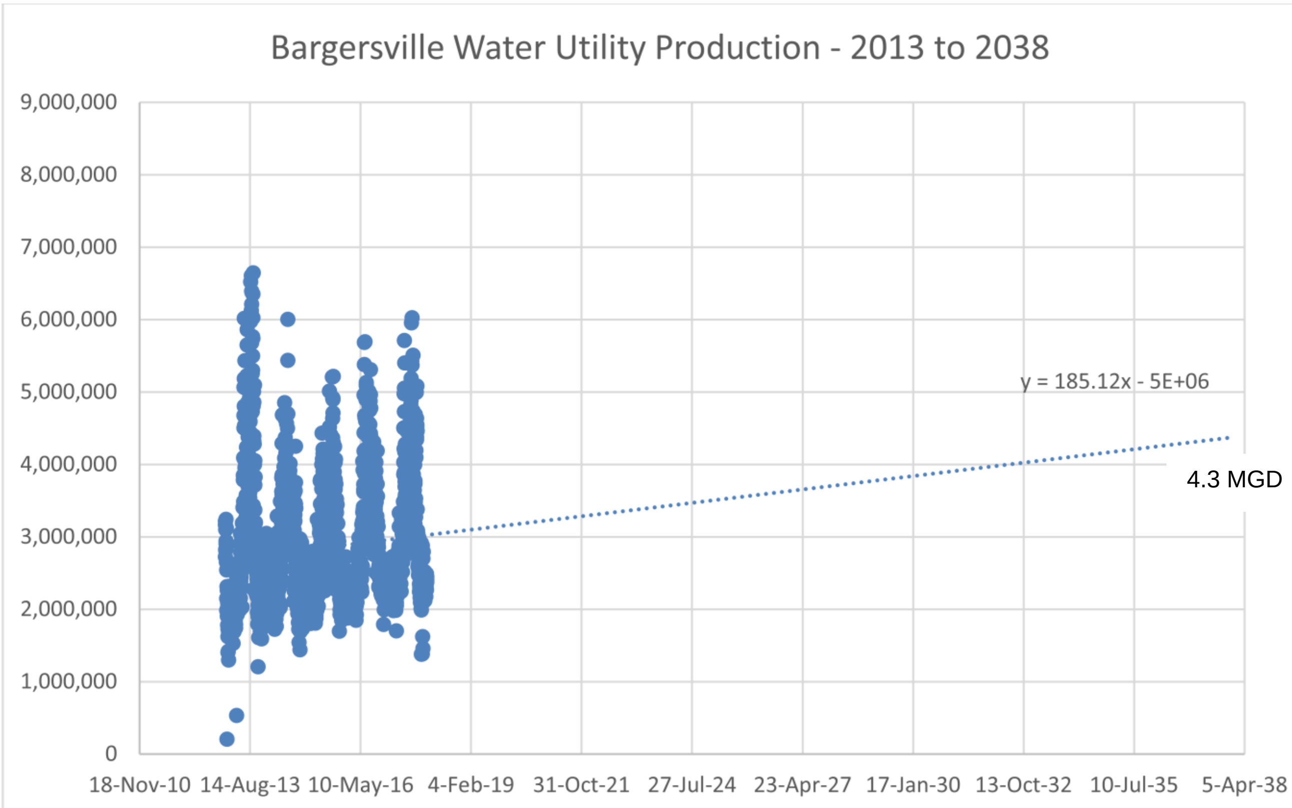


Figure 4.01-1 Bargersville Water Production–2013 to 2038

Each of the results from these methods for determining demand can be found in Table 4.01-5.

Method	Average Annual Daily Production (gpd)	Average Summer Daily Production (gpd)	Peak Daily Production (gpd)
Population Based	4,024,000	6,438,000	10,060,000
Customer Based	4,568,000	7,126,000	
Production Based (2013 to 2017)	4,335,000	6,579,000	11,141,000
Average	**4,309,000**	**6,714,000**	**10,601,000**

Table 4.01-5 2038 Projected Daily Water Production

Based on the projections shown in Table 4.01-5, it would be reasonable to project that average daily production would be approximately 4.3 mgd, and the peak daily production would be approximately 10.6 mgd. A typical summer day in 2038 will likely require water production of approximate 6.7 mgd. These are the projected amounts of treated water that the Town would be pumping from the water plants. The entire water system should be planned around these supply requirements. The WTPs and booster stations should be capable of continuing to provide water throughout the peak daily water supply requirement of 10.6 mgd. The storage for the system should be based on the 4.5 mgd average daily water supply.

4.02 WATER SUPPLY ANALYSIS

The current firm well capacity is 7.2 mgd at the northern wellfield and 5.8 mgd and the southern wellfield. This results in an overall firm well capacity of 13.0 mgd for the system. While the wellfields have the needed capacity to supply the planning period water demand, the recommended improvements to the water treatment plants will have the capacity to supply 14.7 mgd. Additional supply wells should be considered to more closely match the WTP capacities.

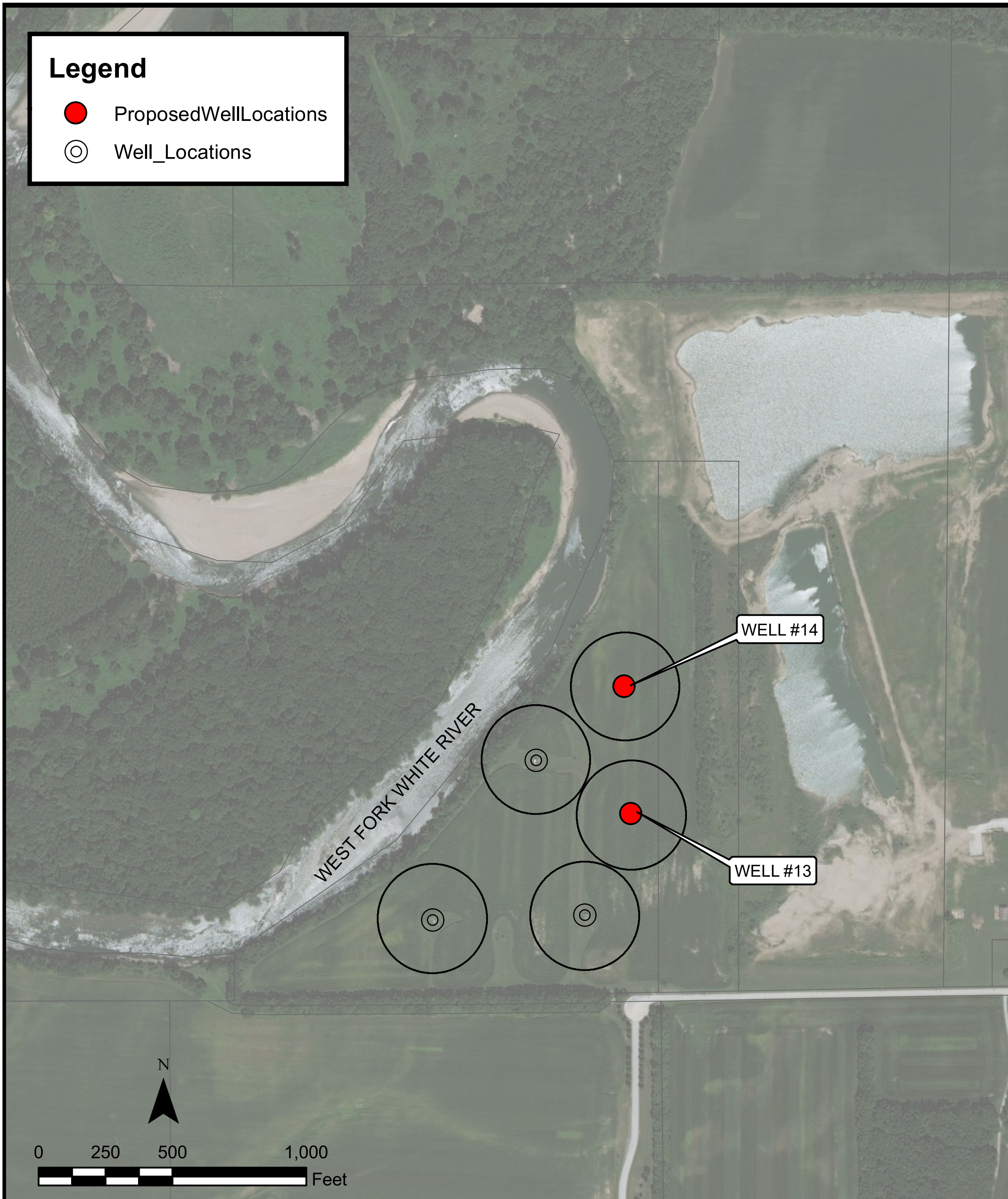
A. WTP No. 1–Northern Wellfield

The WTP No. 1 wellfields requires an additional 1.2 mgd in capacity to supply 8.7 mgd reliably to WTP No. 1. There are concerns with existing Wells No. 6 and 9. Well No. 6 (at WTP No. 1) lacks the desired capacity. Well No. 9 is larger than each of the other wells and is overly relied on to supply the WTP with raw water. In regard to Well No. 9, it would be recommended that two wells be constructed within several hundred feet of Well No. 9 to provide the capacity necessary in the event that something were to occur to Well No. 9 due to the amount of time it has been used since it was constructed. Two wells would provide the Town with the ability to continue to meet the capabilities of the future WTP capacity even if something were to occur to Well No. 9 that would remove it from service for an extended period of time. Figure 4.02-1 shows the proposed locations for these wells. The Town would maintain a 300-foot setback distance on each of the new wells to protect from encroachment from gravel mines. The Town should continue to explore the capabilities of the existing wellfield. It would be suggested that the two new wells be built at different times and a new 16-inch raw water main be installed between the existing wellfield and the WTP.

B. WTP No. 2–Southern Wellfield

The wellfield for WTP No. 2 does not require much work at this time. The main improvement the Town should consider for this wellfield is placing each of the wells onto variable frequency drive (VFD) starters. At this time, the WTP must always operate the smaller 1,500 gpm well with one of the larger wells when it is desired to produce water at approximately 4,000 gpm. This results in the 1,500 gpm well running more often than the other two wells. If the existing well starters are replaced with VFDs, the Town would have the ability to operate the two larger wells together without exceeding the rating of the WTP. It will provide more flexibility on the operations side of the wellfield and WTP.

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\4.02-1 WTP #1 PROPOSED WELLFIELD.mxd
User: scottw
Date: 9/21/2018
Time: 11:09:16 AM



WTP #1 PROPOSED WELL LOCATIONS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 4.02-1
4005.086

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

4.03 WTP ANALYSIS

The existing process and buildings have been previously discussed in Section 3. With the overall existing WTP capacity being approximately 11.4 mgd, it is recommended that the Town increase its treatment capacity since the projected peak daily flow for the planning period will result in the system operating at approximately 93 percent treatment capacity. Based on the anticipated demand falling below the treatment capacity, it is recommended that at least one of the WTP's optimize its existing filtration capacities rather than building a full expansion at WTP No. 2. Since WTP No. 1 will need a substantial rehabilitation project during the planning period because of age, it is recommended that the Town concentrate on optimizing this WTP during this planning period. The following section will provide an analysis of those issues that have been identified with the existing facilities.

A. Plant Metering

Generally, meters used within the WTP should be calibrated on an annual basis as they have been. The Town should also plan to replace the meters used at the treatment facility every 20 years or sooner if the calibration process determines that the meter is losing accuracy at a quicker rate.

The process itself should have metering in the following locations: raw water main, recycle stream, each fluidized bed reactor, finished water main, and WTP domestic supply. Flow meters capable of both instantaneous flow readings and totalizing flows should be provided for the raw water, recycle, finished water, and backwash water. Instantaneous meters should be supplied for the filter inlets. Finally, totalizing meters should be provided for the WTP domestic plant supply. Both WTPs should consider replacing their meters during the planning period since the existing meters will be between 25 and 40 years old at the conclusion of the planning period.

B. Softening–Fluidized Bed Reactors (FBRs)

Each WTP provides softening using FBRs. The existing reactors appear to be in sufficient condition for continued operation. The recommendation for each reactor is that the Town should consider sandblasting and repainting each reactor during the next capital project. These tanks should be maintained in much the same manner as the water tanks in the system, with maintenance including repainting the tanks with each capital project at the WTP. This will allow for continued protection of the carbon steel from the sand, caustic soda, and water that are in or injected within the tank.

The softening process at WTP No. 1 is one of the primary limiting factors, along with the recarbonation basin, at the WTP that causes a reduction in firm capacity at the WTP. The permanent reactors at WTP No. 1 have a total rated capacity of 3,900 gpm. It is recommended that the Town install two additional 1,100-gpm FBRs. The existing outdoor reactor could likely be reused, but it is recommended that it is moved closer to the building, enclosed, and rehabilitated in the same manner as the others, along with an additional new reactor. With this improvement, the new softening process would have a total capacity of 6,100-gpm, a firm capacity of 5,000-gpm, and a capacity of 5,500 gpm with the small reactor offline. Since softening is not required for finished water, the total capacity of the softeners can be considered toward the firm capacity of the WTP.

The softening capacity at WTP No. 2 is sufficient for the 20-year planning period. Beyond the planning period, the Town can complete a phased approach that would initially only add softening capacity to increase the WTP capacity to 8.3 mgd, which is what both the filters and recarbonation tank can handle.

C. Recarbonation Tanks

There are two requirements for the functionality of the recarbonation basin. The entire basin is required to have a detention time of 20 minutes and the mixing chamber of the tank is to have a detention time of at least 3 minutes. WTP No. 2 has a 116,600 gallon tank, which provides an overall detention time of 28 minutes at the 4,160 gpm design capacity. WTP No. 1 has an 89,500 gallon tank, which provides an overall detention time of 22 minutes at 3,900 gpm.

During this planning period, it is recommended that the Town increase the size of the recarbonation tank at WTP No. 1 to 122,000 gallons with the recommended capital project. This, along with the recommended softening improvements, will allow the utility to increase the capacity of the WTP to approximately 8.7 mgd.

At WTP No. 2, the recarbonation tank can continue providing treatment up to a rated capacity of 8.3 mgd.

The recarbonation basins also provide detention time for iron to precipitate. If chlorine is added upstream from the recarbonation tank, iron removal should be completed before reaching the filters. With WTP No. 2, the iron removal is aided with polymer addition before the filters. This allows for the finer iron particles to form large flocs that are easier for the gravity sand filters to remove. It is not recommended that this manner of iron removal be used typically, but if necessary it provides additional redundancy for the WTPs to treat for secondary drinking water standards.

C. Filtration

Filtration is based on requirements that limit their capacity to 4 gpm/sq.ft. of filter. The overall capacity of the WTP filtration capacity is to be determined on an N-1 basis. This means that the rated capacity of the WTP has to assume that one filter cell is offline. For WTP No. 1, the allowable capacity of the treatment plant would be determined based on the abilities of nine of the filter cells, and WTP No. 2 would be based on the abilities of three of the filter cells.

The firm capacity of the filters at WTP No. 1 is 6,084-gpm or 8.7 mgd. This is based on 10 filter cells (9 active) that are each 13 feet by 13 feet with a flow of 4 gpm/sq.ft. The primary area of concern for the filters is the age of the equipment inside the filters. Three of these filters have backwash troughs and other internal equipment that is approaching 40 years old. The media in the filters are in excess of 20 years old. The other seven filters are over 20 years old and will pass 40 years in service during this planning period. Additionally, the media in these seven filters is original to the filter. Our recommendation is that the Town consider replacing the equipment and media in all 10 filter cells as a part of the next capital project. This equipment replacement would include transitioning the original three filters to an air scour process for backwash to match the other filter cells. A new blower would be recommended along with the filter equipment as well. This project is recommended to occur in the mid 2020’s, which will result in all 10 filters having no improvements completed for 30 years.

The firm capacity of the filters at WTP No. 2 is 5,808 gpm or 8.3 mgd. This is based on 4 filter cells (3 active) that are each 22-feet by 22-feet with a flow of 4 gpm/sq.ft. The filters should continue in sufficient operational condition through the planning period. However, it is recommended that the Town should replace the filter media during the planning period.

D. Clearwells

As previously discussed, the WTP has two clearwells with a total capacity of 1.25 million gallons. Depending on the rated capacity of the WTP, this results in a clearwell detention time of between 3.5 to 5 hours. While this volume may be sufficient for treatment concerns, it results in the WTP being required to be staffed more often while water is being produced. With the future average daily water demand of approximately 4.3 mgd, it is recommended that the Town consider replacing the 0.25 MG clearwell with a clearwell with a volume between 1.5 and 2.0 MG. This clearwell capacity will result in a detention time of more than 8 hours while operating at plant capacity. During average daily demand conditions, the Town should be able to produce the necessary water to fill the clearwells over the course of 8 to 12 hours. Furthermore, the clearwell capacities at both WTP's would be sufficient to provide water to the system throughout the remainder of the day without additional water needing to be produced before the next day.

With the future peak daily demand projected to be 10.6 mgd, a third clearwell at WTP No. 2 would be recommended. With 6 MG of storage at both WTPs, the Town would need to produce approximately 7.6 MG of water each day on a weekend to maintain water for the system. With the recommended upgrades to WTP No. 1 that are recommended during the planning period, the Town would be capable of producing up to 7.3 mgd with a 12-hour shift on each day. Between WTP stored water and produced water, the Town would have up to 20.6 MG available for a 48 period. Based on the summer diurnal curve for the system, it would be projected that the Town would need approximately 21.2 MG for a 48 hour period starting at 4 AM on Saturday and ending at 4 AM on Monday. The current system effective storage is 2.5 MG. From a storage standpoint, the system would have 1.9 MG of available water at the end of the weekend. This accounts for 22 percent of system storage (clearwells and elevated water tanks) still being available, without the additional clearwell at WTP No. 2 the system storage would be at about 12 percent of available storage. Based on this worst case scenario, it is recommended that the Town construct a third clearwell at WTP No. 2, during the planning period, to allow for reduced shifts being required on the weekends during the summer as well. However, it is not recommended that the Town would allow for water to drop to this level at any time in the system. This scenario is only meant to show that it is possible. If it were to occur where multiple peak days were to occur together, the Town should have provisions in place for an on-call person to come in when the water would drop below a certain level.

An additional benefit to the additional clearwell storage is the benefits that water storage contributes to 4-log virus removal by disinfection. The necessary CT value for water at F° is 6.0 (Chlorine Concentration x Time [minutes]) for 4-log removal of viruses. If this value is maintained and correctly monitored, the Town does not have to monitor its wells for bacteria contamination. With a large amount of clearwell storage, the chlorine injection prior to the clearwells can be maintained at a lower value to decrease the likelihood of producing disinfection byproducts. Additional chlorine can be added before the high service pumps to increase the chlorine level to the amount needed within the distribution system.

E. Pumps

Each WTP has three sets of production pumps; the recycle pumps, intermediate pumps, and high service pumps. The Town should consider replacing each of these pumps at WTP No. 1 with their next project. With the recommendation of increasing the treatment plant capacity from 5.6 mgd to 8.7 mgd with the future capital project, the pumps will need to be increased appropriately to match this change in production capacity. The recycle pumps will need to be capable of operating at approximately 600 gpm. This is both because of the allowed increase of recycle based on the stream making up 10 percent of the WTP influent flow, and with the increased flow, the Town will likely see an increase in the number of backwashes that will be required. At this size, the pump would need 7 hours to return 250,000 gallons to the WTP. In general, this would allow for five filter backwashes during a night shift, followed by up to 12 hours to allow for settling, and finally day shift operating the recycle to return the water to the process and send the remaining water to the lagoons. The intermediate pumps would each need to be designed to pump approximately 3,000 gpm. Finally, the Town should install four 2,000 gpm high service pumps for supplying water to the system.

Since the overall treatment capacity is not proposed to change at WTP No. 2, the existing pumps should be sufficient for the planning period. The Town will need to continue routine maintenance on each of the pumps, but it is not anticipated that the pumps would need replacement during the 20-year planning period.

F. Backwash Waste Process

The backwash waste process includes the recycle tank and lagoons.

At WTP No. 1, there is one 94,000 gallon recycle tank and four backwash waste lagoons. With 10 filters at the WTP, the Town should consider having the capability to store the backwash volume from five of these filters on a given day. Assuming 15 gpm/sq.ft. backwash rate and a 20-minute backwash, the recommended volume for the backwash recycle tank would be approximately 254,000 gallons. With the existing tank volume, the Town should consider whether it would be necessary to construct a second 160,000-gallon backwash recycle tank. The quantity of lagoons that are on-site at this time should be sufficient for the planning period. With the next capital project, the Town may choose to perform maintenance on these lagoons by cleaning them out from the years of backwash waste.

At WTP No. 2, there is one 230,000 gallon recycle tank and one 300,000 gallon backwash lagoon. With four filters at the WTP, the Town should consider having the capability to store the backwash volume from 2 of these filters on a given day. Assuming 15 gpm/sq.ft. backwash rate and a 20-minute backwash, the recommended volume for the backwash recycle tank would be approximately 217,000 gallons. Based on this the existing backwash recycle tank should be sufficiently sized for the planning period. The backwash lagoon should be cleaned out of the iron sludge during the next project to maintain its usefulness into the future.

G. Chemical Addition Processes

As previously discussed, both WTPs use chlorine, fluoride, carbon dioxide, and caustic soda. WTP No. 2 also uses polymer to aid the filters in removing iron from the water. Finally, both WTPs use sand as a catalyst for the hardness to precipitate onto to quickly promote its removal. Chlorine has an H-3 occupancy rating, while fluoride (as fluorosilicic acid) and caustic soda have an H-4 occupancy rating. The H occupancy means that the chemical room(s) need to be separated from the remainder of the WTP by fire-rated walls and ceilings. The fire rating of these walls and ceilings are determined by the fire protection throughout the remainder of the facility. If the entire facility has sprinklers, one-hour walls and ceiling would be required between the chemical rooms and the remainder of the facility. If the facility does not have sprinklers, the walls and ceilings between the chemical room and the remainder of the facility need to have either a one- or two-hour rating depending on whether the remainder of the facilities receive a F-1 or F-2 rating, and the chemical rooms still require sprinklers.

Additionally, each liquid storage option that will be discussed below assumes a bulk storage tank with a day tank to be a portion of the recommended solution. This maintains compliance with the existing Recommended Standards for Water Works where it is stated that day tanks shall be provided where bulk storage of chemical is provided (5.1.11.a). The bulk storage tanks are recommended because generally the chemical costs are less expensive with bulk deliveries, and bulk storage results in safer conditions for operators by minimizing the exposure to each chemical.

1. Chlorine

Chlorine is added to the water for two purposes. Chlorine that is added before filtration (prechlorination) is added for the purpose of primarily oxidizing iron. The reaction requires approximately 2 parts per million (ppm) chlorine to remove 1 ppm iron. Chlorine that is injected following the filtration process is primarily used for disinfection purposes. The addition of chlorine following filtration should be closely monitored to only maintain the levels of chlorine that are necessary for disinfection. This level is normally between 0.5 and 1 ppm free chlorine. If excessive chlorine is present, disinfection byproducts are more likely to occur within the system.

Chlorine gas is considered an oxidizing gas and toxic by the International Fire Code. The maximum storage quantity per control area to not receive a hazardous rating is 150 pounds (lbs). This rating causes the chlorine room to be rated as a high hazard with an H-3 occupancy rating since both WTPs operate with multiple 150-lb chlorine gas cylinders present in the room.

The Recommended Standards for Water Works, 2012 Edition, has a number of requirements for chlorine gas storage and feed. Chlorine gas is a chemical that is commonly used, but extremely dangerous, so the storage and feed requirements have been getting consistently more stringent recently. Three of the most relevant standards to the utility are: provisions must be made to neutralize chlorine gas from the largest container when the WTP is located near residential or developed areas (5.4.1.d.11); full and empty containers shall only be housed in the chlorine storage room (5.4.1.h.1); and protected from direct sunlight (5.4.1.h.5). There are additional standards that involve HVAC requirements that would dictate other design aspects, but these standards seem to be most applicable to the current situation for the utility.

Finally, chlorine injection points should be present in three locations within the WTPs. The prechlorination point should occur before the filters; an intermediate injection point should occur between the filters and clearwells; and a postchlorination point should occur on the discharge of the high service pumps. Before the intermediate and postchlorination points there should be continuous residual monitoring for both free and total chlorine. The utility should consider using the intermediate injection point to adjust to the desired system chlorine levels with the postchlorination injection point being used to polish off the level after the clearwells. This would allow the utility to include the clearwells towards their 4-log virus removal credit. This credit would allow for the utility to no longer be required to continually monitor its groundwater production wells for bacterial and viral contamination.

The Town should consider replacing the chlorine equipment during the next capital project. Based on the corrosivity of the chlorine gas, it is recommended that the Town would plan on replacing the chlorine equipment closer to every 15 years rather than waiting 25 to 30 years to update the chlorine process. Additionally, WTP No. 1 should consider the installation of a 150-lb chlorine scrubber at the WTP. The existing WTP is close to residential neighborhoods with residences being located within one-quarter mile of the WTP in all directions.

WTP No. 2 should consider replacing the current chlorine system with the project that would occur during this planning period. At that point the system would be approximately 20 years old, and it would be viewed as having exceeded its expected useful life. Unlike WTP No. 1, a scrubber should not be necessary at WTP No. 2 because of its location being relatively set back from residential houses.

2. Fluoride

The Town adds fluoride to the finished water to help prevent dental tooth decay. The decision to fluoridate is made by the Town and is not mandated. Assuming that the Town continues to fluoridate, the following is a discussion of the recommended improvements.

The Town feeds a 23 percent solution of fluorosilicic acid as the fluoride source. The chemical is rated as both toxic and corrosive by the International Fire Code. This rating means that the maximum quantity allowed to be stored in a facility before receiving a hazardous rating is 500 lbs, or approximately 50 gallons. Once this volume of fluorosilicic acid is exceeded, the room containing the chemical receives an H-4 occupancy rating. With an H-4 occupancy rating, the room that it is located in should be separated from the rest of the WTP. The walls separating the room from the remainder of the chemical rooms would need to have a minimum 1-hour fire rating. Finally, the maximum egress distance from the room to an exit from the WTP would be 75 feet.

It is recommended that both WTPs update their fluoride process when the next capital improvement project occurs. This would include pumps, tanks, scales and piping as well as HVAC (continuous ventilation required) in each room being replaced because of the highly corrosive environment that exists inside these rooms.

3. Caustic Soda

The Town adds caustic soda at each of its WTPs for the removal of calcium hardness from the raw water. This chemical addition, along with the FBRs and catalyst, aid the Town in reducing the water hardness to approximately 150 ppm.

The Town feeds a 50 percent solution of caustic soda as the sodium hydroxide source. The chemical is rated as both toxic, corrosive, and water reactive by the International Fire Code. This rating means that the maximum quantity allowed to be stored in a facility before receiving a hazardous rating is 500 lbs, or approximately 50 gallons. Once this volume of caustic soda is exceeded, the room containing the chemical receives an H-4 occupancy rating. With an H-4 occupancy rating, the room that it is located in should be separated from the rest of the WTP. The walls separating the room from the remainder of the chemical rooms would need to have a minimum 1-hour fire rating. Finally, the maximum egress distance from the room to an exit from the WTP would be 75 feet.

WTP No. 1 will require modifications to the existing caustic soda storage location since it shared by the catalyst system. These improvements would include separating the two areas and possibly including a sprinkler system. WTP No. 2 does not require structural modifications, but the pumps and other transfer equipment should be replaced with the next project when the system is more than 20 years old.

4. Carbon Dioxide

The Town add carbon dioxide to the water following the softening process to adjust the pH of the water and improve its stability. The softening process will typically raise the pH to between 9 and 10, the pH of the finished water is then adjusted, using carbon dioxide, down to approximately 8.0.

At this time, there would be no specific projects recommended related to the carbon dioxide tanks.

5. Catalyst

The catalyst that is used by the FBR softening process is sand. The sand is sent to the FBRs using a hopper and jet pump to combine the sand into water that then discharges into each FBR depending on how valves are opened or closed. Both catalyst systems were installed in 2012, so it is not anticipated that they will need to be replaced at WTP No. 1 during its recommended project, and it will need to be assessed before the WTP No. 2 project to determine whether they would need to be replaced or not.

H. <u>Supervisory Control and Data Acquisition (SCADA)</u>

SCADA improvements are recommended at both WTPs. The purpose of the improvements are to allow for both WTPs to be able to produce water while an operator is only present at one WTP. This would involve the ability for an operator to, at a minimum, control the process by having the capability of only starting and stopping production. In this case, if issues arise based on chemical feed the operator would shut down the water plant and then address the issue at the site. The second manner of control would give the operator the full ability to adjust feed rates of chemicals and pumping rates from a computer rather than on-site. Either manner of control would allow for continued operation at both WTPs while only one WTP is staffed. We would recommend that during typical business hours there is at minimum one operator at each WTP, and then the remaining time when treatment is occurring there would be an operator present at one of the two WTPs.

I. Staffing Requirements

With the large difference between the summer peak demand and the average daily demand the utility oftentimes has issues regarding staffing since the need for water production is much higher during the summer than the rest of the year. Generally, the Town needs to have at minimum six operators. During the average daily flow periods, five operators would be at the WTPs during the day for an 8-hour shift that would encompass 10 hours each day and one operator would work 12-hour days on the weekend and one day through the week. One of the 5 daily operators would be a backup person for the weekends on a rotating basis. During the summer months, three operators would be at the WTP during the day for an 8-hour shift, one operator would work second shift, one operator would work a third shift, and the weekend operator would continue with the same schedule as the remainder of the year.

Without the recommended improvements for the clearwells and SCADA, the Town will need to consider the need to have a minimum of 11 operators. Both WTPs during the summer would need to be staffed 24 hours a day 7 days a week. This results in nine operators, which would need two operators to be available for covering when people are out for reasons such as vacations, sickness, and planned leave.

J. Recommended Project

Based on the previous discussion, both WTPs will need modifications to either optimize the WTP or update systems that have exceeded their typical expected service life. The following is a summary of these improvements.

1. WTP No. 1

   a. Softening: Move FBR No. 5 to the building and purchase a sixth FBR. Sandblast and repaint the existing FBRs. Enclose the two additional FBRs into the building envelope. Demolish the existing media blow down pit and build a new one west of the existing facility.

   b. Recarbonation Tank: Expand the existing recarbonation tank by constructing a new channel directly to the west of the existing tank and providing the appropriate connections.

   c. Filtration: Remove media and equipment from each of the 10 filter cells. Install new equipment and media into each filter cell. Add air scour to original three filters.

   d. Clearwells: Demolish the original 0.25 MG clearwell. Build a new clearwell on-site with a capacity up to 2.0 MG.

   e. Pumps: Replace all the production pumps. This will include the recycle, intermediate, and high service pumps. Replacement is due to the new WTP capacity after the recommended project is complete.

   f. Backwash Process: Construction of a new 160,000-gallon recycle tank to be used in parallel with the existing backwash recycle tank.

g. Modify the Existing Chemical Rooms: This modification would include separating the caustic soda from the catalyst feed system.

h. Upgrade Chemical Systems: Replace the existing equipment in the chlorine and fluoride rooms. Also, a chlorine scrubber with the capacity to handle at least 150 lbs. of chlorine.

i. Piping: Replace meters and undersized piping. The piping will primarily be limited to connecting new portions of the process and installing new larger finished water piping to extend to the location where the 12- and 16-inch pipes split into different directions.

j. Building Improvements: New HVAC, electrical, and controls systems would be installed.

2. WTP No. 2

a. Clearwells: Construct a new 1 MG clearwell.

b. Upgrade Chemical Systems: Replace the existing equipment in the chlorine, fluoride, and caustic soda rooms.

c. Piping: Replace meters. The piping will primarily be limited to connecting the new clearwell into the treatment process.

d. Building Improvements: New HVAC, electrical, and controls systems would be installed.

4.04 HYDRAULIC MODEL DISCUSSION

This section discusses the development of the computerized hydraulic water distribution system model for the Town. The following is a discussion of the GIS infrastructure importation to WaterGEMs V8i and water demand allocation. The model calibration was previously completed with the 2017 Hydraulic Model Update project and the method to complete this calibration is in Appendix C.

A. <u>GIS Importation to WaterGEMS V8i</u>

WaterGEMs V8i was the software selected to create a computerized hydraulic model of the water distribution system. GIS information was imported into the WaterGEMs V8i previously using the ModelBuilder function. The GIS information included water main diameter, length, and material.

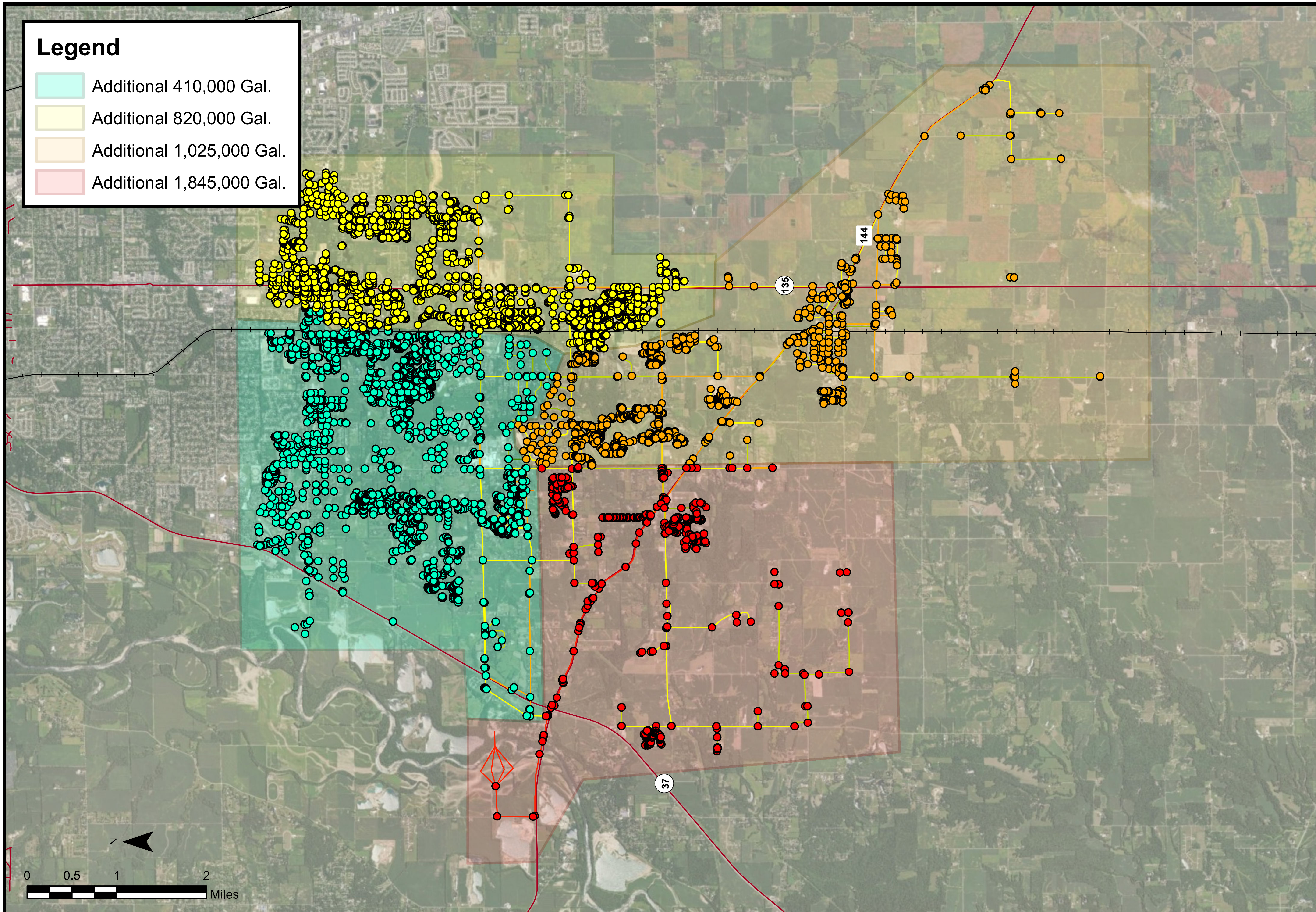
Upon importing the GIS information, WaterGEMs V8i automatically created a junction node at each end of a water main, excluding ends of water mains that connect to a tank or pump station. These junction nodes serve as points of elevation and allocated water demand sources in the model. Elevation

B. Water Demand Allocation

The Town's water meter location and usage information was used to distribute water demands throughout the model. Water meter usage data and addresses from October 2016 to February 2017 were used to estimate average and maximum demand days in the system. October 2016 was selected to use as the 2016 average day demand condition at approximately 2.23 mgd. A geocoding process was used to determine the location of the meters in the Town's water distribution system. The water demand was allocated to junction nodes via a WaterGEMs V8i Load Builder function. The LoadBuilder function took each meter location and water usage and assigned those values to the nearest geological junction node.

Once the 2016 average day demand was established, base water demands were increased by a factor of 2.91 across the entire water model to create a 2018 maximum day demand condition of 6.5 mgd. The 10.6 mgd 2038 maximum day demand condition was evaluated by distributing an additional 4.1 mgd to the 2018 maximum day demand condition. Figure 4.04-1 shows the allocation of the additional 4.1 mgd to specific anticipated growth areas as outlined in discussions with the Town. The 4.1 mgd was divided into 4 separate quadrants, northwest quadrant (10 percent), northeast quadrant (20 percent), southeast quadrant, (25 percent), and southwest quadrant (45 percent). Rather than multiplying these distributed percentage factor to each demand junction, the associated demand was evenly distributed across each demand junction within each zone based on the number of junctions. In other words, the proportion of the 4.1 mgd added to each area was divided among each junction within that area, leading to an even distribution. This method was used to best simulate a real-life growth scenario in which those areas that are not yet developed fully, are those most likely to become developed in the future and will have a higher demand increase ratio compared to those with an already relatively high demand. The 2038 maximum day demand condition was modeled as 10.6 mgd and the 2038 average day demand condition was modeled at 4.5 mgd. The 2038 average day demand was modified based on the 2016 average day demand considering a 2.27 mgd growth using the same allocation method as the 2038 maximum demand to anticipated water demand increases in each growth area.

A Town specific 24-hour diurnal curve was created from the water meter usage data for the month of June in 2018, a peak summer month. Figure 4.04-2 shows this diurnal curve. Based on this diurnal curve, the maximum demand that can occur during summer peak days can reach approximately 10,750 gpm.



PROPOSED ADDITIONAL DEMAND ZONES

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 4.04-1
4005.086

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\4.04-1 Junction Zones.mxd User: scottw Date: 9/10/2018 Time: 4:30:18 PM Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

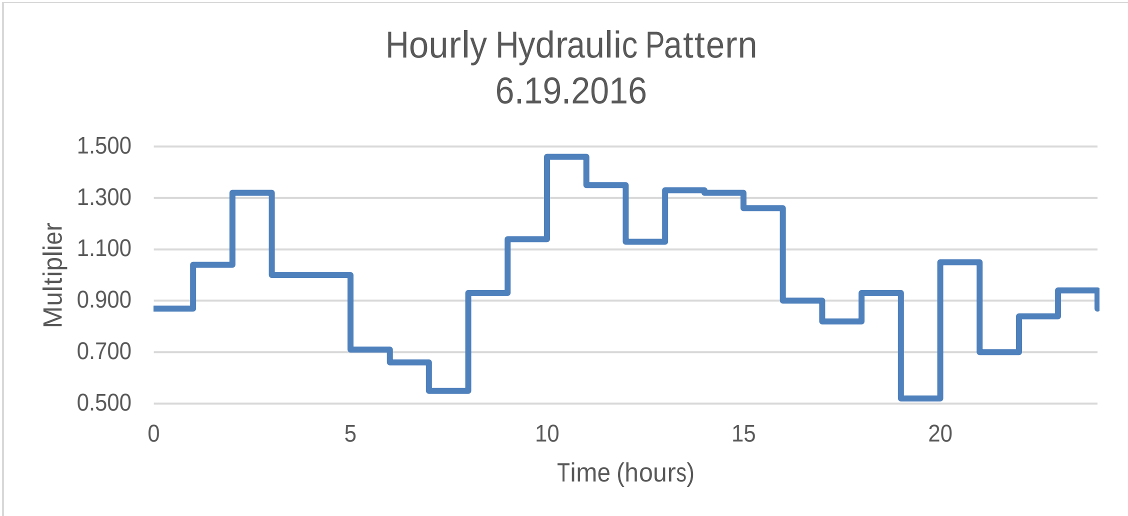


Figure 4.04-2 Bargersville 24-hour Diurnal Curve

4.05 CAPACITY EVALUATION

The purpose of this evaluation is to determine the effectiveness of the systems design to meet maximum domestic demand with the production of the WTPs and water storage. Days of maximum demand can occur on several days in succession, especially during the summer months. As a result, water withdrawn from storage during any one maximum day must be replaced before the following day to ensure an adequate supply of water for the next day. Therefore, total demand on the maximum day determines the minimum amount of water that must be available at the start of each day.

It is recommended the system be designed to meet maximum domestic demand with the firm capacity, often referred to as the “N minus 1” capacity, of each pumping station. The firm capacity refers to the capacity of the pumping station assuming the largest individual pump is out of service. If the firm capacity is less than the maximum day domestic demand, storage will be depleted, and an inadequate amount of water may exist for the following day. Alternatively, if the firm capacity of the system meets or exceeds the total demands, all storage tanks may be refilled during any 24-hour period and water will be available to meet the following maximum day demands.

The following sections below evaluate the capacity of each pressure zone under two water demand scenarios.

1. 2038 Peak Daily demand
2. 2038 Peak Daily Maximum Day plus Fire Flow.

Note that the firm pumping capacity in each pressure zone is greater than the 2038 Peak Daily Demand. The evaluations assume that all Water Storage Tanks are limited to a maximum 75 percent of the total storage volume to account for operational fluctuations.

Table 4.05-1 summarizes the average and maximum demands in each proposed zone used for the capacity evaluation. Figure 4.05-1 outlines the limits of the proposed pressure zones and the reason for these limits is discussed further in 4.06.A.2.

Pressure Zone	2038 Average Daily Demand (gpm)	2038 Peak Daily Maximum Demand (gpm)
Northern Zone	823	2,219
Southern Zone	2,301	5,142
System Total	**3,124**	**7,361**

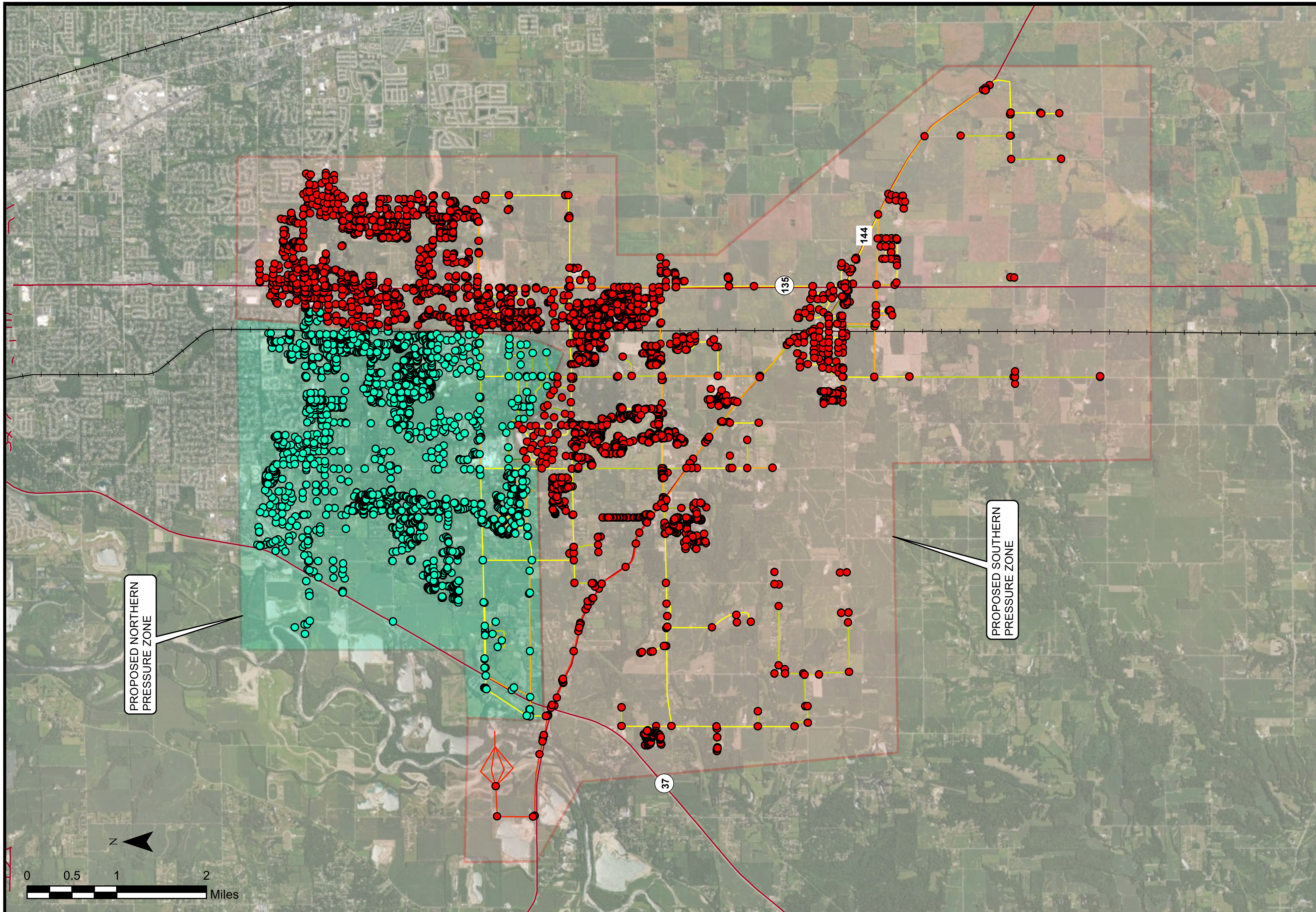
Table 4.05-1 Average and Peak Daily Demand for Each Pressure Zone

A. Northern Pressure Zone

1. 2038 Peak Daily Demand

The 2038 peak daily demand for the water distribution system is estimated to be 10.6 mgd or 7,361 gpm. The total peak Daily Demand for the Northern Pressure Zone equals 2,219 gpm. The existing 2038 pump capacity for the Northern Pressure Zone is 3,750 gpm which is greater than projected demands.

Figure 4.05-2 shows the projected hourly maximum day demand for the Northern Pressure Zone based on the diurnal curve developed for the Town.



PROPOSED PRESSURE ZONES

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 4.05-1
4005.086

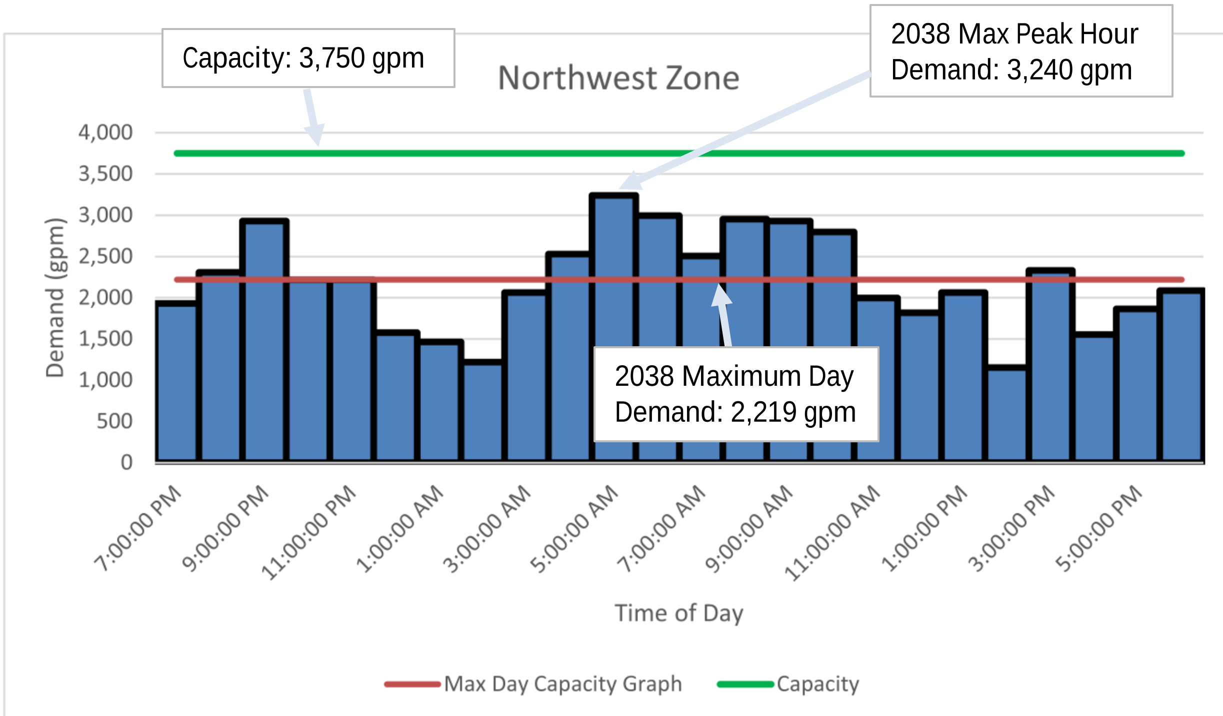


Figure 4.05-2 Northern Pressure Zone 2038 Peak Daily Demand Capacity Analysis

Based on the hour-by-hour calculations of usage, the existing high service pumps at WTP No. 1 exceed the peak-hour demand in all time periods. For the purposes of the future maximum demand day calculations, it is assumed 25 percent of the total storage in the WSTs is needed for operational fluctuations, or 0.26 mg of the total 1.05 mg of storage within the proposed northern pressure zone. The existing 0.79 mg of available storage provided by Orchard and Critchfield Tanks is therein sufficient and can be used for meeting domestic demands and operational needs since no additional storage is required to meet 2038 peak demands.

2. 2038 Peak Daily Demand Plus Fire Flow

The total amount of water available to satisfy the maximum day plus fire demand is equal to the firm capacity of the pumping station plus the water available from usable storage.

The Insurance Services Office (ISO) typically recommends basic fire flow requirements based on the amount of water a municipality should be able to supply. The maximum basic fire flow requirement for a community of this size is 2,500 gpm for 3 hours, which was assumed for all the following capacity analyses.

The total demand for the domestic plus fire flow for the Northern pressure zone is 4,719 gpm (2,219 gpm domestic demand plus 2,500 gpm fire demand) with 0.79 mg of existing available storage. There must be enough capacity to supply this demand for 3 hours. The storage capacity is thus estimated by dividing available storage by 180 minutes. (Note: water cannot be delivered at this “storage capacity” rate. This evaluation is only for gauging the quantity of storage.)

The storage capacity analysis for the maximum day plus fire flow for the Northern Pressure Zone is as follows:

Peak Daily Demand	-2,219 gpm
Fire Demand	-2,500 gpm
WTP No.1 HSP	+3,750 gpm
Available Storage	+4,375 gpm
Total	+3,406 gpm

The reserve capacity of the proposed Northern Pressure Zone is 3,406 gpm or approximately 0.63 mg during a 3-hour fire event. Therefore, no additional storage is required to meet the 2038 peak daily domestic demand plus fire flow.

B. Southern Pressure Zone

1. 2038 Peak Daily Demand

The 2038 peak daily demand for the Southern Pressure Zone under proposed operation is estimated to be 5,142 gpm. The pump capacity at WTP No. 2 equals 4,500 gpm. The overall pumping capacity of the Southern Pressure zone is lower than the 2038 peak daily demand.

Figure 4.05-3 shows the projected extreme peak month hourly average day demand for the Southern Pressure Zone under the proposed system.

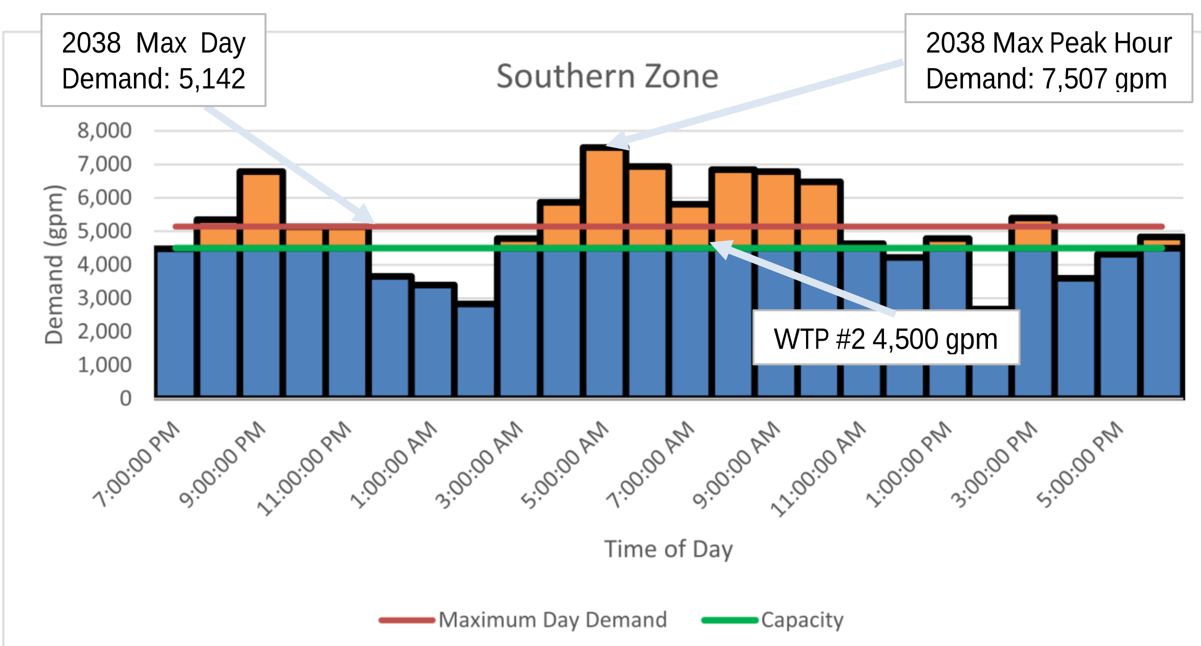


Figure 4.05-3 Southern Pressure Zone 2038 Peak Daily Demand Capacity Analysis

Based on the hour-by-hour calculations of usage, approximately 1.26 mg of storage are required from elevated storage to meet projected peak demands. Total existing storage in the proposed Southern Pressure Zone, provided by the existing Stones Crossing Tank, Kinder Tank, Curry Tank, and Bargersville Tank, is approximated at 2.10 mg of existing storage. This leads the existing available storage to be approximately 1.58 mg, after factoring in the 25 percent storage reduction required for operational fluctuations. This estimated available storage is therefore sufficient to meet future storage needs when the modified pressure zone is in place. It is recommended that the Town install additional storage capabilities or provide additional water capacity from the WTP in the case that maximum demand were to continue through multiple days. This analysis only considers the quantity of water stored and not the static pressure provided by storage tanks. While additional volume is not necessary, the existing tanks may not provide the desired level of service regarding pressure.

2. 2038 Peak Daily Demand Plus Fire Flow

The total demand for the domestic plus fire conditions is 7,642 gpm (5,142 gpm domestic demand plus 2,500 fire flow demand) with 1.58 mg of available storage. The storage capacity analysis for the peak 2038 daily demand plus fire flow is as follows:

Peak Daily Demand	-5,142 gpm
Fire Demand	-2,500 gpm
WTP No. 2 HSP	+4,500 gpm
Available Storage	+8,750 gpm
Total	+5,608 gpm

The reserve capacity of the Southern Pressure Zone is 5,608 gpm or 1.0 mg during a 3-hour fire event. Therefore, no additional storage is required to meet the 2038 peak daily demand plus fire demands.

4.06 DISTRIBUTION SYSTEM ANALYSIS

The distribution system analysis uses the results from the hydraulic model to confirm or identify projects needed to strengthen the utilities distribution system. These proposed projects include: a new elevated water tank, a new booster station, new transmission water mains, fire flow related water main replacement, and pipe replacement projects.

The Town decided that the main parameters for the system to be capable of delivering to rate payers are: minimum system pressures of approximately 55 psi, and fire flow capabilities that meet ISO. In accordance with Guide for Determination of Needed Fire Flow, Edition 06-2014, Chapter 7; the following improvements are based on what is required to reasonable attain these levels of service.

A. System Storage

As previously discussed in Section 4.01 of this report, the projected water demand for the system on an average day is approximately 4.5 mgd. The existing storage capacity throughout the system is approximately 6.40 million gallons. The Recommended Standards for Water Works, 2012 Edition, states that “the minimum storage capacity for systems not providing fire protection shall be equal to the average daily consumption." (7.0.1.a) The hydraulic model was used to determine fire flow requirements regarding storage.

1. Additional Storage Requirements Due to System Demand

Based on the projected average demand, the system storage would need to be approximately 4.5 million gallons by 2038. The current elevated system storage is approximately 2.5 million gallons. This would indicate that additional system storage of approximately 2.0 million gallons would need to be added to the system. However, it can be assumed that the utility can include its clearwells at the WTPs when making this consideration. The volume of the four clearwells at the WTPs is 3.25 million gallons. This results in the system stored volume being 1.25 million gallons more than would be needed to provide storage for an average day in 2038.

Based on this evaluation, the Town does not need to consider additional storage to meet demand requirements in the future.

2. System Hydraulic Grade

The existing system operates on two pressure zones. The North Pressure Zone is operating at this time at a hydraulic grade of between 900 and 910 ft. msl. The Southern Pressure Zone operates at a hydraulic grade of between 950 and 955 ft. msl. The ground elevations throughout the system range between 660 and 855 ft. msl. Modifications of the pressure zone boundaries are recommended because of ground elevations. Figure 4.05-1 shows the recommended new pressure zones. The northern pressure zone generally covers those areas where the ground elevation is 770 ft. msl. and less. Those areas with ground elevations above 770 ft. msl. are generally found in the southern pressure zone.

The Northern Pressure Zone is generally west of the railroad and north of Stones Crossing Road. This pressure zone would maintain the existing Northern Pressure Zone hydraulic grade of 900 to 910 ft. msl. The primary difference between the new pressure zone and the existing one is that those areas east of the railroad tracks will transfer to the new Southern Pressure Zone. The existing pressure zone has issues supplying more than 45 psi of pressure to the neighborhoods east of SR 135. The ground elevation for this area is approximately 800 ft. msl., which does not lend itself to a hydraulic grade of between 900 and 910 ft. msl. when the goal of the Town is to maintain a water pressure around a minimum of 55 psi, and no lower than 50 psi.

The new Southern Pressure Zone will continue to provide water at a hydraulic grade of between 950 and 955 ft. msl. However, as described previously, it will extend to north of Smith Valley Road in the area east of the railroad tracks. The new hydraulic grade in this area would result in a pressure increase of between 15 and 20 psi. The resulting pressure for the customers would increase from the mid 40 psi range to the low to mid 60 psi range. However, the Town should be prepared for the possibility that increasing pressures in this area may result in water main breaks and additional leakage during the initial adjustment period.

3. Future Project Alternatives

The water utility has three options for water storage tank projects. The first option (Tank Raising Option) would include raising Curry Water Tank, constructing a new 500,000-gallon water tank around Stones Crossing Road, and abandoning Stones Crossing Water Tank. This option is not viewed as feasible because it would not be recommended to raise Curry Water Tank the 55 feet that would be necessary to bring it in line with the overflow elevation of Bargersville Water Tank.

The second option (Stones Crossing New Tank Option) includes one new water storage tank and abandoning Curry and Stones Crossing Water Tanks. The new tank would be 1.0 million gallon elevated tank around Stones Crossing Road. The new tank would have an overflow elevation of 960 to match the elevation of Bargersville Water Tank. The hydraulic model has indicated that this option would provide adequate pressures throughout the system. This is the recommended option since the Town will maintain multiple tanks at the same hydraulic grade, which will more easily allow for tank maintenance in the future.

The final option (Bargersville New Tank Option) includes one new water tank and abandoning Bargersville, Stones Crossing, and Curry Water Tanks. The new Bargersville Tank would be located at the Street Department property on 2 Cent Road. The new tank would have a capacity between 1.0 and 1.5 million gallons. The overflow elevation for the new tank would be set between 955 and 975 depending on the Town's decision between providing more than 50 psi pressure for all customers or matching the elevation at Kinder Water Tank. This option would require improvements to the 12-inch water main that comes into Bargersville on CR 144. The new water main size would start around N 400 W and end at Harriman Avenue and would be 20 inches. The hydraulic model has indicated that this option would provide adequate pressures throughout the system.

B. Booster Stations

The Town currently operates one booster station, Kinder Booster Station, to distribute water from Kinder Water Tank to Bargersville Water Tank and the system. The Town has two other stations, Waterloo and SR 135, but they have not been operational since WTP No. 2 came online in 2013.

The peak daily demand in 2038, established by this Master Plan to be 10.6 mgd, was used to model the future system to determine the future needs. One improvement that would be recommended above the rest would be to install a new booster station that could pump water from the proposed Northern Pressure Zone to the Southern Pressure Zone. The need for this is because of the projected water demands throughout the system. The future Northern Pressure Zone is projected to need 2,282 gpm, or approximately 3.3 mgd; while the Southern Pressure Zone is projected to need 5,704 gpm, or 8.2 mgd. The future recommended WTP capacities are 8.7 mgd at WTP No. 1 and 6 mgd at WTP No. 2. With WTP No. 1 providing water to the Northern Pressure Zone, and WTP No. 2 providing water to the Southern Pressure Zone, it becomes clear that a booster station is necessary between the two zones to allow for the excess capacity at WTP No. 1 to be able to provide water to the Southern Zone to supplement the water being provided by WTP No. 2.

With the new proposed splitting of the system occurring along the railroad, a site for a new booster station would be needed because each of the existing booster station that are not used would be deep inside the new Southern Pressure Zone. The recommended location to construct a booster station would be at Critchfield Water Tank. While the tank will be located inside the new Southern Pressure Zone, it can be isolated so that it is still providing pressure for the Northern Pressure Zone and providing suction pressure for a new booster station.

During annual average days in 2038, it is projected that the Southern Pressure Zone will require approximately 2,300 gpm, or 3.3 mgd. Based on this demand, it is recommended that the proposed Critchfield Booster Station have a capacity of 2,500 gpm. The Town should consider a three pump booster station, with each pump sized to pump 1,250 gpm.

The recommended booster station would allow for WTP No. 1 to serve both pressure zones during the projected annual average daily flow in 2038. The booster station should include a bypass with a control valve to allow for WTP No. 2 to also serve both pressure zones in 2038 during the projected annual average daily flows.

C. Distribution System Piping

1. Critical Raw Water and Finished Water Transmission

The future growth anticipated for the Town's water utility along with the level of service that the Town would like to supply highlights the needs for new transmission mains to accomplish these goals. The following raw water and finished water transmission mains are those mains that have been identified as critical updates for the system. Table 4.06-1 serves to rank each of these transmission mains in terms of their criticality over the next 20 years.

Project	Water Main Size (in)	Water Main Length (ft)
North Well Field Raw Water Main	16	5,000
Critchfield/Eagle Subdivision	16/10	6,000/1,500
Southern 135	12	12,000
Northern 135	12	1,200
300 N–Phase 1	12	11,500
Whiteland Road–Phase 1	12	5,500
625 W–North/Aldersgate Drive	8	3,500
625 W–South	8	7,000
Whiteland Road–Phase 2	12	6,000
300 N–Phase 2	12	6,500
SR 37 Crossings	12,16, and 24	4,000
100 N/125 W	8/6	13,100/2,500
400 W	12	3,500
600 W	8	5,000

Table 4.06-1 Proposed Raw Water and Finished Water Transmission Water Main Projects

With the proposed additional production wells at the northern well field and the proposed expansion of WTP No. 1, the Town will need a second raw water main to carry water from the well field to WTP No. 1. The purpose for this second water main is both redundancy and capacity. A 16-inch water main is generally capable of carrying between 3,000 and 4,000 gpm. The future WTP capacity for WTP No. 1 may approach 5,500 gpm, and the future well field firm capacity will be between 5,000 and 5,500 gpm. Each of these capacities will result in water velocity in the pipe that approaches 9 ft/sec. A second raw water main would reduce pipe velocity to approximately 3.75 ft/sec. Additionally, a second raw water main provides the Town with redundancy to still be able to produce more than 6 mgd at WTP No. 1 even in the event that the other raw water main is lost.

The Critchfield/Eagle Subdivision transmission main is necessary for WTP No. 1 to be capable of supplying water to Critchfield Water Tank in sufficient quantities to maintain water levels while the proposed Critchfield Booster Station is operating. Both the water main and booster station are necessary to provide sufficient water to maintain pressures in the southern pressure zone during future peak scenarios. Additionally, these improvements would allow the Town to remove either WTP from service during normal demand periods in the future and yet maintain water service to the entire system while that WTP is offline.

The SR 135 projects are needed to allow Kinder and Critchfield Booster Stations to have the capability to fill the recommended new water tank along Stones Crossing Road. The hydraulic model shows that the new water tank, during peak future conditions, will have 1,883 gpm moving through it during both filling and draining cycles each day. This type of flow requires multiple 12-inch water mains to provide the necessary water to supply the area. During normal operating conditions, the 12-inch water mains would allow for the system to supply either portion of the system with water from the opposite pressure zone.

The CR 300 projects are necessary to provide fire flow to a portion of the system that does not have fire flows that exceed 500 gpm. It would also help to increase the fire flow for Mallow Run Winery. These projects are primarily necessary for the future growth of the system. The 20-year projections indicate that this area of the system could see an increase in demand of nearly 1 mgd during normal conditions and over 2 mgd during peak conditions. The existing system has a single 6-inch water line. The issues with the existing water main is that it is necessary to loop it to improve the flows for the entire area. The first phase of the CR 300 projects involves connecting the 12-inch water main in the Town with the 6-inch water main that is approximately 2.25 miles west of town on CR 300. The second phase of the project involves replacing the existing 6-inch water main with 12-inch water main to Banta Road. The first phase is necessary to provide fire flow, and the second phase is to finish a necessary transmission main for this area of the system, which is currently lacking one and the area has a high potential to be a location for a great deal of growth. The Town should consider reaching out to landowners at this time to start trying to obtain easements for these future water mains.

The CR 625 North/Aldersgate Drive Projects are to address looping and pressure issues. The CR 625 N. portion of the project creates a loop for the system to the north of the CR 144 transmission main. Without this water main, the houses between CR 625 West and Morgantown Road along Smokey Row Road have lower pressures during times of higher demand due to the higher elevations that are present and a lack of looping with the pressure zones being split along CR 650 N. The Aldersgate Drive portion of the project is an 8-inch main serving a portion of the neighborhood just north of Orchard Water Tank. While the majority of this neighborhood is in the proposed Northern Pressure Zone, the eastern part of the neighborhood is at an elevation that would cause for minimum pressures to be approximately 30 psi. The existing water main along Chancery Boulevard would remain on the Northern Pressure Zone to maintain the looping needed for the nearby high school, but Aldersgate, Osterly Court, and portions of Haverstock Circle would be transitioned to the southern zone to provide the necessary pressures that would be above 50 psi.

The Whiteland Road projects are needed to further solidify the area where the greatest population growth potential rests. The Town should consider installing Phase 1 to be prepared for this growth, and Phase 2 should occur when population growth would demand it. Phase 1 will involve constructing a new 12-inch water main from Kerrington Proper to the water main that feeds the Whitetail Woods area. Based on continued growth, this 12-inch water main should be extended to Banta Road as Phase 2, when necessary.

Both the 625 West–South and 600 West projects are primarily to provide water for future growth. The projections would anticipate they may be needed during the planning period, but the Town should hold back from installing these water mains to connect Whiteland Road to 300 North until growth of neighborhoods would demand it.

The SR 37 crossings are already in place, but the Town should consider that they may be necessary to be moved due to overpasses and interchanges associated with the I-69 project that will likely be constructed during the planning period. With the interchanges, the existing crossings at the intersections will likely need to move because of the greater amount of property that the interchanges will require. Indiana Department of Transportation (INDOT) will likely not want the water mains to be in the vicinity of the footers for the bridges that will be required. Whether INDOT or the Town has to pay for these projects, the Town should expect that each of its crossings of SR 37 will need to replaced in the future.

The CR 400 West project serves two purposes. The first is to install a 12-inch water main to supply water to the 12-inch water main along CR 300 North that comes directly from the Bargersville Water Tank. This would provide a direct route for water to be able to serve the southwest portion of the system from Bargersville Tank. The second purpose is to extend the water main down from CR 250 North to CR 225 North. CR 225 North is the next road going south from Bargersville where development could start expanding out. While not necessary at this time, it would be most cost beneficial to the Town to construct this in conjunction with the portion of the project that is being installed between CR 300 North and CR 250 North. This additional water main will result in an additional 5,500 gallons of volume in the water main going to the south. With up to 50 customers drawing water from this main, the additional water age due to the larger pipe at this time would be approximately one day. This is likely not an increase that would affect the overall water quality for these customers.

The final transmission projects involve solidifying the level of service to Hopewell and Providence areas. It is recommended that more growth needs to be seen before completing these projects.

The projects would add approximately 37,000 gallons of volume to the system. There are approximately 100 customers in these areas, which results in nearly an additional four days of water age. If the Town sees growth in this area that increases the number of customers to more than 200, it will begin to become reasonable to consider proceeding with these two projects for solidifying the level of service.

Figure 4.06-1 shows these critical transmission main projects and where they are located throughout the service area.

2. Fire Flow Requirements

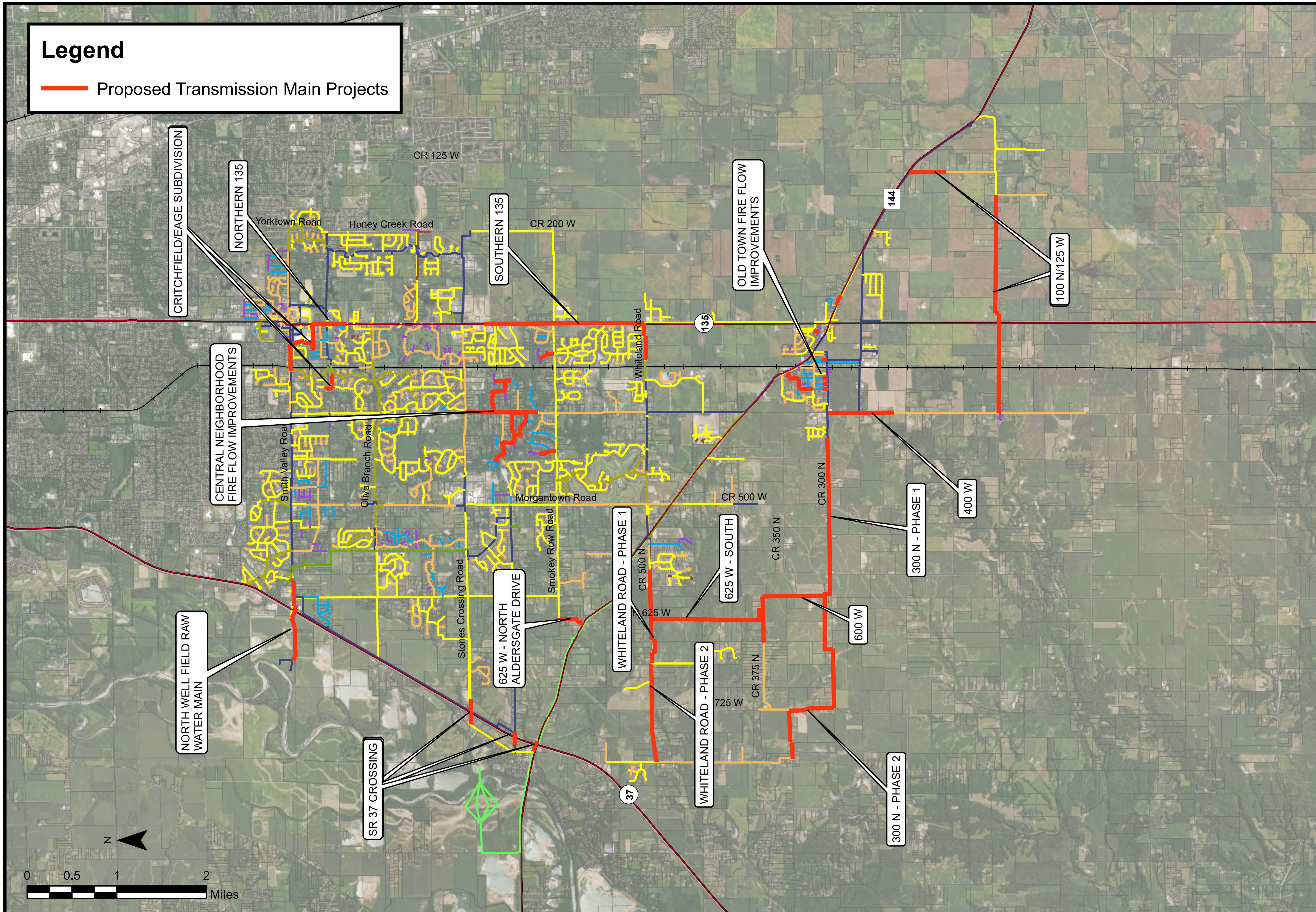
The hydraulic model indicates that the majority of the system is capable of providing over 1,500 gpm of fire flow. The Town has decided to use ISO: Guide for Determination of Needed Fire Flow, Edition 06-2014, Chapter 7 for the basis to determine the amount of fire flow that it needs to be capable of supplying. Table 4.06-2 gives the general fire flow requirements for residential units based on the distance between structures, as stated in the previously mentioned ISO document.

Distance Between Residences	Fire Flow Requirements
More than 30 feet	500 gpm
21to 30 feet	750 gpm
11 to 20 feet	1,000 gpm
0 to 10 feet	1,500 gpm

Table 4.06-2 Residential Fire Flow Requirements

Figure 4.06-2 shows the flows that the distribution system is capable of supplying in different locations. Generally, the middle of the system and the southwest portion of the system are the areas where the lowest fire flows are available. These two areas fail to maintain a fire flow of above 500 gpm, which is the lowest acceptable fire flow for residential units. Additionally, the Old Town area of the utility fails to maintain 1,000 gpm throughout the area. The residences in town differ in their spacing between 15 feet to more than 30 feet. Residences that are only 15 feet apart should have the ability to receive 1,000 gpm of fire flow.

The fire flow projects concentrate on addressing issues in the center of the system and in Old Town Bargersville. The southwest portion of the system is not addressed because the transmission main projects account for addressing the concerns in this area of the system. The Central Neighborhoods project replace 2- and 4-inch water main that is found in these locations with 6- and 8-inch water main to increase the flows that these areas have access to. The proposed improvements increase the available fire flow to between 500 to 1,000 gpm with the exception of the end of cul-de-sacs. The Town should plan on extending new main to within 250 feet of the end of a cul-de-sac with a hydrant at the end of the new water main. Additionally, if the Town decides to pursue these projects in the long term, it should start contacting homeowners about the possibility to obtain easements in certain locations to allow for the looping of future water



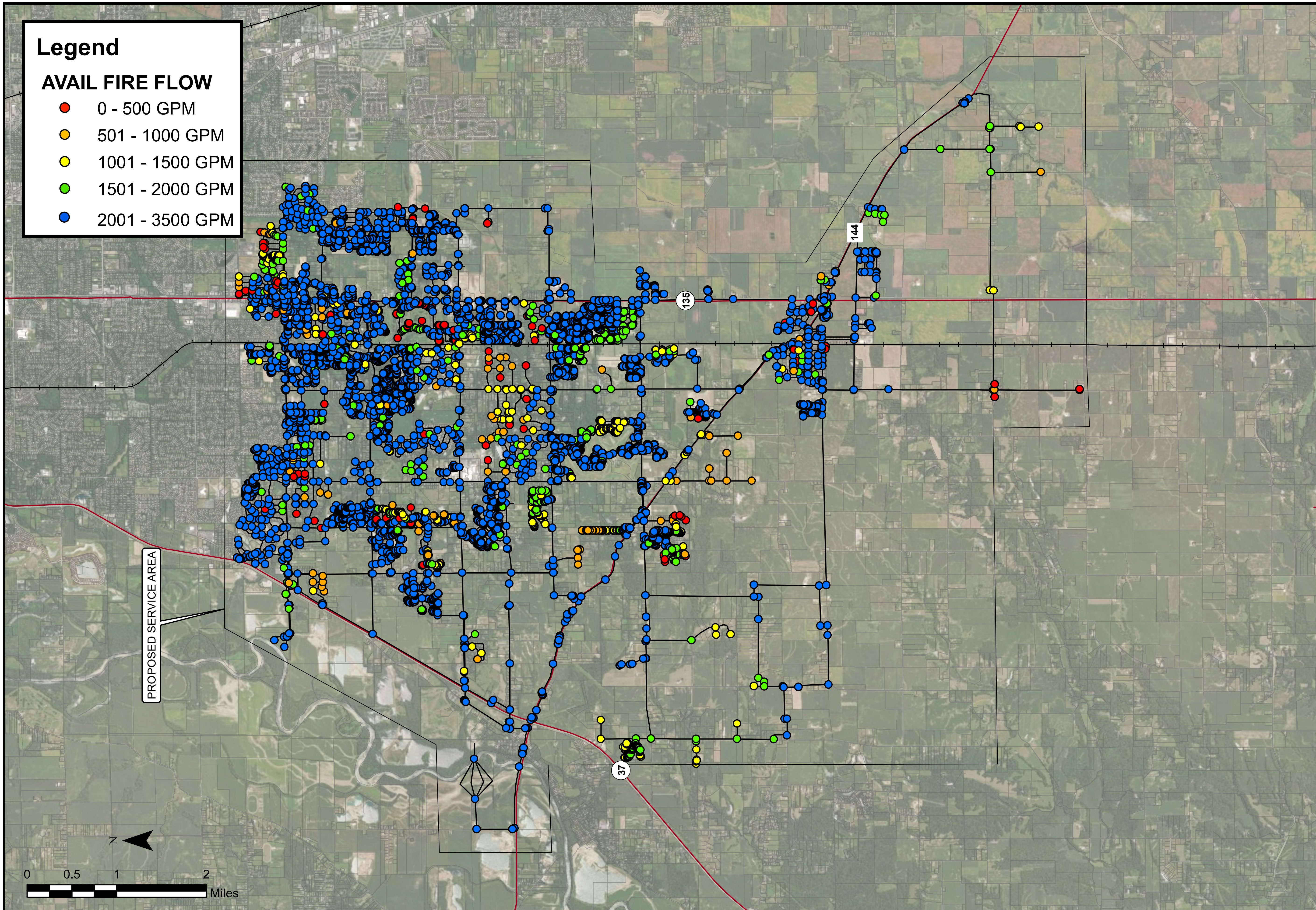
PROPOSED TRANSMISSION MAINS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 4.06-1
4005.086

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\4.06-1 PROPOSED TRANSMISSION MAINS.mxd User: scottw Date: 10/16/2018 Time: 10:46:11 AM Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



PROPOSED FIRE FLOW CAPACITY
PEAK 10.6 MGD FLOW
WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 4.06-2
4005.086

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\4.06-2 Fireflow Analysis Proposed Junctions.mxd User: scottw Date: 10/15/2018 Time: 8:57:29 AM Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community mains. The Old Town project involves replacing 2- and 4-inch water mains with primarily 6-inch water mains. This serves to increase the majority of the fire flow to above 1,000 gpm in the Old Town area of the system.

Project	Road	Water Main Size (in)	Water Main Length (ft)
Central Neighborhoods	Saddle Club Road	8	3,600
	Cedar Hills North and South Drives	6	3,300
	Maplehill Drive	8	1,100
	Golden Grove Road	6	1,500
	Cedar Lane/Hickory Lane/Honey Creek Blvd	6	4,000
	Woodland Stream Drive	6	1,000
	Thornbrier Lane	6	1,000
	Walnut Woods Drive	8	100
Old Town Improvements	North Street/West Street/Park Avenue/Tresslar Avenue	6	2,600
	South Avenue Extensions	6	1,500
	Maple Drive	6	500
	Plank Road	8	700

Table 4.06-3 Proposed Fire Flow Water Main Projects

3. Pipe Replacement Program

During this planning period, it is not recommended to start a pipe replacement program. The suggested fire flow projects have the added benefit of replacing some of the older water main in Town. Seeing that the Town is still in a time of growth, the piping projects that have been recommended to solidify the system are a more immediate need at this time. Table 4.01-1 shows that nonrevenue water is also low at this point, which would further support that now is not the time to start a full pipe replacement program. However, the Town should consider starting a pipe replacement program during the next planning period. At that time the utility will have water main that is approaching 100 years old, which would be the expected life for the pipe that had been installed at the time. The utility should also consider that the funds that are being recommended on transmission main and fire flow projects during this planning period continue at the same level in the future as pipe replacement funds.

4. Future Residential Requirements

Generally, future residential neighborhoods should continue to be built with 6- and 8-inch water mains. The decision between these two sizes should be based upon the nearness of residences to each other and the number of connections that are made to transmission mains located outside of the neighborhoods. If residences will be less than 11 feet apart, consideration should be made for the water mains to be 8-inch mains.

General guidelines for transmission mains as the water system expands south of CR 144 should be 12-inch water mains on the roads that go east-west and 8-inch water mains on the roads that go north-south.

4.07 STUDIES

The Town should consider planning for a wide variety of studies for the water system over the 20-year planning period. These include studies that occur at regular intervals, and those that are more project specific. The regular interval studies include: rate studies, asset management plans, master plan, hydraulic model updates, and elevated tank observation reports. The project specific studies would include: wellfield evaluations, preliminary engineering reports (PER), WTP operational needs reviews, and a unidirectional flushing program.

A. Rate Studies

The Town should consider completing rate studies every 4 or 5 years. This will allow the Town to continuously monitor the financial state of the Town's water system. Regular rate studies will also allow the Town to consider progressive incremental rate increases if necessary, rather than reactionary rate increases that tend to only occur when a utility is not in a good financial situation resulting in large rate increase that is not acceptable to customers. Most customers have become desensitized to minor rate adjustments due to this occurring with each of the private utilities that they work with, so it is more likely that minor adjustments to maintain quality of service will more likely be viewed as acceptable.

B. Asset Management Plans

New Indiana Finance Authority (IFA) projects will be requiring asset management plans to receive funding. With this it is recommended that the Town prepare an asset management plan that will meet IFA requirements and update it as IFA projects are completed. The secondary purpose of the asset management plan would be that it would result in more effective rate studies in regard to determining the proper depreciation fund for the utility. Based on this, it is recommended that the utility budget to complete an asset management plan and then update it every five years as new projects adjust the utilities assets.

C. Master Plan

This master plan should be reviewed at regular intervals and updated during the plan time frame. The Town should consider reviewing their progress and update the plan accordingly in 10 years to determine whether areas of the plan still apply or not based on how growth has occurred in reality. Toward the end of the 20-year planning period, the Town should consider completing another master plan for the next 20-year period.

D. Hydraulic Model Updates

The hydraulic model is only as effective as the information it receives. As the system changes, the model needs to be updated to continue to provide reliable projections for the system. On a regular basis the model should be updated to include new piping, demands, and controls. With the speed that developments are being constructed within Town, the Town should consider updating the model at least every 5 years.

E. Elevated Tank Observation Reports

The general recommendation for water tanks is that they should be reviewed every 5 years to determine their condition and perform minor maintenance if necessary. This plan would recommend that the Town complete regular tank reviews generally on a 5-year cycle.

F. Preliminary Engineering Reports

PERs should be reserved for those larger projects where the Town chooses to pursue IFA funding. This should be reserved for projects such as the WTP No. 1 rehabilitation and distribution system changes in the Critchfield area that are being proposed.

G. Operational Needs Reviews

It is recommended that the Town complete these before proceeding with a water treatment project. These reviews offer a more in-depth review of the WTPs to help to determine the specific projects that the Town would like to proceed with in the future. The review provides a good framework for the funding agency PER but gets into more detail than funding agency PERs typically allow for when following their guidelines.

H. Unidirectional Flushing Plan

Since the Town has had issues with discolored water in the past, there has been a desire expressed to develop a unidirectional flushing plan. It would be recommended that a majority of the big transmission main projects be completed before starting this plan. The plan uses the hydraulic model to review the system and determine what valves need to be opened and closed to achieve scouring velocity (5 ft/s) throughout the system piping. The system would be subdivided into multiple zones that would result in a description for the valve status requirements in each zone to achieve this scouring velocity for the zone that is being flushed.

SECTION 5
WATER UTILITY PROPOSED CAPITAL IMPROVEMENTS

5.01 RECOMMENDED IMPROVEMENTS AND COST OPINIONS

A. Water Supply Wells

As mentioned in Section 4, the Town should consider the construction of two additional supply wells to meet production needs at WTP No. 1. These wells would be located near the three wells that currently supply WTP No. 1 northwest of the WTP. Figure 4.02-1 shows the general location for these new wells. Table 5.01-1 shows the project costs associated with this well installation project. These costs include the anticipated raw water main that would be necessary in conjunction with the proposed wells and the nonconstruction costs. Additionally, the Town should consider replacing the motor starters for the southern wellfield wells with VFDs so it can have more flexibility with the well combinations.

Project	Construction Cost	Contingencies and Non-construction Costs	Total Project Cost[1]
Well No. 13 at Northern Wellfield	$400,000	$140,000	$540,000
Well No. 14 at Northern Wellfield	$400,000	$140,000	$540,000
16-IN Raw Water Transmission Main	$1,250,000	$438,000	$1,688,000
Southern Wellfield Motor Starter Replacement	$200,000	$70,000	$270,000
Total	**$2,250,000**	**$778,000**	**$3,038,000**

[1]Cost are 3rd quarter 2018 dollars

Table 5.01-1 Well Project Cost Opinions

B. WTPs

The WTP projects consist of making improvements at both WTP No. 1 and WTP No. 2.

As outlined in Section 4, there is a significant number of projects that are recommended to be completed at WTP No. 1 to increase production capacity. These projects include the expansion of the detention tank, installing a 2.0 MG clearwell and a new FBR, rehabilitation of filters and existing FBR, modifying the existing backwash and existing chemical and chlorine rooms, replacing all high service pumps and intermediate pumps, as well as, the construction of an additional 1,000 sq ft on the west side of the existing WTP No. 1 to house the new and relocated FBRs and the expansion to the recarbonation basin. It is also recommended that the Town consider replacing all HVAC, electrical control systems, and various piping and valves systems. Additional site work will be required for office space atheistic improvements and the expansion to the building. The WTP No. 1 improvement project is recommended to be completed in 2024. Figure 5.01-1 shows the general sites changes that would be associated with these improvements.

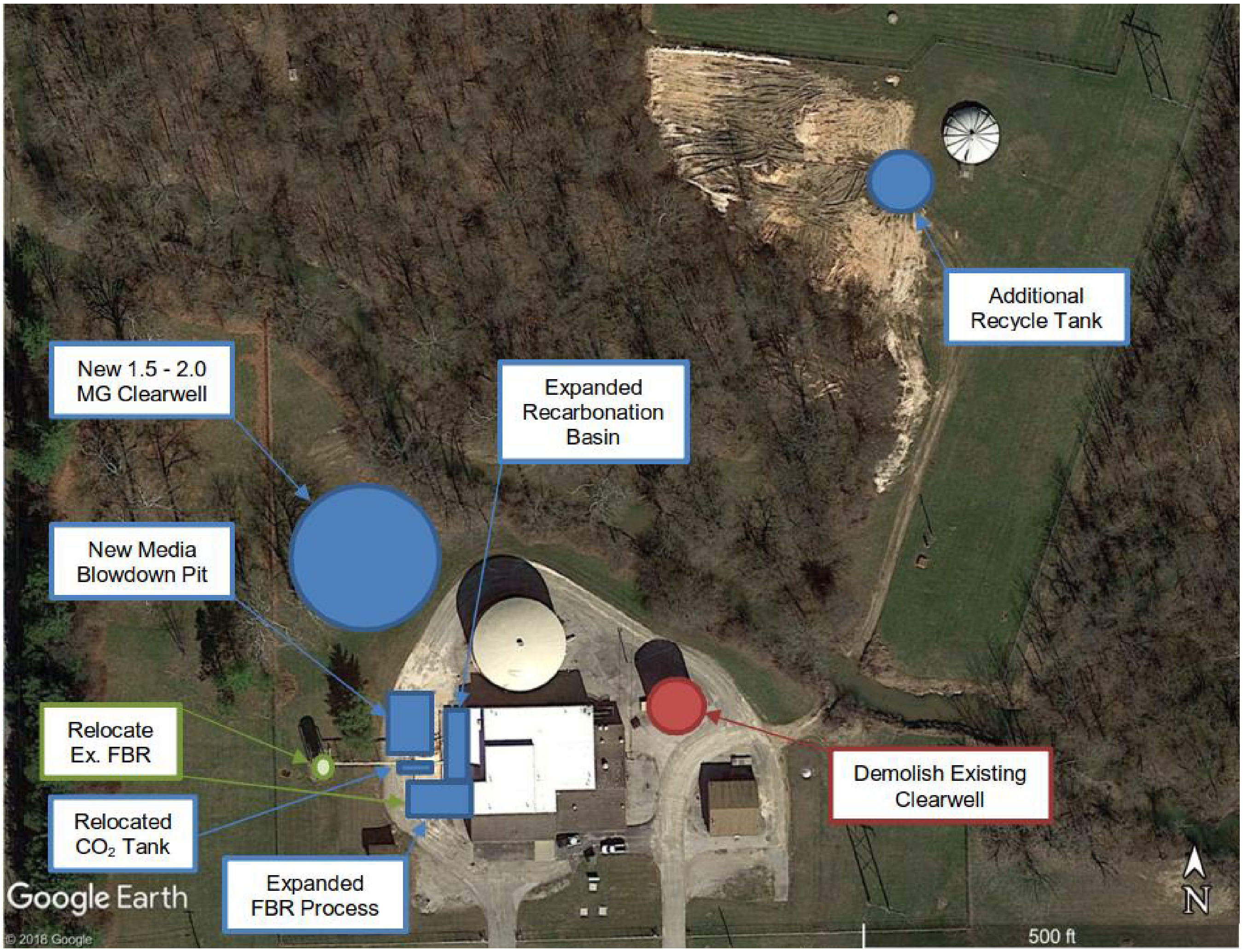


Figure 5.01-1 WTP Site Changes

The improvements required at WTP No. 2 are not recommended until 2033, since WTP No. 2 was constructed in 2012, and none of the existing equipment has reached the expected service life at this time. The improvements recommended at WTP No. 2 are mainly common maintenance items and the replacement of chemical feed equipment and filter media that will have exceeded their estimated 20-year effective service life by the end of this planning period. It is recommended that the third clearwell be installed during this planning period to help the utility limit staffing requirements on the weekends during the summer months.

Table 5.01-2 shows the projected costs for each project.

Project	Construction Cost	Contingencies and Nonconstruction Costs	Total Project Cost[1]
WTP No. 1	$9,962,000	$3,487,000	$13,449,000
WTP No. 2	$2,630,000	$921,000	$3,551,000
Total	**$ 12,592,000**	**$4,408,000**	**$17,000,000**

[1]Cost are 3rd quarter 2018 dollars

Table 5.01-2 Treatment Project Cost Opinions

C. Water Distribution System

The proposed water distribution system improvements will include projects affecting the water storage, booster stations, and piping.

1. Water Storage

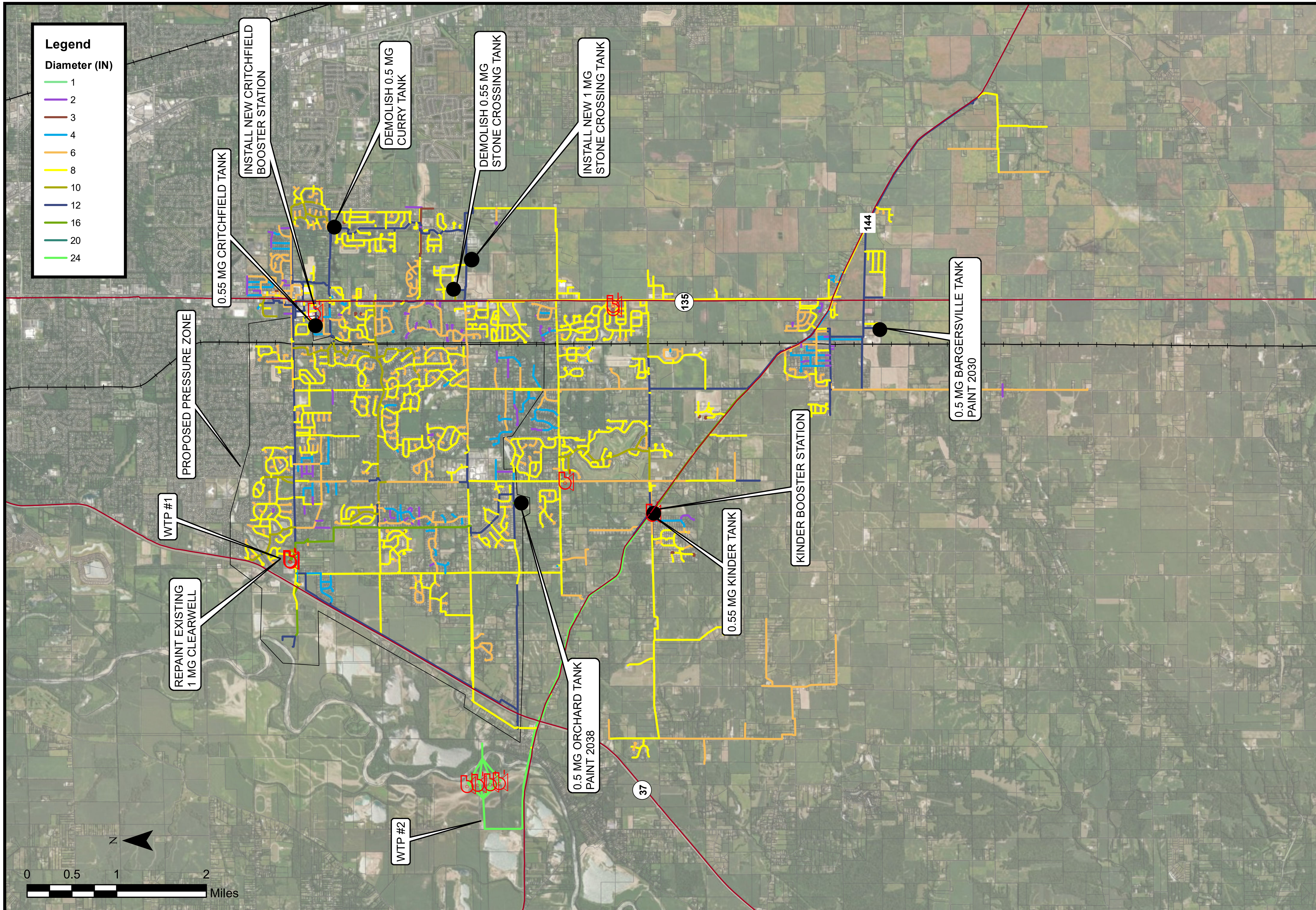
The recommended water utility water storage solution involves the installation of a new raised 1.0 MG tank in the northeast part of the distribution system that will serve as the new Stones Crossing Tank. This proposed tank will replace the existing Curry and Stones Crossing Tanks and these tanks will be demolished. It is proposed that the overflow elevation of this tank match the Bargersville Tank in the southern part of the system at a level of 960 feet. The other valid option is to install a new 1.5 MG Bargersville Tank. Based on the model, this is a valid option and would retain adequate pressures and flows through the system. However the overall construction of a new Stones Crossing Tank on the northeastern section of the distribution system is the cheaper option, and allows for additional storage within this pressure zone in two separate areas using the existing Bargersville Tank. This two storage tank option is also beneficial when a tank is needed to be maintenanced in the future. Figure 5.01-2 shows all proposed water storage improvements. It is also proposed the Town perform common maintenance on the existing tanks and repaint them within the 20-year planning period.

Table 5.01-3 shows the costs to complete the system storage work.

Project	Construction Cost	Contingencies and Nonconstruction Costs	Total Project Cost[1]
New Stones Crossing Tank Construction	$3,050,000	$610,000	$ 3,660,000
Repaint 1 MG Clearwell	$ 325,000	$ 75,000	$ 400,000
Bargersville Tank Repainting	$ 400,000	$ 75,000	$ 475,000
Orchard Tank Repainting	$ 400,000	$ 75,000	$ 475,000
Total	**$3,850,000**	**$760,000**	**$ 5,010,000**

[1]Cost are 3rd quarter 2018 dollars

Table 5.01-3 Storage Project Cost Opinions



PROPOSED STORAGE & BOOSTER IMPROVEMENTS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 5.01-2
4005.086

2. Booster Stations

The proposed booster station improvements include the installation of a new Critchfield Booster Station. This new booster station will transport stored water from the northwestern pressure zone to the southern pressure zone, by drawing from Critchfield Tank, which is supplied by WTP No. 1. This proposed Critchfield Booster Station would be capable of pumping 2,250 gpm to the southern section of the system and supplying the proposed Stones Crossing and Bargersville Tank. This booster station improvement will allow the WTP No. 1, after maximum production adjustments, to supply the entire system's demands during nonpeak months. This will allow maintenance to be completed on either one of these plants during non-peak average daily flows. As stated in Section 4, this booster station should include a bypass with a control valve to allow for WTP No. 2 to also serve both pressure zones during the projected annual average daily flows.

Table 5.01-4 shows the projected costs to complete these projects.

Project	Construction Cost	Contingencies and Nonconstruction Costs	Total Project Cost[1]
Critchfield Booster Station	$750,000	$263,000	$ 1,013,000

[1]Cost are 3rd quarter 2018 dollars

Table 5.01-4 Booster Station Project Cost Opinions

3. Distribution System Piping

The water utility needs to consider three groups of distribution system piping improvement projects proceeding forward. The first group are those projects related to water transmission. The second group is related improving fire flows in a number of areas. The third group is water main replacement. Table 5.01-5 shows the costs associated with specific projects that have been identified. Figures 5.01-3 through 16 show the recommended layout for each project identified in the following.

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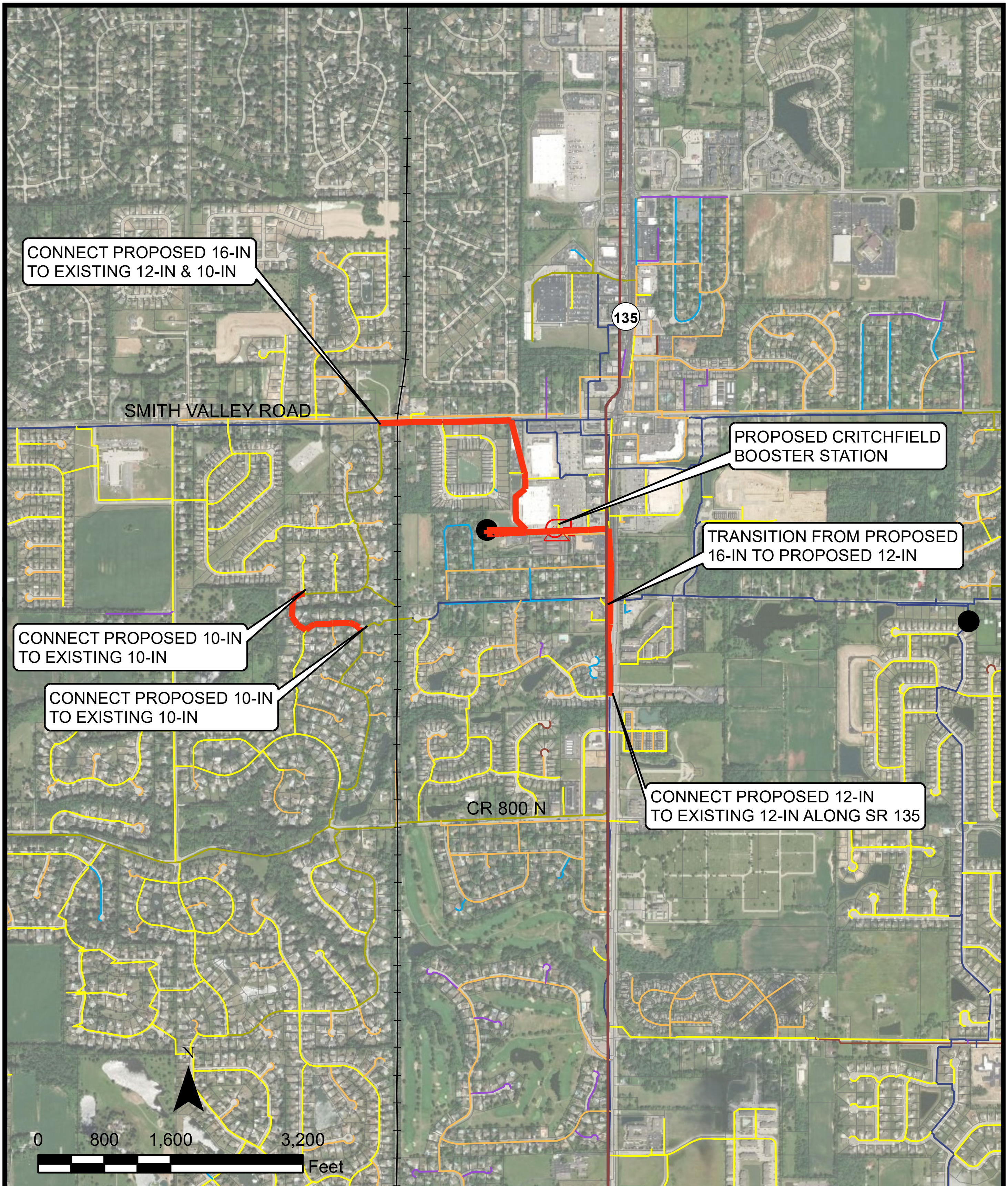

PROPOSED TRANSMISSION MAIN
CRITCHFIELD/EAGLE SUBDIVISION/NORTH 135

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-3
4005.086

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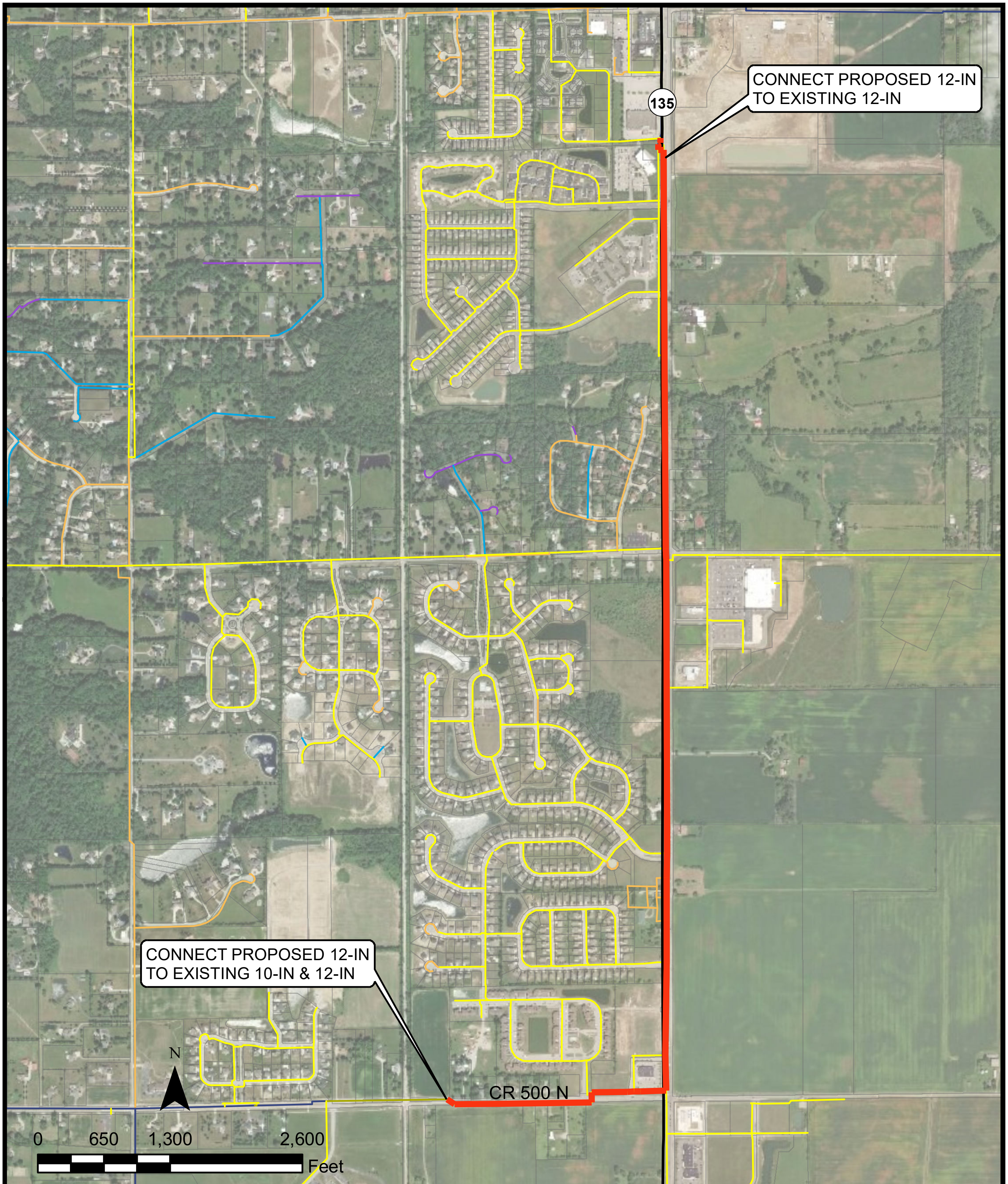

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PROPOSED TRANSMISSION MAIN
SOUTH 135

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-4
4005.086

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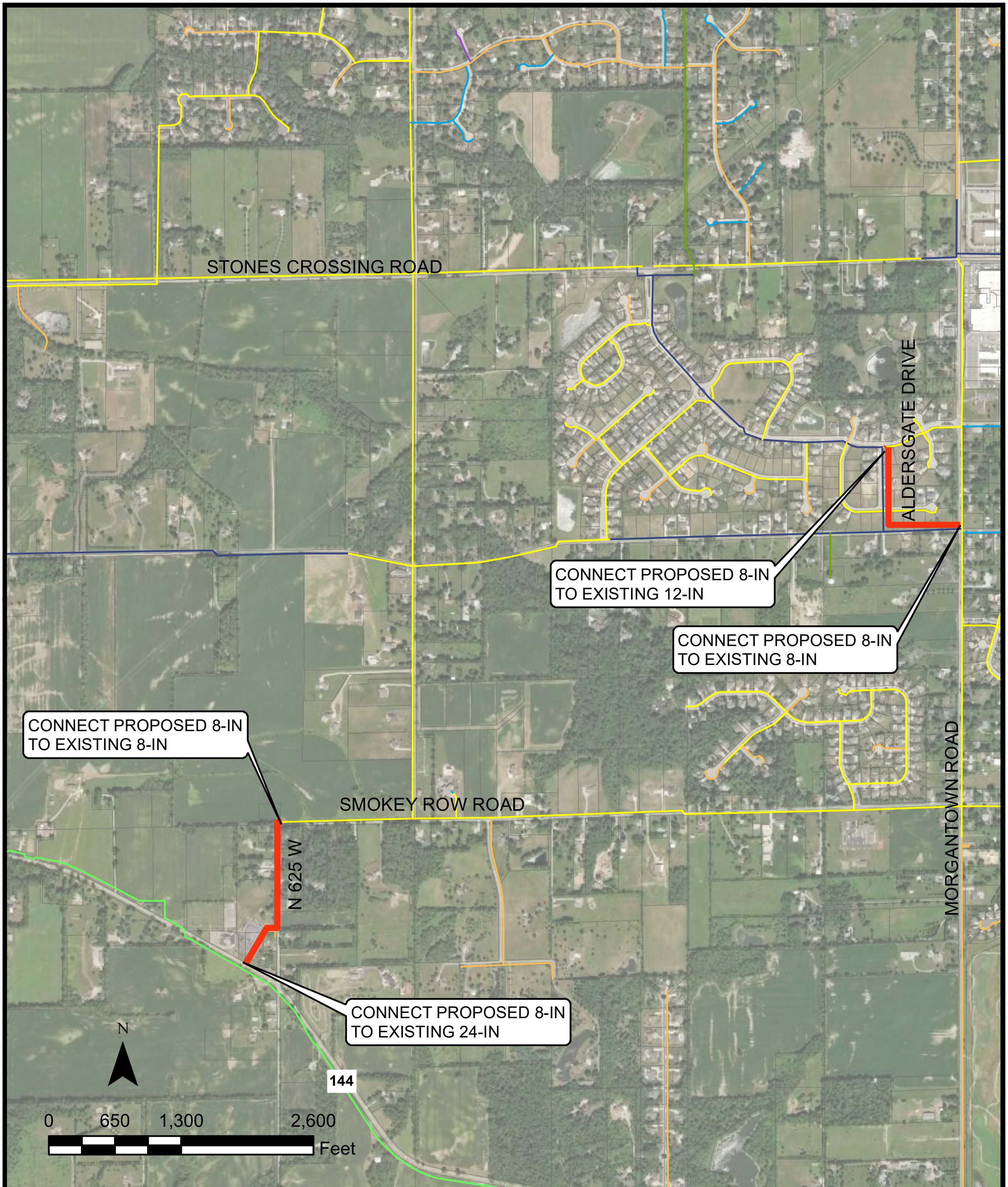

PROPOSED TRANSMISSION MAIN
625 W DRIVE / ALDERSGATE DRIVE

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-5
4005.086

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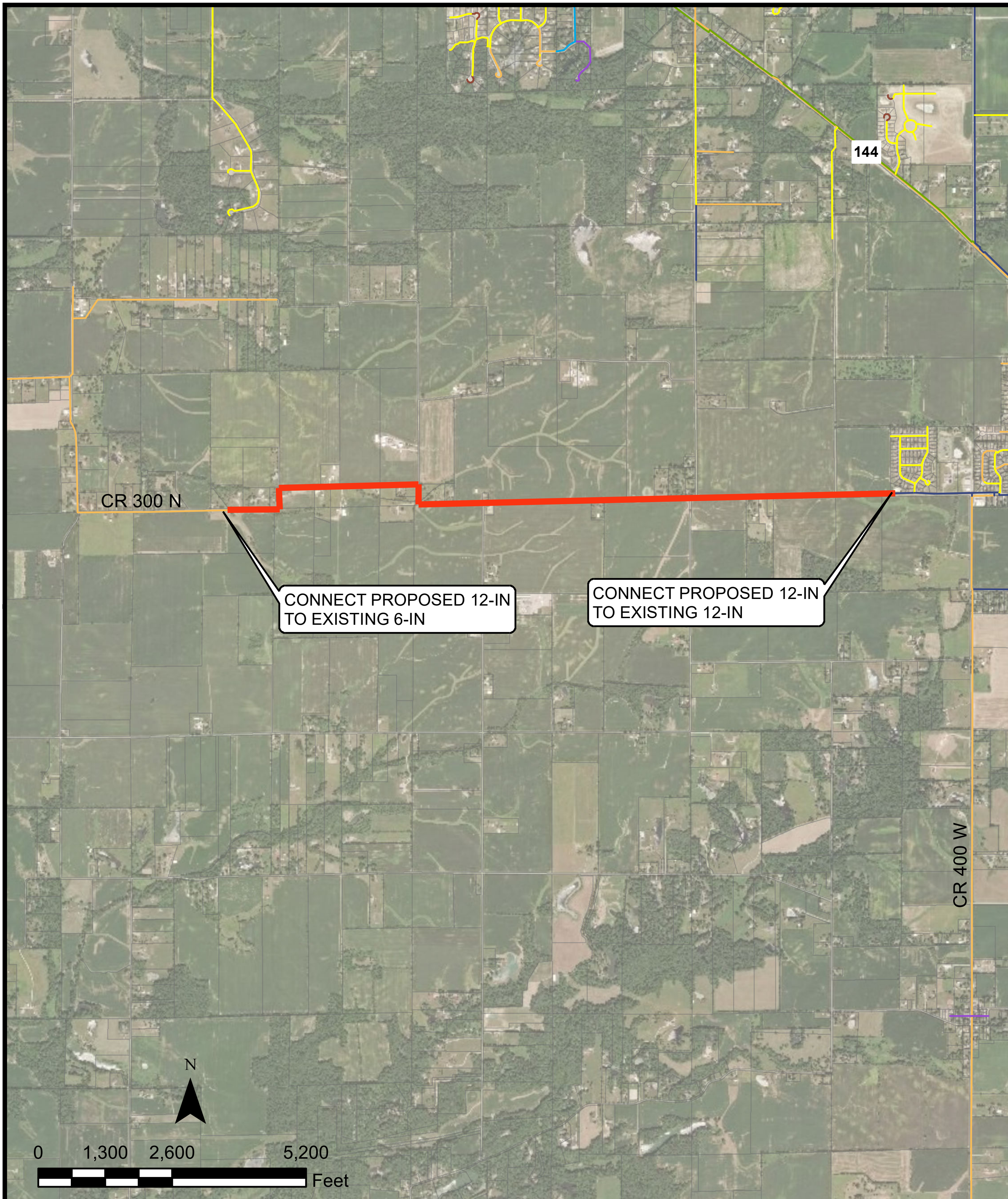

PROPOSED TRANSMISSION MAIN

300 N - PHASE 1

WATER UTILITY MASTER PLAN

TOWN OF BARGERSVILLE

BARGERSVILLE, INDIANA

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FIGURE 5.01-6

4005.086

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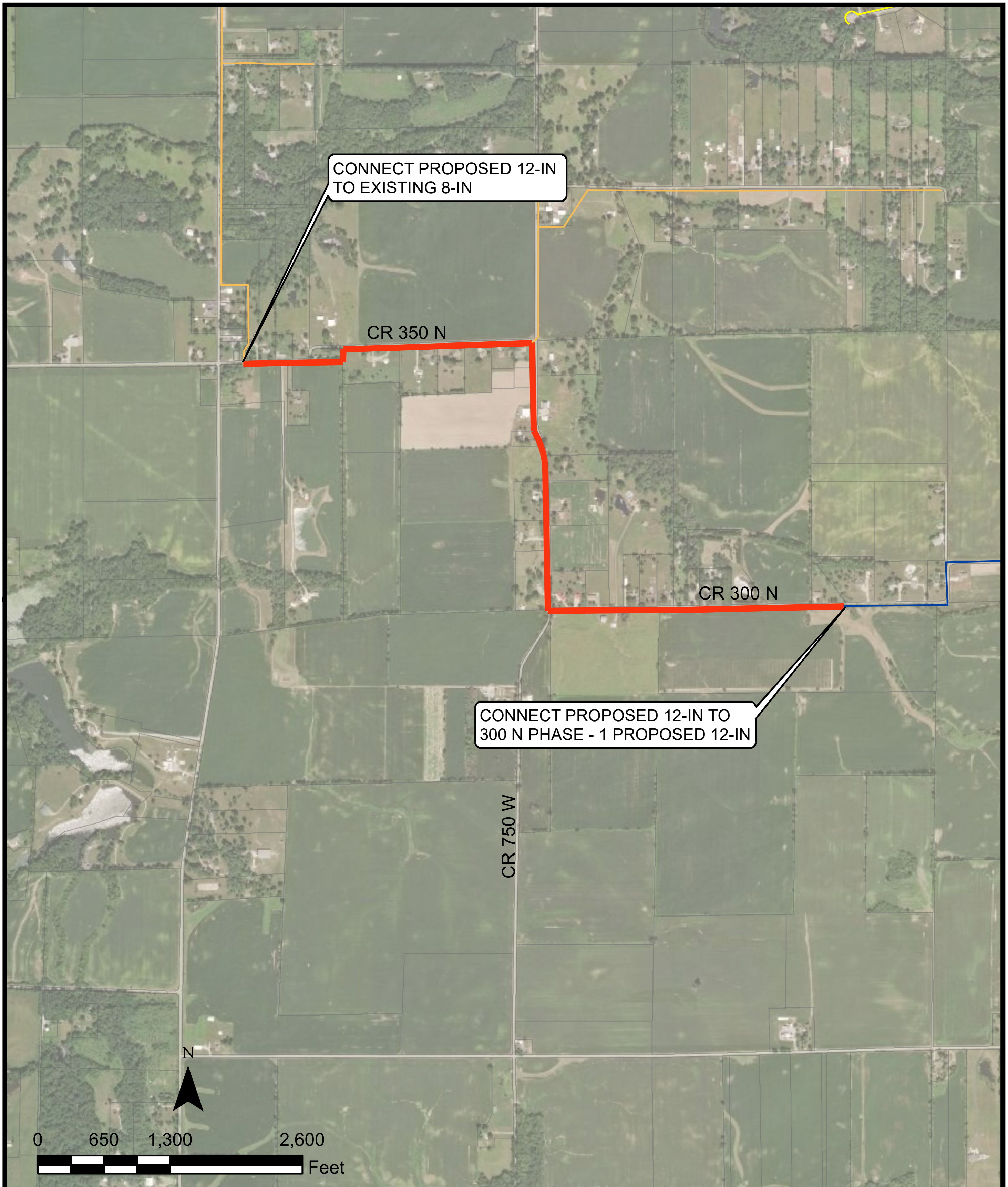

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PROPOSED TRANSMISSION MAIN
300 N - PHASE 2

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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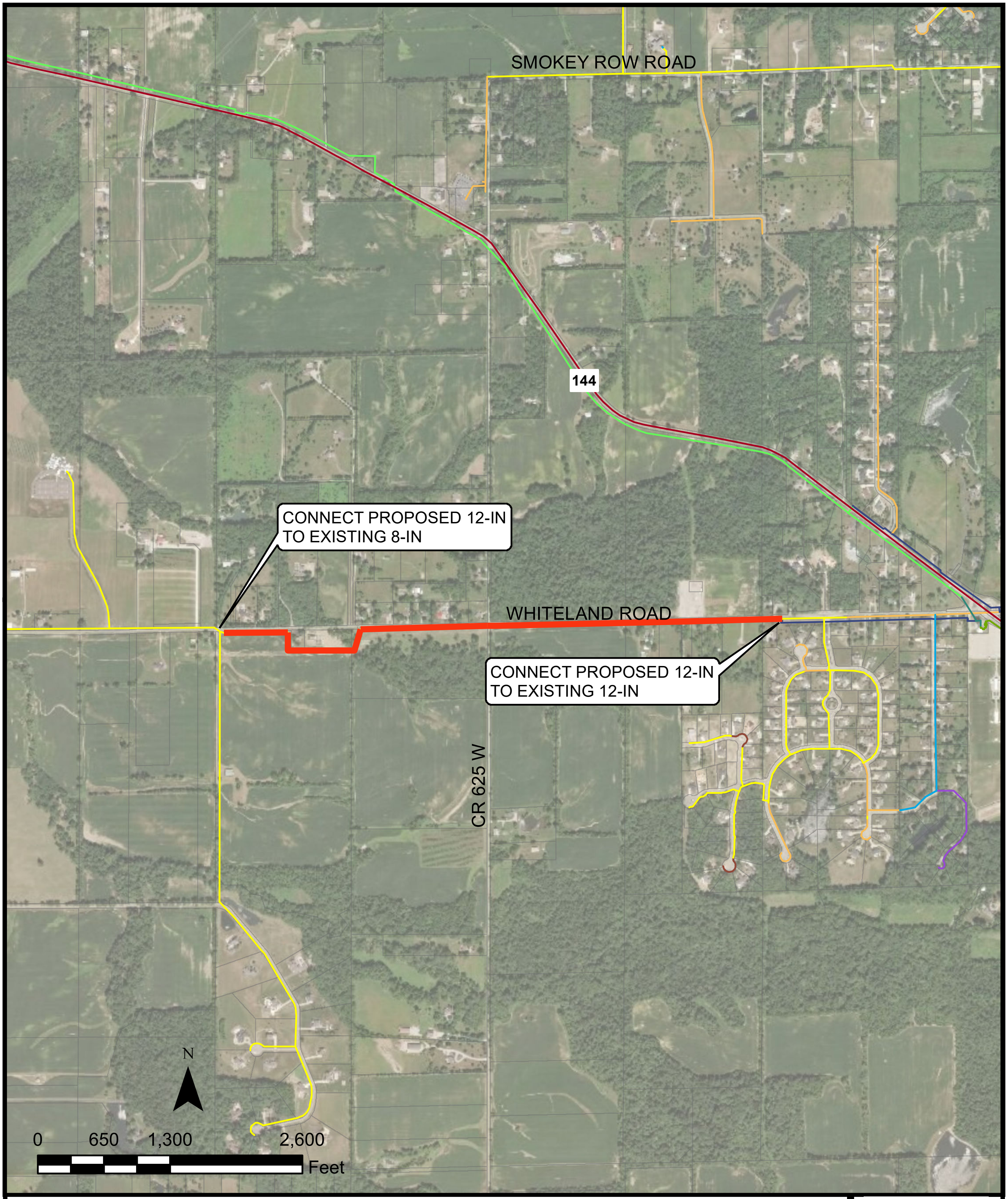
FIGURE 5.01-7
4005.086



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PROPOSED TRANSMISSION MAIN
WHITELAND ROAD - PHASE 1

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-8
4005.086

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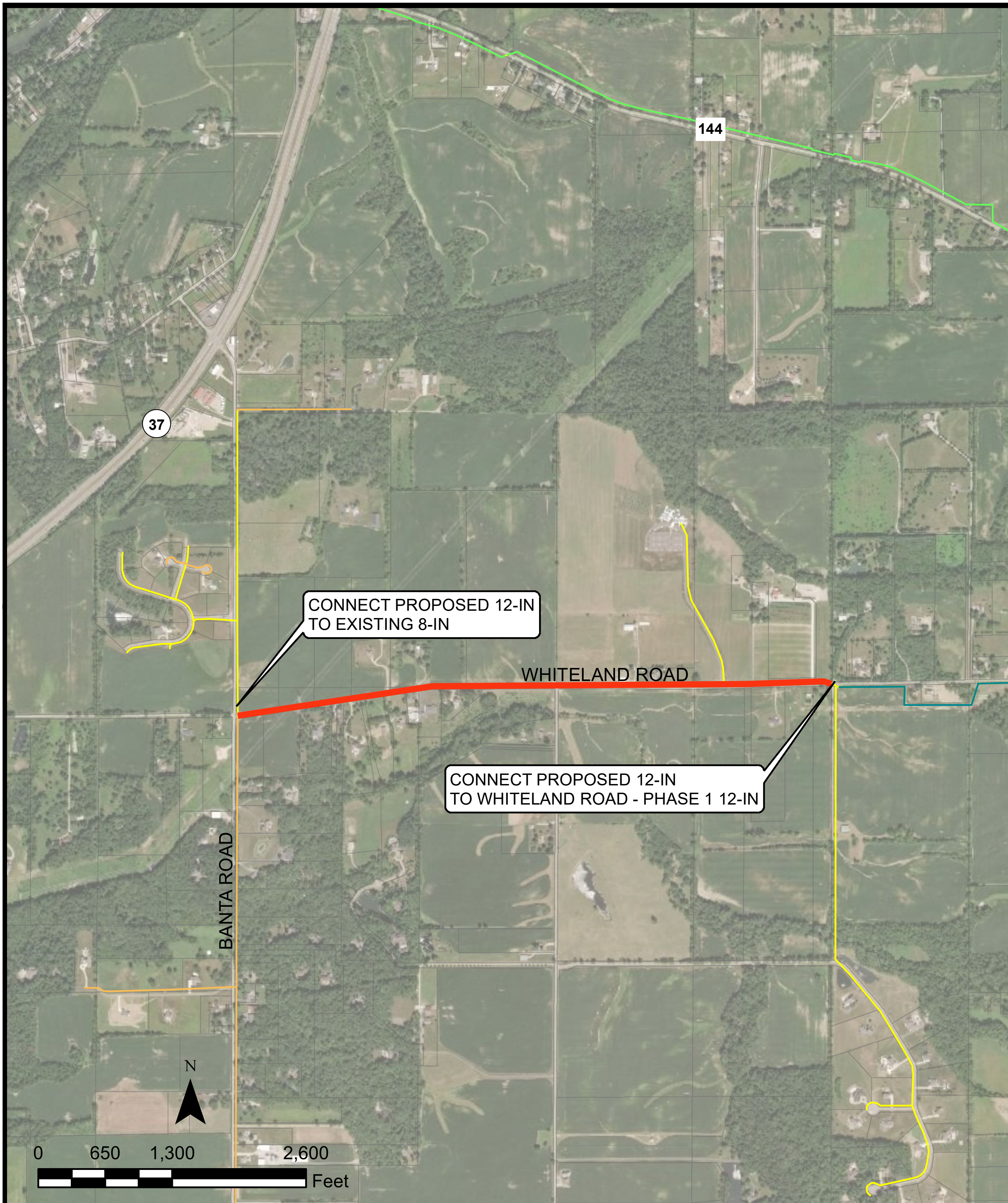

PROPOSED TRANSMISSION MAIN
WHITELAND ROAD - PHASE 2

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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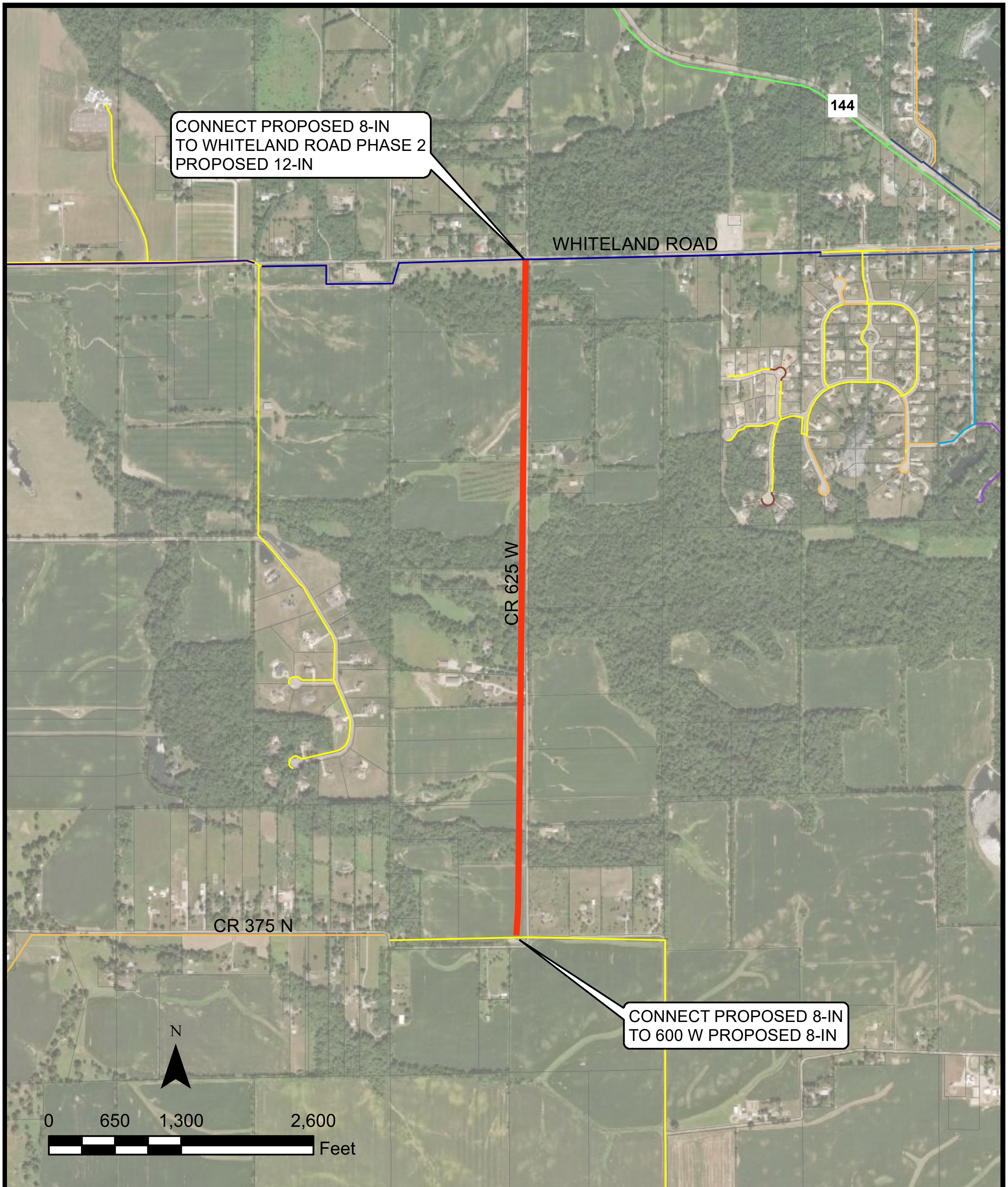
FIGURE 5.01-9
4005.086



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PROPOSED TRANSMISSION MAIN
625 W

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-10
4005.086

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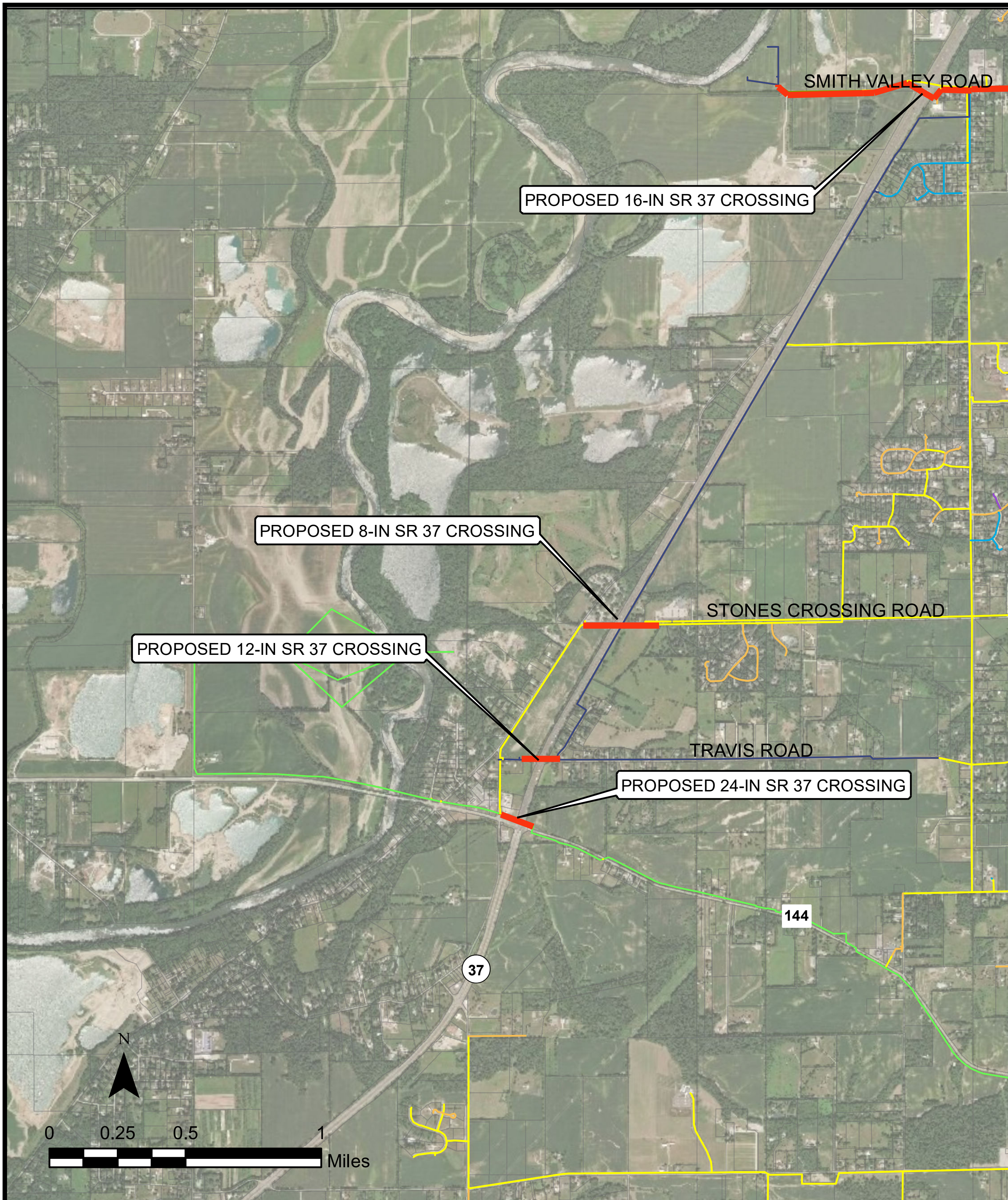

PROPOSED TRANSMISSION MAIN
SR 37 CROSSINGS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-11
4005.086

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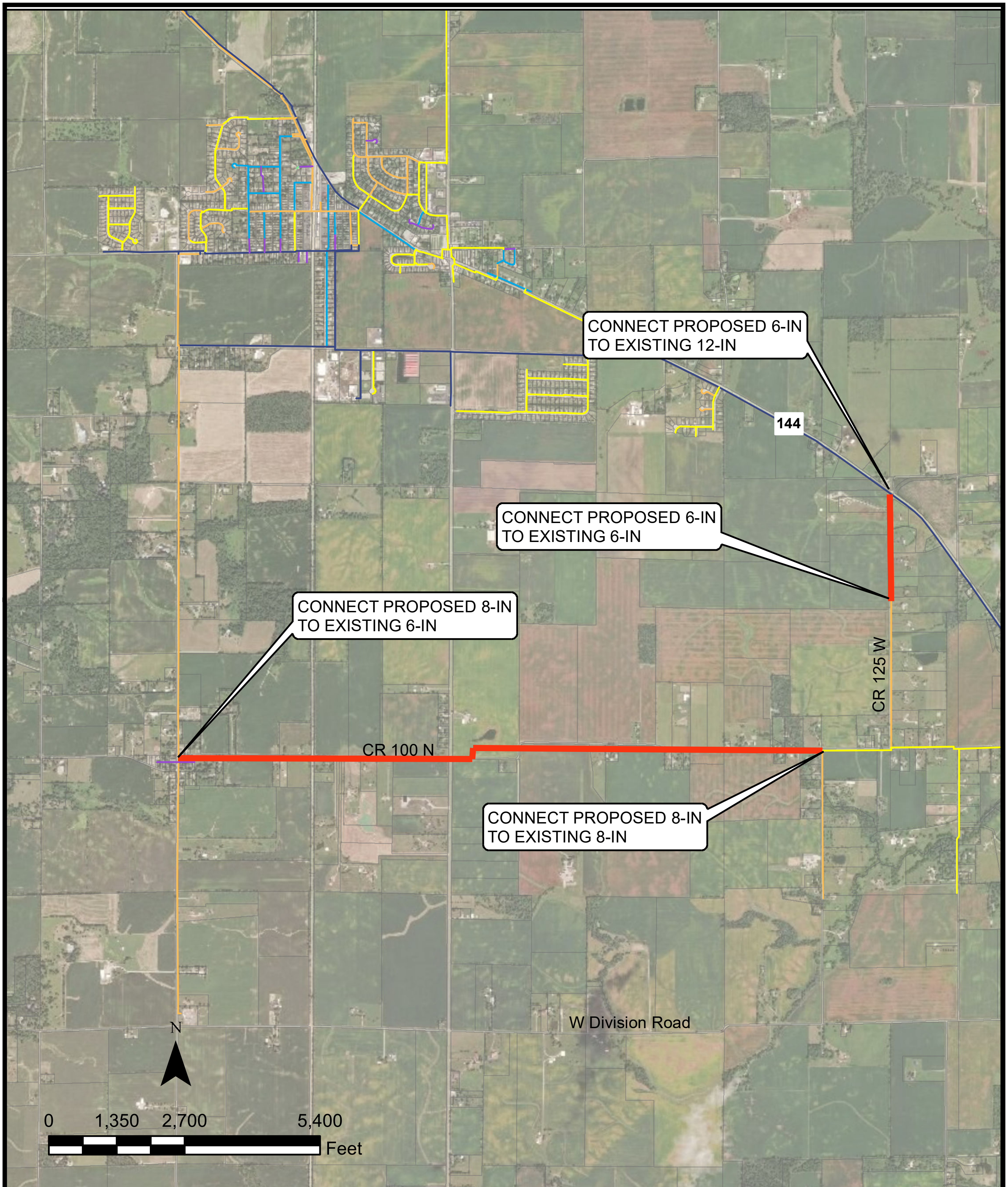

PROPOSED TRANSMISSION MAIN
100N AND 125 W

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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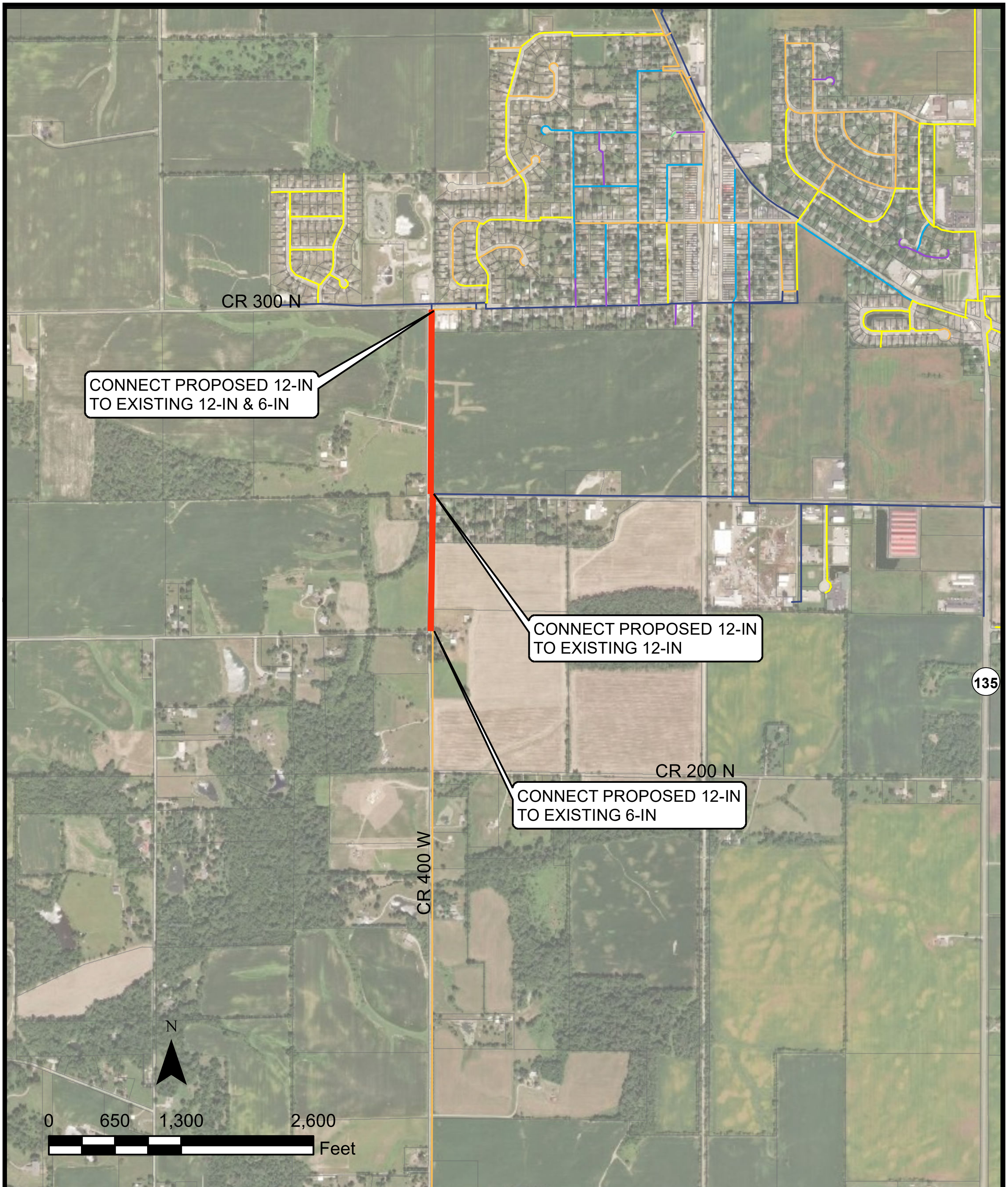
FIGURE 5.01-12
4005.086



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PROPOSED TRANSMISSION MAIN
400 W

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-13
4005.086

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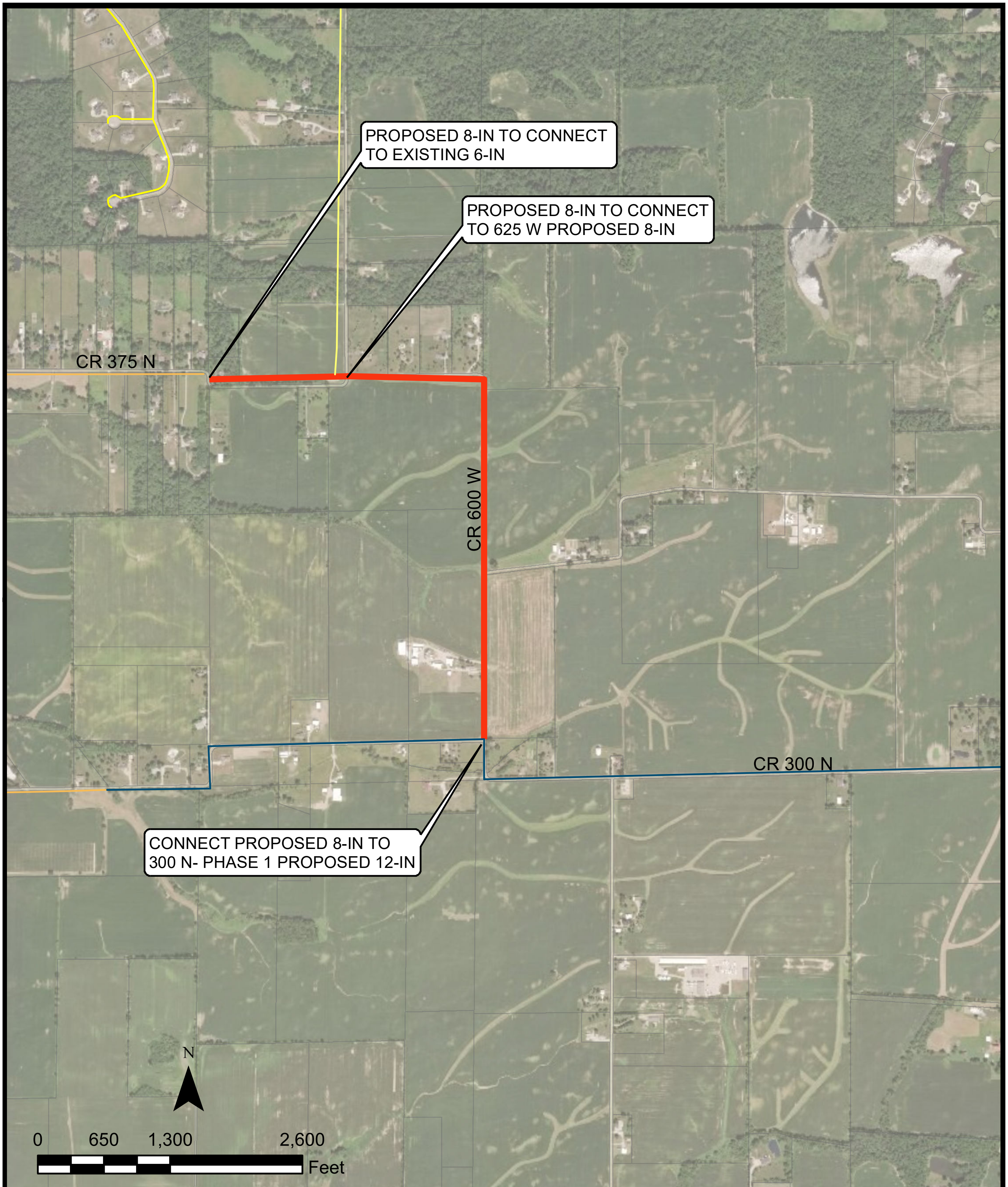

PROPOSED TRANSMISSION MAIN
600 W

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-14
4005.086

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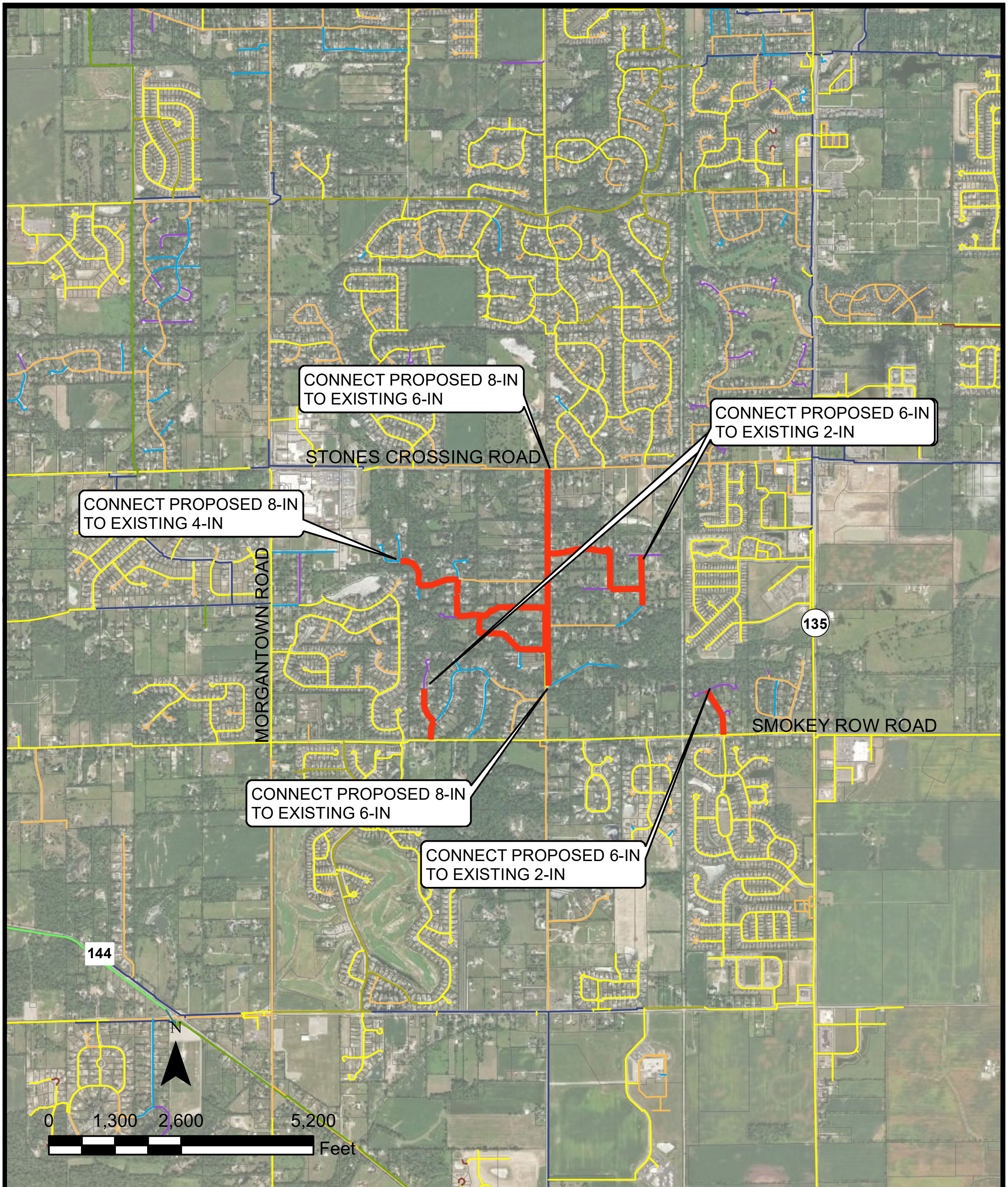

PROPOSED WATER MAIN
CENTRAL FIRE FLOW PROJECTS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-15
4005.086

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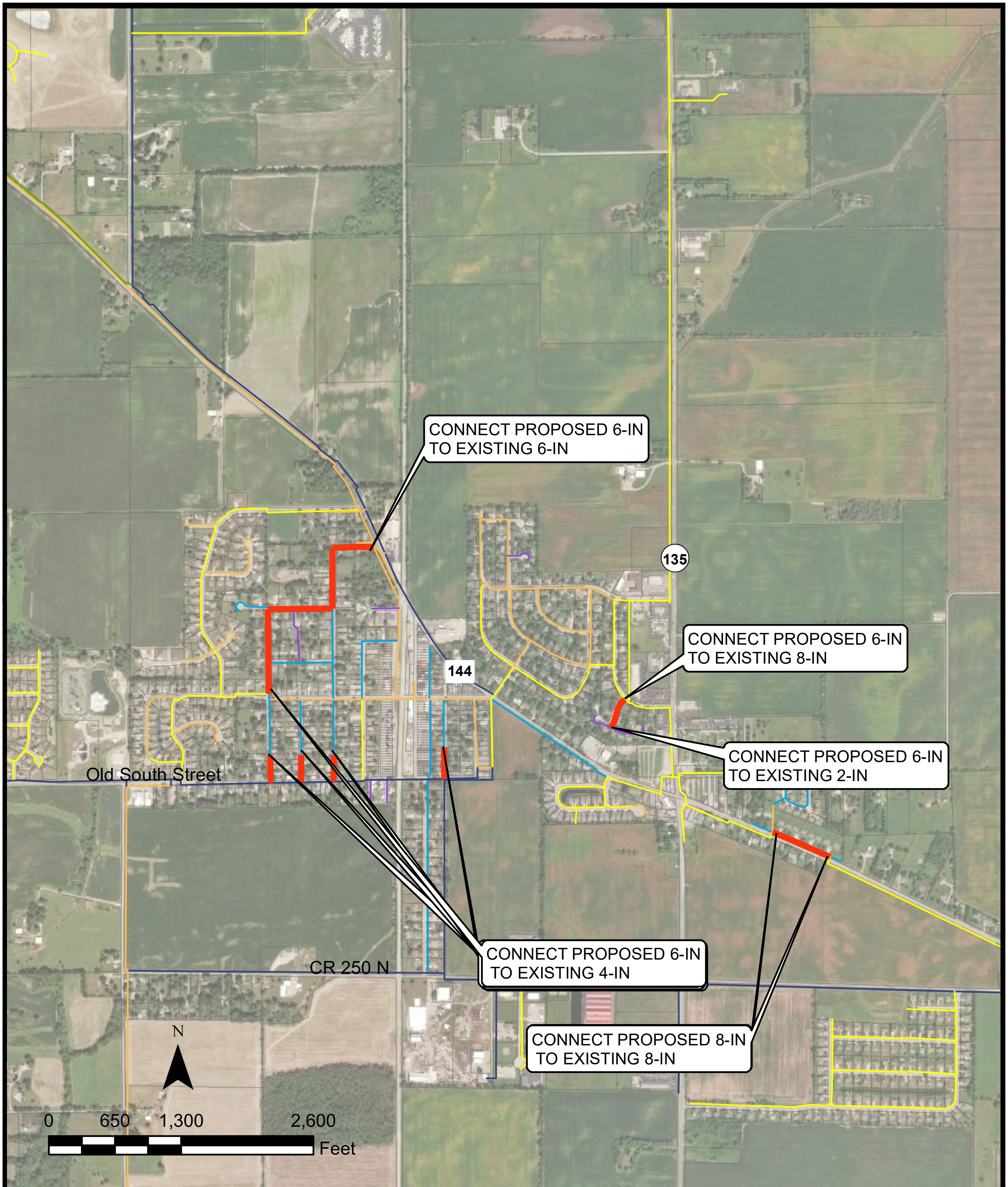

PROPOSED WATER MAIN
OLD TOWN FIRE FLOW PROJECTS

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

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FIGURE 5.01-16
4005.086

Project	Pipe Size (inches)	Pipe Length (feet)	Cost per Foot	Construction Cost	Contingencies and Nonconstruction Costs	Total Project Cost[1]
Critchfield/Eagle Subdivision/North 135 Transmission Mains	16/10/12	6,000/ 1,500/ 1,200	$185/ $150/ $170	$ 1,539,000	$ 541,000	$ 2,080,000
South 135 Transmission Main	12	12,000	$170	$ 2,000,000	$ 700,000	$ 2,700,000
Aldersgate/625 West (North) Drive Water Main	8	3,500	$130	$ 455,000	$ 155,000	$ 610,000
300N Water Main–Phase 1	12	11,500	$125	$ 1,438,000	$ 502,000	$ 1,940,000
300N Water Main–Phase 2	12	6,500	$125	$ 810,000	$ 280,000	$ 1,090,000
Whiteland Road Water Main–Phase 1	12	5,500	$125	$ 690,000	$ 240,000	$ 930,000
Whiteland Road Water Main–Phase 2	12	6,000	$125	$ 750,000	$ 260,000	$ 1,010,000
625 W (South) Water Main	8	7,000	$100	$ 700,000	$ 245,000	$ 945,000
SR 37 Crossings	12/16/24	4,000	$650	$ 2,600,000	$ 910,000	$ 3,510,000
100 N/125 W Water Main	8/6	13,100/ 2,500	$80/ $60	$ 1,198,000	$ 420,000	$ 1,618,000
400 W Water Main	12	3,500	$125	$ 435,000	$ 150,000	$ 585,000
600 W Water Main	8	5,000	$90	$ 450,000	$ 155,000	$ 605,000
Central Neighborhoods Fire Flow Projects	8/6	4,700/ 10,900	$150/ $130	$ 2,125,000	$ 750,000	$ 2,875,000
Old Town Fire Flow Projects	8/6	700/ 4,600	$150/ $130	$ 703,000	$ 247,000	$ 950,000
Total		**109,700**		**$15,893,000**	**$ 5,355,000**	**$21,448,000**

[1]Cost are 3rd quarter 2018 dollars

Table 5.01-5 Identified Water Main Project Cost Opinions

5.02 RECOMMENDED WATER SYSTEM STUDIES

As discussed in Section 4, the Town should consider completing multiple studies for its water system over the 20-year planning period. These studies will occur at regular intervals and will place the Town in the best position for the preparation for future development and the needs at each WTP. Table 5.02-1 outlines the cost of each of these studies as well as the time they should occur within the planning period. Some studies may need to occur sooner or could be delayed depending on timing of growth of the water system. The costs associated with each study is a general amount for the purpose of providing the Town with a general idea of the extent of funds that would be needed to complete studies. Until the scope for each study is established, a true cost cannot be determined.

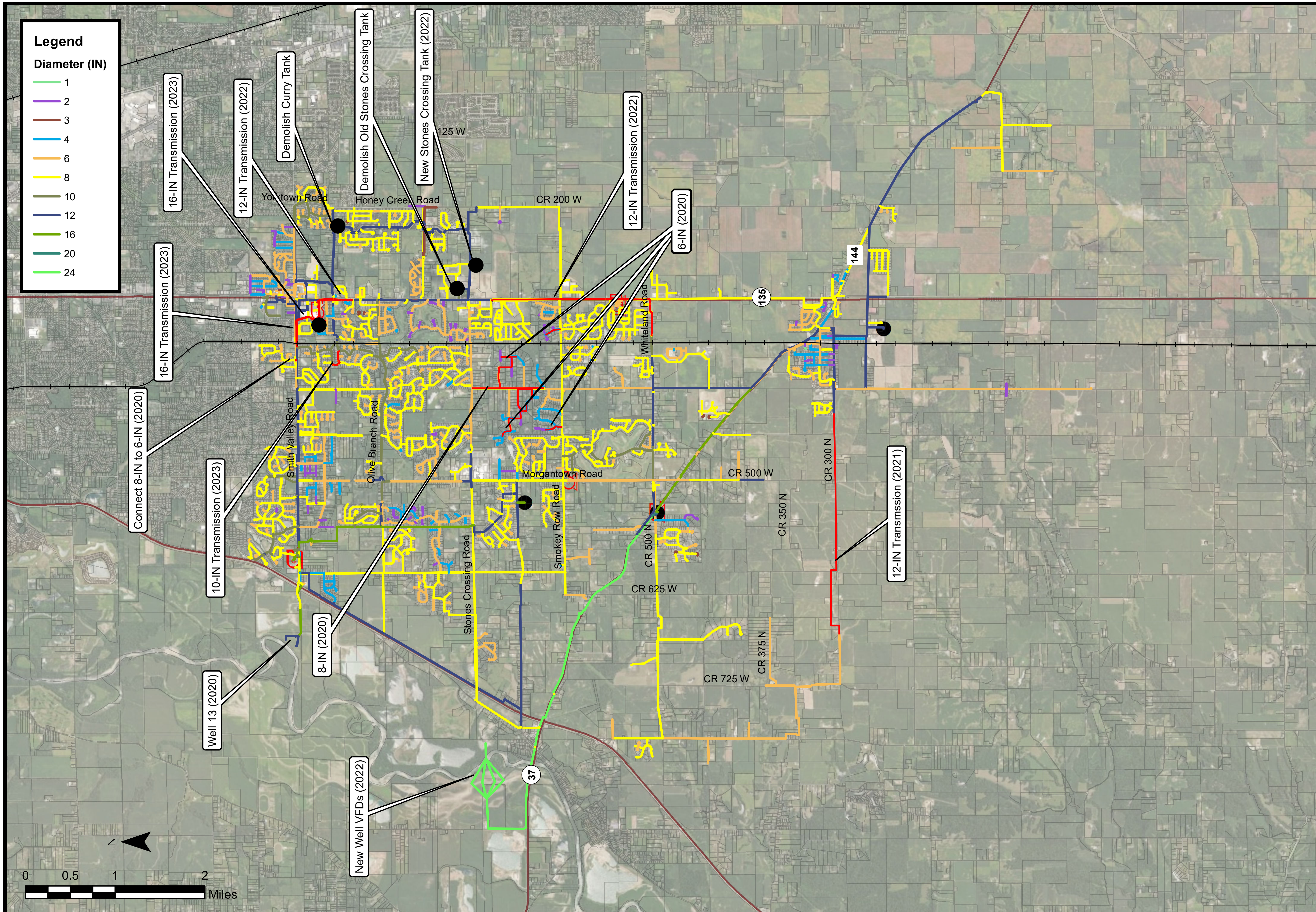
Year	Study	Cost[1]
2019	Asset Management Plan	$40,000 – $50,000
2019	Rate Study	$20,000 – $30,000
2019	North Wellfield Evaluation	$15,000 – $25,000
2020	Tank Observation Study	$10,000 – $20,000
2020	Water System PER	$30,000 – $40,000
2021	Operational Needs Review–WTP No. 1	$70,000 – $80,000
2022	WTP No. 1 PER	$30,000 – $40,000
2023	Hydraulic Model Update	$10,000 – $15,000
2023	Rate Study	$20,000 – $30,000
2024	Asset Management Plan Update	$10,000 – $20,000
2025	Tank Observation Study	$10,000 – $20,000
2026	Unidirectional Flushing Plan	$70,000 – $80,000
2027	Master Plan Update	$30,000 – $40,000
2027	Rate Study	$20,000 – $30,000
2028	Hydraulic Model Update	$10,000 – $15,000
2029	New Asset Management Plan	$40,000 – $50,000
2030	Tank Observation Study	$10,000 – $20,000
2031	Operational Needs Review-WTP No. 2	$70,000 – $80,000
2031	Rate Study	$20,000 – $30,000
2032	WTP No. 2 PER	$30,000 – $40,000
2033	Hydraulic Model Update	$10,000 – $15,000
2034	Asset Management Plan Update	$10,000 – $20,000
2035	Tank Observation Study	$10,000 – $20,000
2035	Rate Study	$20,000 – $30,000
2038	Update Hydraulic Model	$10,000 – $15,000
2038	New Master Plan	$65,000 – $75,000
	Total	**$690,000 – $930,000**

[1]Costs are 3rd quarter 2018 dollars

Table 5.02-1 Recommended 20-Year Water System Studies

5.03 RECOMMENDED 5-YEAR IMPROVEMENTS

Based on the needs of the system, it is anticipated that the water utility will need to strengthen the northern part of the distribution system storage and piping, as well as, the water supply capabilities for both WTPs, before water treatment improvements are completed. Table 5.03-1 shows the proposed projects for the next 5 years in the order that they would occur. Figure 5.03-1 outlines these improvements within the Town's distribution system.



WATER DISTRIUBTION IMPROVEMENTS
PRESENT TO 2023

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 5.03-1
4005.086

Path: S:\COL\4000--4099\4005\086\Drawings\GIS\5.03-1 Distribution System Improvements (0-5years) SAW.mxd User: scottw Date: 10/16/2018 Time: 1:39:37 PM Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Construction Year	Project	Total Project Cost[1]
2020	Well No. 13 Installation at Northern Wellfield	$ 540,000
2020	Central Neighborhoods Fire Flow Projects	$ 2,875,000
2021	12-IN Transmission Main SR 135–South	$ 2,700,000
2022	12-IN Transmission Main W 300 N–Phase 1	$ 1,940,000
2022	WTP No. 2 New Well VFDs	$ 270,000
2022	8-IN Water Mains on Aldersgate Drive and Northern 625 W	$ 610,000
2023	New Stones Crossing Tank	$ 3,660,000
2023	Transmission Mains on Critchfield/Eagle Subdivision/North 135	$ 2,080,000
	Total	**$ 14,753,000**

[1]Cost are 3rd quarter 2018 dollars

Table 5.03-1 Recommended 5-Year Improvements

5.04 RECOMMENDED 10-YEAR IMPROVEMENTS

Once the initial water distribution and storage system improvements have been completed, the Town can proceed to start the water treatment improvement projects along with an additional raw water supply project to provide redundancy across an interstate. During this 5-year window, the Town should start the improvements to WTP No. 1 that have been recommended. Table 5.03-1 shows the recommended projects within 5 to 10 years, in the order that they are proposed to occur. Figure5.04 1 outlines these proposed improvements.

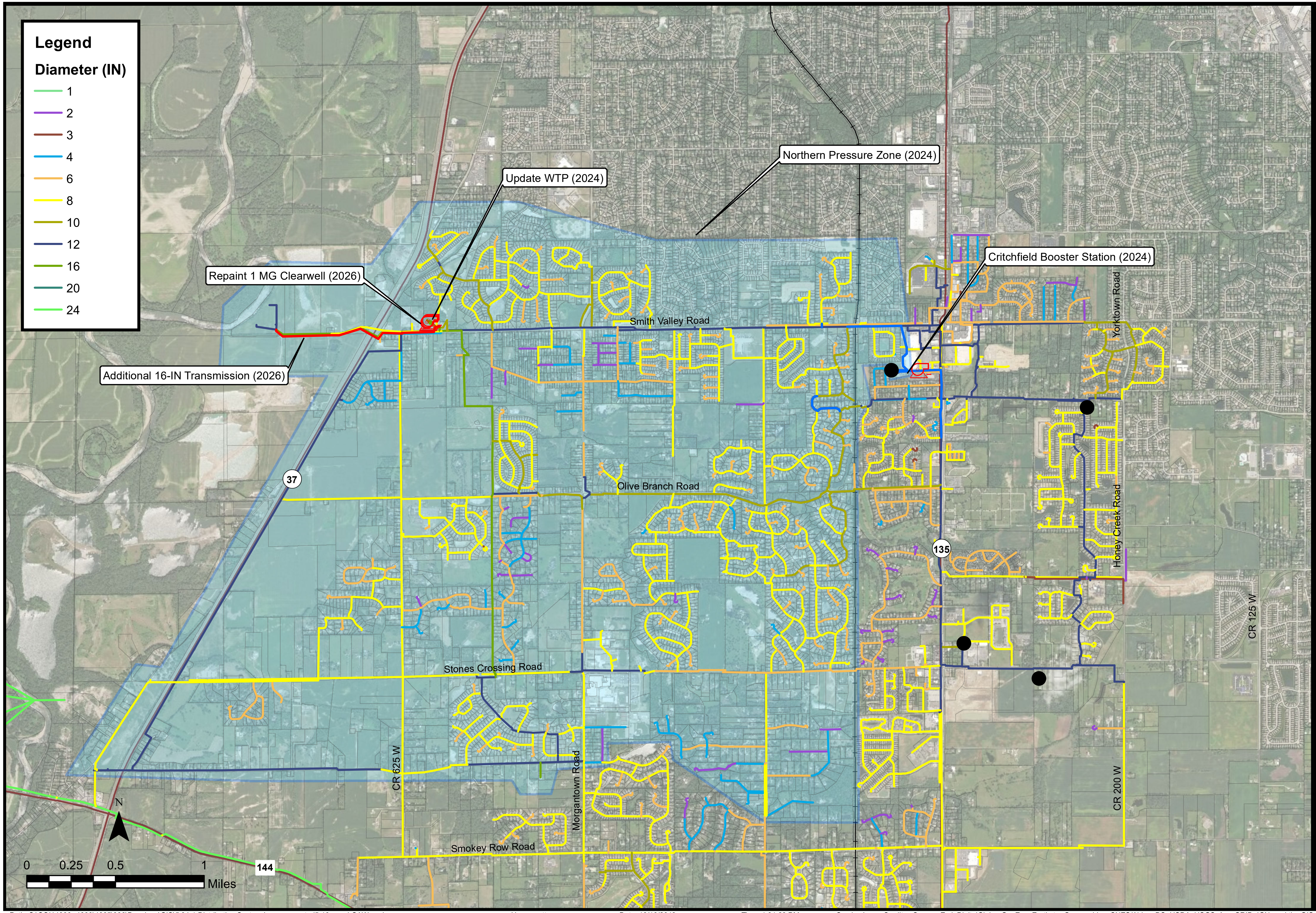
Construction Year	Project	Total Project Cost[1]
2024	Critchfield Booster Station	$ 1,013,000
2024	Pressure Zone Changeover	N/A
2025	Update WTP No. 1	$ 13,449,000
2026	Additional 16-IN Raw Water Transmission Main	$ 1,688,000
2028	Repaint 1 MG Clearwell	$ 400,000
	Total	**$ 16,550,000**

[1]Cost are 3rd quarter 2018 dollars

Table 5.04-1 Recommended 10-Year Improvements

5.05 RECOMMENDED 20-YEAR IMPROVEMENTS

After the WTP No. 1 projects have been completed, it is recommended that the Town proceed with a more intensified water main replacement program and water transmission main installment on the southern section of the system. Based on these recommendations, the Town will have an increased rate of feet of pipe installed each year, in addition to fire flow improvement projects. The completion of these water mains recommended for the next 10 to 20 years of the planning period will be based on future development schedules, however a predicted outline is shown in Table 5.05-1. Toward the end of this period, the Town should continue to investigate the installation of additional wells to



WATER DISTRIBUTION SYSTEM IMPROVEMENTS 2024 TO 2028

WATER UTILITY MASTER PLAN
TOWN OF BARGERSVILLE
BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

FIGURE 5.04-1
4005.086

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supply WTP No. 1 and WTP No. 2. Figure 5.05-1 outlines the location of these proposed improvements.

Construction Year	Project	Total Project Cost[1]
2029[2]	SR 37 Crossings	$ 3,510,000
2030	12-IN Transmission Main Whiteland Road–Phase 1	$ 945,000
2030	12- IN Transmission Main W 300 N–Phase 2	$ 1,010,000
2030	Bargersville Tank Painting	$ 475,000
2031	Well No. 14 Installation at Northern Wellfield	$ 540,000
2032	12-IN Transmission Main N CR 400 W	$ 450,000
2032	Old Town Fire Flow Projects	$ 946,000
2033	8-IN Water Main CR 625 W - South	$ 945,000
2034	Update WTP No. 2	$ 3,551,000
2035	12-IN Transmission Main Whiteland Road–Phase 2	$ 975,000
2036	8-IN Transmission Main CR 600 W	$ 625,000
2037	Water Mains on W CR 100 N/CR 125 W	$ 1,888,000
2038	Orchard Hill Tank Painting	$ 475,000
	Total	**$ 16,335,000**

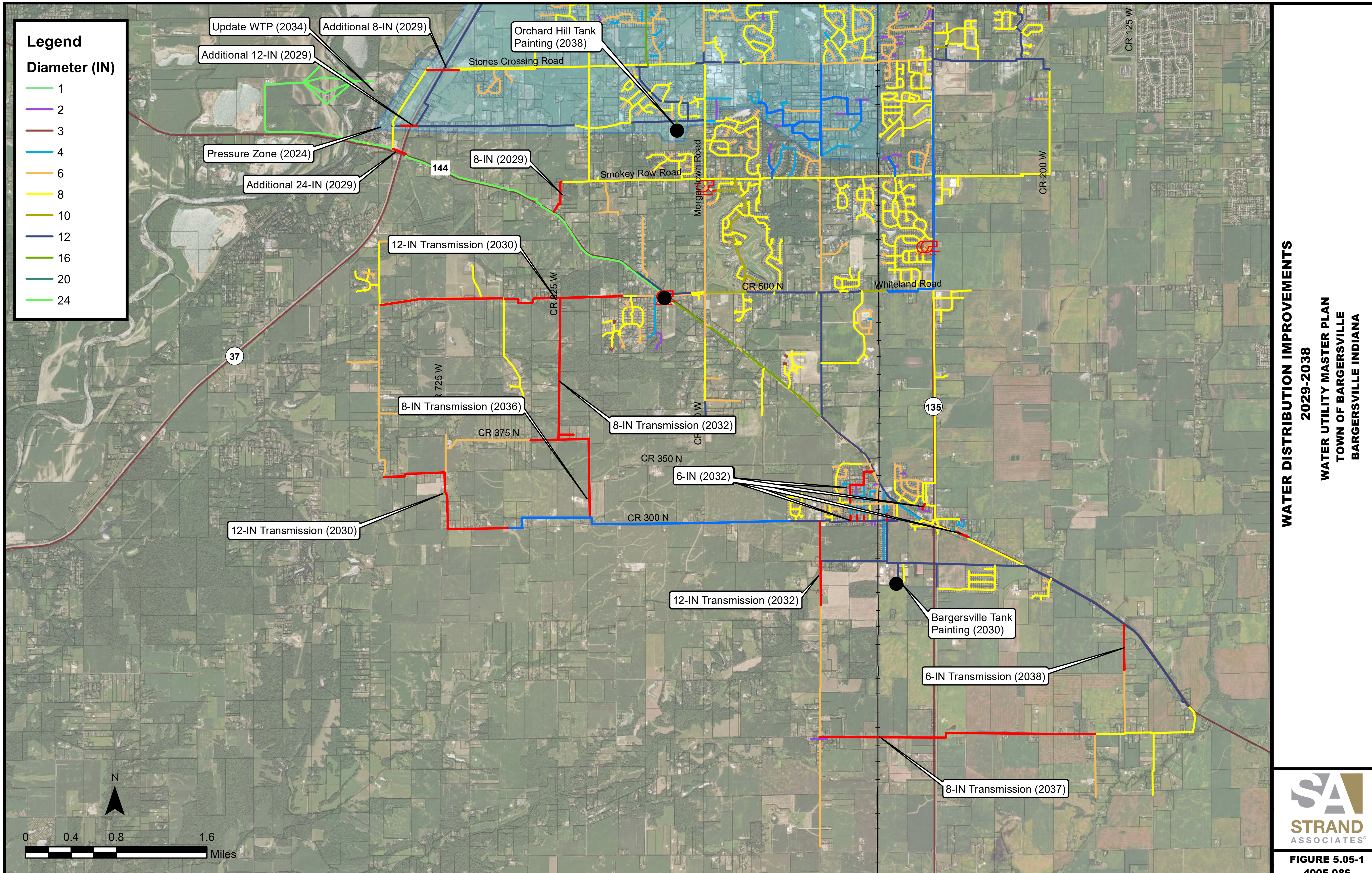
[1]Costs are 3rd quarter 2018 dollars
[2]Projected time, dependent upon I-65 requirements

Table 5.05-1 Recommended 20-Year Improvements

5.06 ADDITIONAL RECOMMENDATIONS

The following item is also recommended:

- Investigate property and easement acquisition to enable the recommended projects.



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APPENDIX A
WATER RATE ORDINANCE

BARGERSVILLE ORDINANCE NO. 2014-16

AN ORDINANCE ESTABLISHING WATER RATES AND CHARGES FOR THE USE OF SERVICES RENDERED BY THE MUNICIPAL WATER UTILITY OF THE TOWN OF BARGERSVILLE, INDIANA AND REPEALING ORDINANCES INCONSISTENT THEREWITH

WHEREAS, the Town of Bargersville (the "Town") owns and operates a Municipal Water Utility for the purpose of providing a sufficient supply of water at a proper quality and pressure to the inhabitants of the Town, and properly protecting the health, well-being and property of the Town and its inhabitants; and

WHEREAS, the Town's water utility also serves areas outside the corporate limits; and

WHEREAS, the Town Council has caused London Witte Group to prepare a Rate and Cost of Service Analysis dated August 12, 2014 (the "Analysis"); and

WHEREAS, the Analysis indicates rates as established by existing Bargersville ordinances should be changed; and

WHEREAS, the Town Council now finds the existing rates and charges for the use of and service rendered by the waterworks system of the Town should be changed and that the rates, as so changed, will be sufficient to pay all the necessary expenses incident to the operation of said waterworks, including maintenance costs, operation charges, upkeep, repairs, depreciation, debt service and debt service reserve on existing and planned obligations of the waterworks, to provide a sinking fund for the liquidation of indebtedness, and to provide adequate funds to make extensions and replacements, and to make payments in lieu of taxes, and that accordingly, the existing rates and charges will produce income more than sufficient to maintain the waterworks property in sound physical and financial condition to render adequate and efficient service, all as provided in Indiana Code 8-1.5-3-8, so that the existing rates and charges should be changed; and

WHEREAS, the rates adopted herein are nondiscriminatory, reasonable and just; and

WHEREAS, it is necessary and desirable that the rates and charges be sufficient to provide revenues to compensate the Town for taxes that would be due on the utility property were it privately owned.

NOW THEREFORE, BE IT ORDAINED BY THE TOWN COUNCIL OF THE TOWN OF BARGERSVILLE, INDIANA, AS FOLLOWS:

Section 1. There shall be and there are hereby established for the use of and the service rendered by the Water Utility of the Town of Bargersville, Indiana, the following recurring rates and charges: See Exhibit A, attached hereto and made a part hereof.

Section 2. All parts of Ordinances establishing recurring rates and charges inconsistent herewith are repealed, such repeal being effective as of the effective date of this Ordinance.

Section 3. All rates and charges not amended herein shall not be repealed or changed as a result of this Ordinance. In particular, all non-recurring charges established by Bargersville Ordinances shall not be repealed or changed.

Section 4. This Ordinance and the rates and charges set forth herein shall be effective for amounts payable on November 15, 2014.

Passed and adopted by the Town Council of the Town of Bargersville, Indiana, this 16th day of September, 2014 by a vote of 5 ayes and 0 nays.

Town Council of the Town of Bargersville, Indiana

Ken Zumstein, President

Gayle Allard

Bruce Morris

Rowana Umbarger

Jim Beck

ATTEST:

Steve Longstreet, Clerk-Treasurer

Bargersville Municipal Water
Bargersville, Indiana

Exhibit A

(A) For Customers without In-Ground Water Sprinkling

Metered Rates, per month	Per 1,000 Gallons
First 20,000 gallons	$ 5.06
Over 20,000 gallons	$ 5.06

Base charge, per month Meter Size	
5/8"	$ 5.96
1"	$ 7.82
1-1/2"	$ 9.67
2"	$ 14.78
3"	$ 52.36
4"	$ 66.28
6"	$ 98.76
8"	$ 135.88
10"	$ 177.64

(B) For Customers with In-Ground Water Sprinkling

Metered Rates, per month	Per 1,000 Gallons
All gallons Consumed	$ 5.06

Base charge, per month Meter Size	
5/8"	$ 5.96
1"	$ 7.82
1-1/2"	$ 9.67
2"	$ 14.78
3"	$ 52.36
4"	$ 66.28
6"	$ 98.76
8"	$ 135.88
10"	$ 177.64

(C) Flat Rate - Unmetered customers

Charge Per Month	$	113.48

(D) Hydrant Rental, per month

Public Hydrant	$	86.38
Private Hydrant	$	86.38

(E) Private Fire Protection, per month

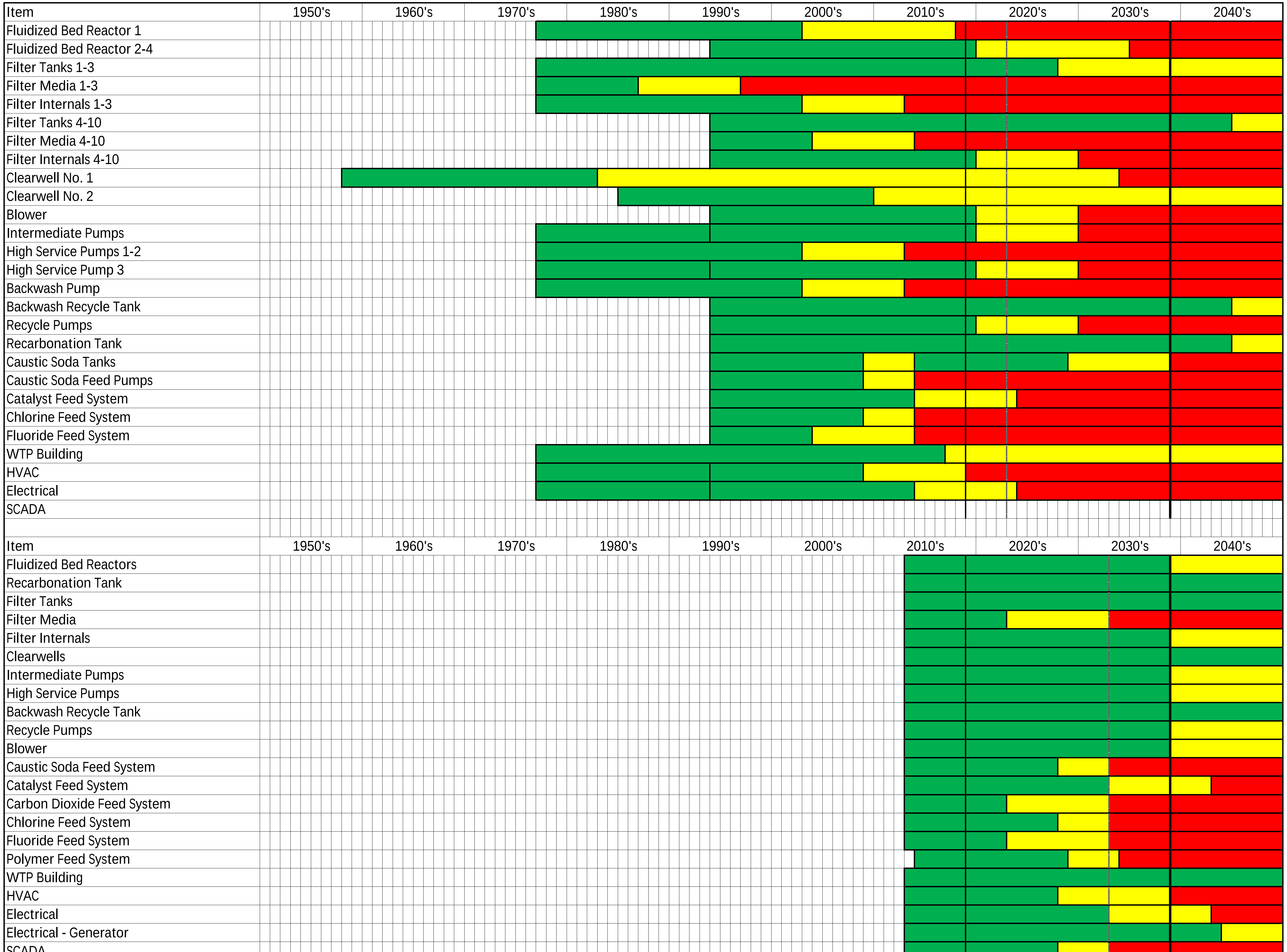
Sprinkler Connection		
2"	$	5.57
4"	$	31.35
6"	$	86.38
8"	$	153.56
10"	$	355.46
12"	$	511.86

(F) Public Fire Protection Surcharge

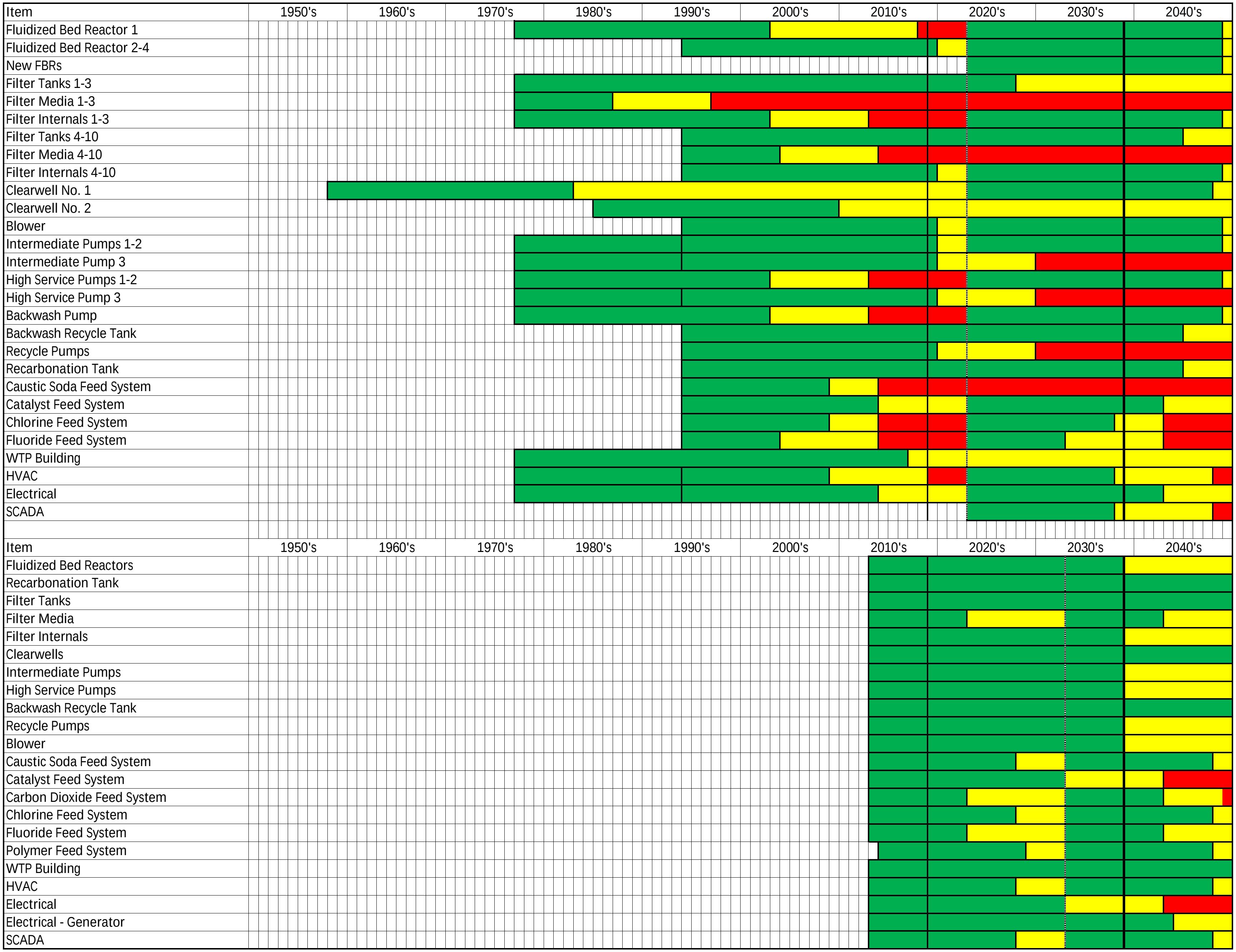
Charge per month	$	7.37

APPENDIX B
WTP PROCESS USEFUL LIFE EXPECTANCY

Existing Condition Timeline
Water Treatment Plants



Existing Condition Timeline
Water Treatment Plants



APPENDIX C
2017 HYDRAULIC MODEL UPDATE

STRAND ASSOCIATES®

Strand Associates, Inc.®
629 Washington Street
Columbus, IN 47201
(P) 812-372-9911
(F) 812-372-7190

August 10, 2017

Ms. Niki Balish, Utility Administrator
Bargersville Utilities
24 North Main Street
Bargersville, IN 46106

Re: Bargersville Water Model Updates

Dear Ms. Balish:

The water hydraulic model update project is now complete with calibration of the updated model. The existing hydraulic model was updated with information from Bargersville's GIS system that provided more accurate water main and system demand information for model construction.

Calibrating the water model involved conducting hydrant flow tests and collecting supervisory control and data acquisition (SCADA) operational data in coordination with the Town during the time of each hydrant flow test. Strand Associates, Inc.® (Strand) selected all the hydrant flow test locations for calibration purposes based on the water distribution system layout. alibration locations are shown in the attachment. Strand then worked with the water distribution staff to conduct the hydrant flow tests.

Eight hydrant flow tests were used to calibrate the water model. Once the hydrant flow tests were completed, the results were manually entered into the WaterGEMs model. The model was then calibrated by running multiple model iterations to find the most reasonable C-factor for each water main. Table 1 summarizes the results of the fire hydrant tests compared to the simulated results.

Test No.	Junction	Simulated Flow (gpm)	Observed Hydraulic Grade (ft)	Simulated Hydraulic Grade (ft)	Difference (ft)	Difference (psi)
1	J-4978	1,094	904.26	896.37	-7.89	3.4
2	J-5074	1,477	882.11	886.04	3.93	1.7
3	J-960	1,021	867.4	857.04	-10.36	4.5
4	J-476	531	Test Not Used			
5	J-4761	805	792.01	792	-0.01	0.0
6	J-5410	1,156	924.26	928.66	4.4	1.9
7	J-5896	1,150	872.43	862.95	-9.48	4.1
8	J-5535	1,126	901.7	899.12	-2.58	1.1

Table 1 Model Calibration Results

JEM:vls\S:\COL\4000--4099\4005\069\Wrd\Letter for Bargersville WaterGems.docx

Ms. Niki Balish, Utilities Administrator
Bargersville Utilities
Page 2
August 10, 2017

A model is considered well calibrated when the field and modeled pressure agree within plus or minus 5 pound per square inch (psi). All hydrant flow tests met or exceed this criterion with the exception of hydrant flow test No. 4, excluding it from the data. The reason for the exclusion of this test is due to field constraints that prevented the test from being able to be run normally, leading to an anticipated false pressure measurement.

With the conclusion of this project, the model is now ready to conduct future studies involving residential development and expansion, new tank installments, pump upgrades, and fire flow analyses. Please let us know if you have any questions.

Sincerely,

STRAND ASSOCIATES, INC.®

James E. McNulty

James E. McNulty, P.G.

Ryan C. Mackos

Ryan C. Mackos, P.E.

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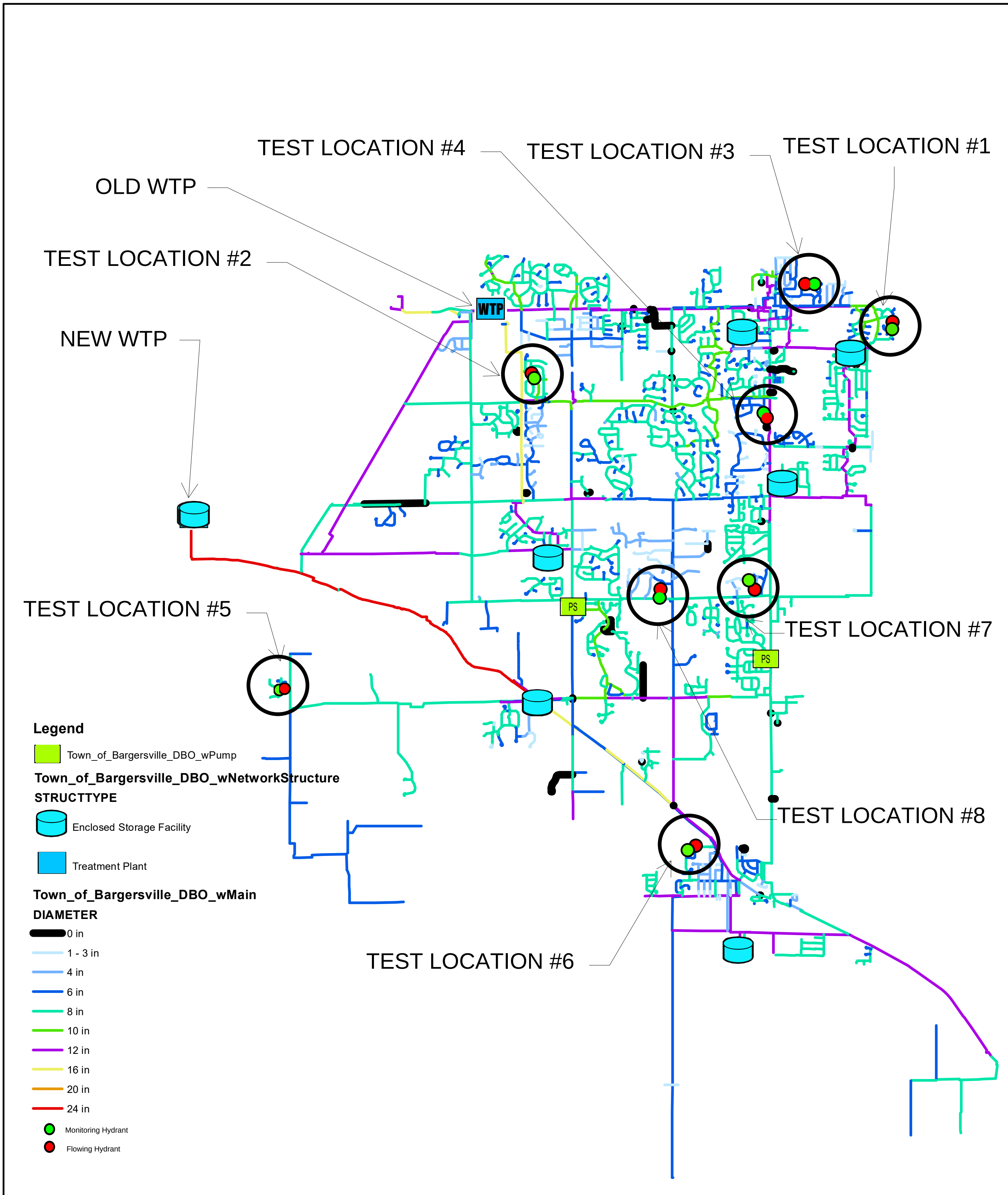
User: scottw
Date: 7/14/2017
Time: 8:39:11 AM



HYDRANT SELECTION FOR WATER MODEL CALIBRATION
BARGERSVILLE UTILITIES

BARGERSVILLE, INDIANA

STRAND ASSOCIATES®

4005.069

For more location information please visit www.strand.com

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