2017 WATER SYSTEM STUDY –

HIGH PRESSURE ZONE

FOR

Mooresville, NC

PREPARED BY:

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1.0 Purpose and Background

1.1 Project Purpose

The Town of Mooresville owns and operates a water distribution system located in Iredell County, North Carolina. The Town of Mooresville is looking to upgrade and expand their water infrastructure in order to improve the water supply at the Industrial Park and high pressure zone in the town. The Town of Mooresville contracted WK Dickson (WKD) to prepare a hydraulic model and study to evaluate the current water system and recommend improvements to accomplish the following primary objectives:

- Provide sufficient water to the Industrial Park along Mazeppa Road;
- Provide redundancy to the Industrial Park and the Mooresville Business Park East;
- Evaluate the possibility of expanding the high pressure zone; and,
- Evaluate options for providing additional elevated storage in the high pressure zone.

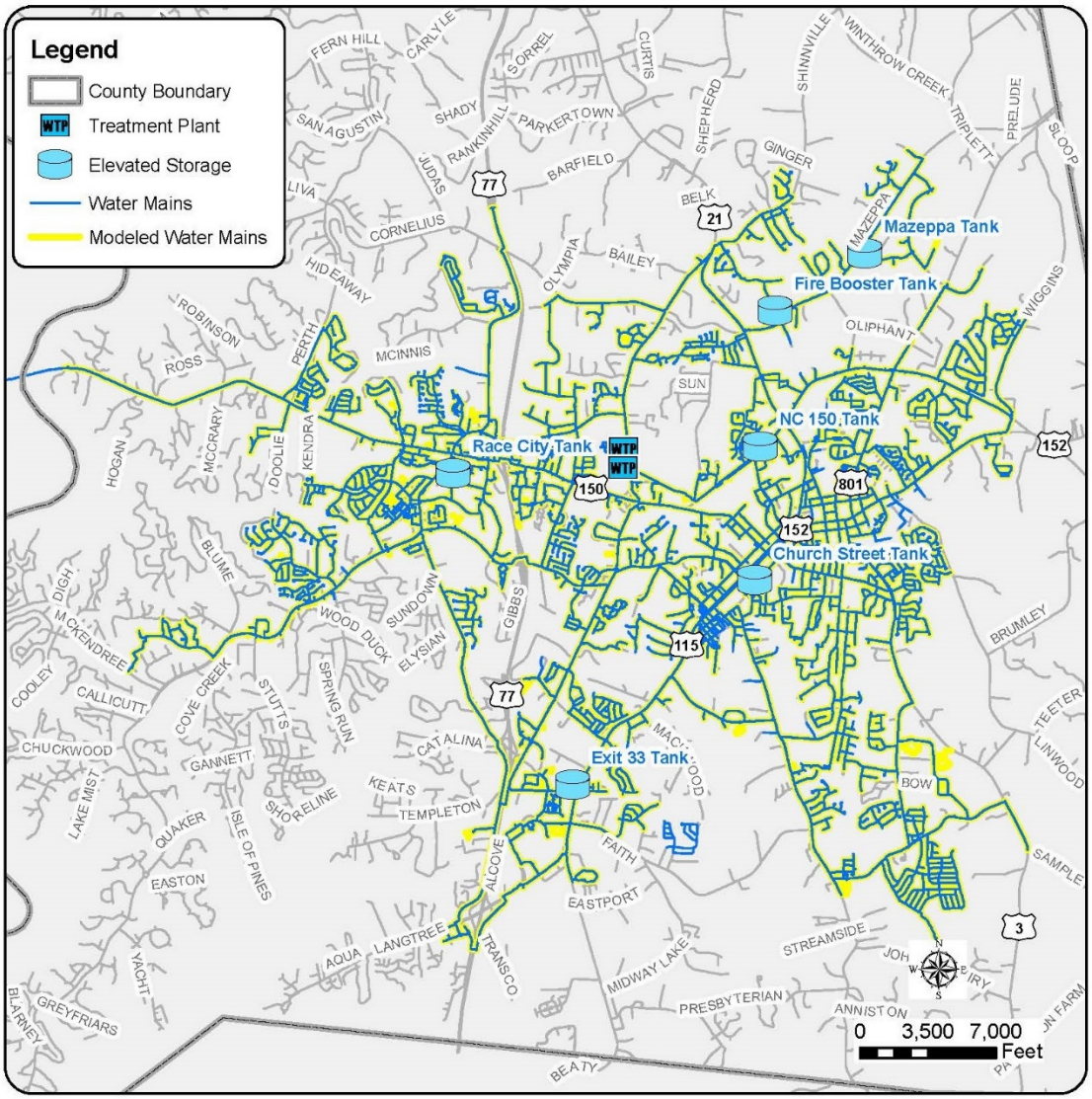
Black & Veatch prepared a water system master plan in 2009 for the Town. The WKD study is not meant to replace the master plan, but to support and update the recommendations specifically related to the High Pressure Zone.

1.2 Existing Conditions:

The water system in the Town of Mooresville consists of approximately 284 miles of water mains, ranging in diameter from 1-inch to 36-inches. There are two treatment plants located north of the intersection of Charlotte Highway (Highway 21) and West Plaza Drive (NC Highway 150) which supply treated water to the town. The Old Water Treatment Plant has a capacity of approximately 6 MGD, while the New Water Treatment Plant has a capacity of 12 MGD, for a total capacity of 18 MGD. Treated water is stored in five tanks: Mazeppa, NC150, Church Street, Exit 33, and Race City. One fire booster pump station and storage tank are also located in the town.

The hydraulic model includes all water lines 6-inches in diameter and greater to provide an accurate assessment of hydraulic performance. Additionally, some critical 1-inch, 2-inch, 3-inch and 4-inch water mains were included in the model. Figure 1.1 depicts the portions of the Town of Mooresville water system that were modeled.

Figure 1.1 – Model Extents



1.3 Model Calibration:

The Town of Mooresville provided WKD with a number of items to aid in calibration of the model, as detailed below:

- The water system GIS database as of August 2017, populated with attribute data such as pipe material and diameter, valve locations, pump locations, and tank locations.
- Water billing records for June 2016 through May 2017 complete with physical address locations.
- Daily water production records and water consumption records from January 2009 – July 2017
- Record drawings
- Pump curves for critical water system pumping systems
- Storage tank operating levels and pump control parameters
- SCADA output data showing tank levels and pump status over a 1-week period during average day demands
- Critical valve locations, types, and pressure settings if applicable

To further calibrate the model, twenty-seven hydrant flow tests were conducted on November 29, 2017. Water treatment plant pump status and tank levels at the time each test was conducted were input to the model, and each hydrant's modeled residual pressure was verified to be no more than 10% different than the test result, as shown in Table 1.1. The existing conditions model was also calibrated using static pressures from each hydrant test. Figure 1.2 shows the locations of the hydrants that were tested.

Calibration of the extended period model involved comparing system data obtained over time to the way in which the model performed over the same time period. Currently, the Mazeppa Tank and Church Street Tank function as the control tanks for the booster pump station and the treatment plant, respectively. Tank levels and pump control logic were manipulated in the model to duplicate the performance of the water system shown on the SCADA output provided by the Town of Mooresville. Once the cycle times and tank levels closely matched the recorded data, the model was considered calibrated for both extended period and steady state simulations.

Figure 1.2 – Hydrant Test Locations

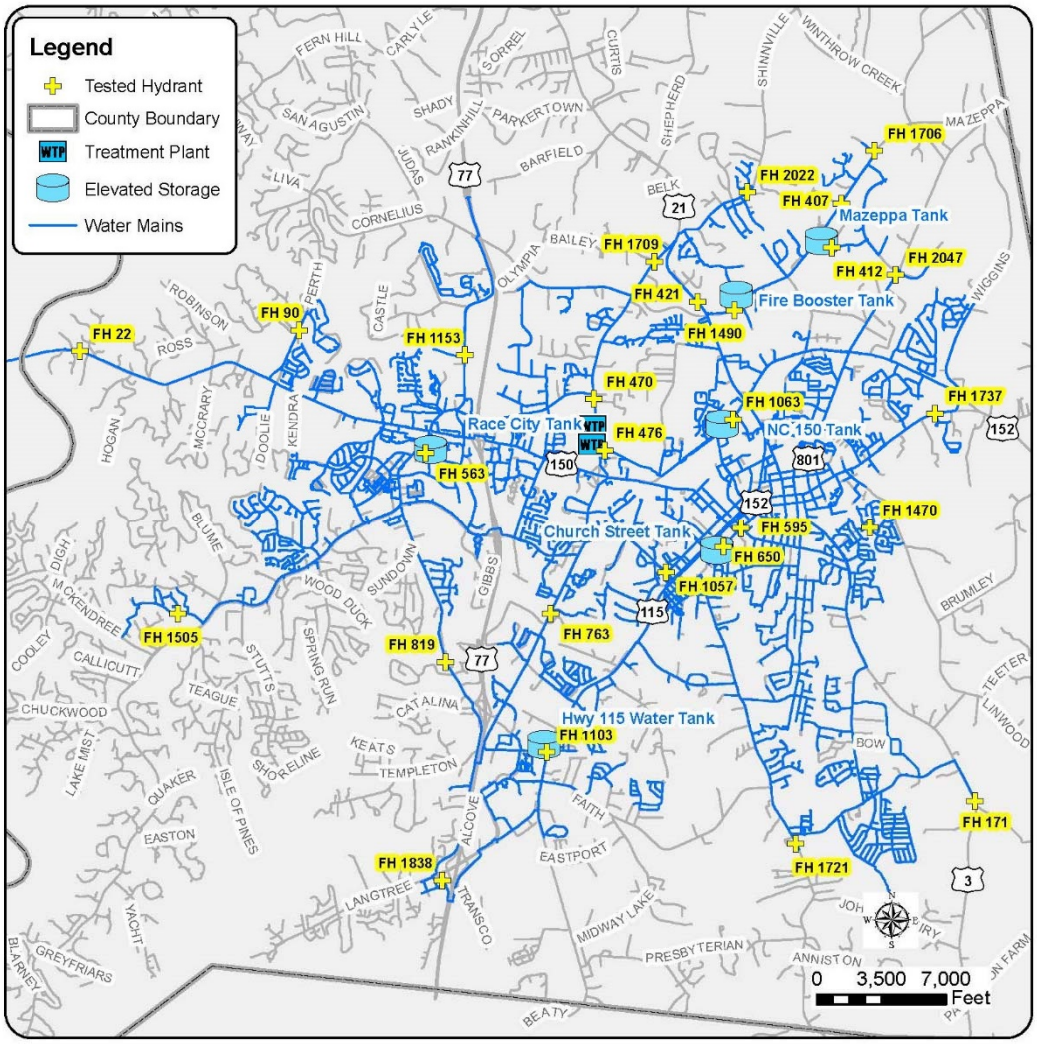


Table 1.1 – Hydrant Flow Test Calibration Results

Test ID	Pressure Hydrant GIS ID	Test Residual Pressure (psi)	Model Residual Pressure – ADD (psi)	Error
01	FH 2047	87	89	2%
02	FH 412	82	83	1%
03	FH 407	74	73	1%
04	FH 1706	68	69	1%
05	FH 1490	67	72	7%
06	FH 421	38	37	3%
07	FH 2022	55	57	4%
08	FH 1709	41	40	2%
09	FH 470	59	57	3%
10	FH 476	65	69	6%
11	FH 1063	49	48	2%
12	FH 1737	50	49	2%
13	FH 1470	66	68	3%
14	FH 171	71	76	7%
15	FH 1721	72	73	1%
16	FH 1103	65	64	2%
17	FH 595	55	55	0%
18	FH 650	60	61	2%
19	FH 1057	67	68	1%
20	FH 763	111	110	1%
21	FH 1838	89	87	2%
22	FH 819	107	108	1%
23	FH 1505	84	85	1%
24	FH 563	66	67	2%
25	FH 22	86	85	1%
26	FH 90	69	71	3%
27	FH 1153	103	105	2%

1.4 Water System Evaluation

The existing Town of Mooresville water distribution system was analyzed under five demand conditions: steady-state and extended period average daily demand (ADD), steady-state and extended period maximum daily demand (MDD), and fire flow. The 12-month water billing records provided by the Town of Mooresville were totaled for each customer and divided by 365 to determine the average daily usage at each water meter. Each billing record also included a latitude/longitude coordinate that was used to locate the record in GIS. The billing points and their usage were then distributed to the closest pipe. The total average daily billed usage was compared to the average daily water production at both treatment plants. The difference between the total metered ADD and the treated ADD was distributed evenly amongst all meter locations in the town. MDD was obtained by dividing the maximum single day usage by the ADD from daily treatment plant records. The resulting peaking factor was applied uniformly across all meter locations. Table 1.2 reveals the flows and factors used to develop each demand condition.

Table 1.2 – Water System Demands

Demand Condition	Flow (MGD)	Peaking Factor
ADD (Billed)	5.46	-
ADD (Treated)	6.21	1.00
MDD (Treated)	9.36	1.51

The lowest system pressure experienced in the model during average day or maximum day demand with tanks at their lowest operational levels, high service pumps off, and Mazeppa Booster Station on is 34 psi. This pressure occurs near the suction intake of the Mazeppa Booster Station at the intersection of Mazeppa Road and Clark Branch Lane.

The suction pressure at the Mazeppa Booster Pump Station is a known operational concern for the Town of Mooresville, and under high demand, filling the main zone tanks while supplying the high pressure zone becomes challenging. The extended period simulation validates these concerns, as the graphs on the following pages reveal. Under ADD conditions, all tanks are able to cycle, but during MDD conditions, main zone tank cycling is irregular and the Mazeppa tank cannot be filled to capacity.

Model results indicate that the existing system can provide the required fire flow to all hydrants in the system during maximum day demand. The minimum available fire flow at 20 psi residual is 564 gpm, which occurs at the end of Huntly Lane.

Figure 1.3 – Existing ADD Tank Cycling

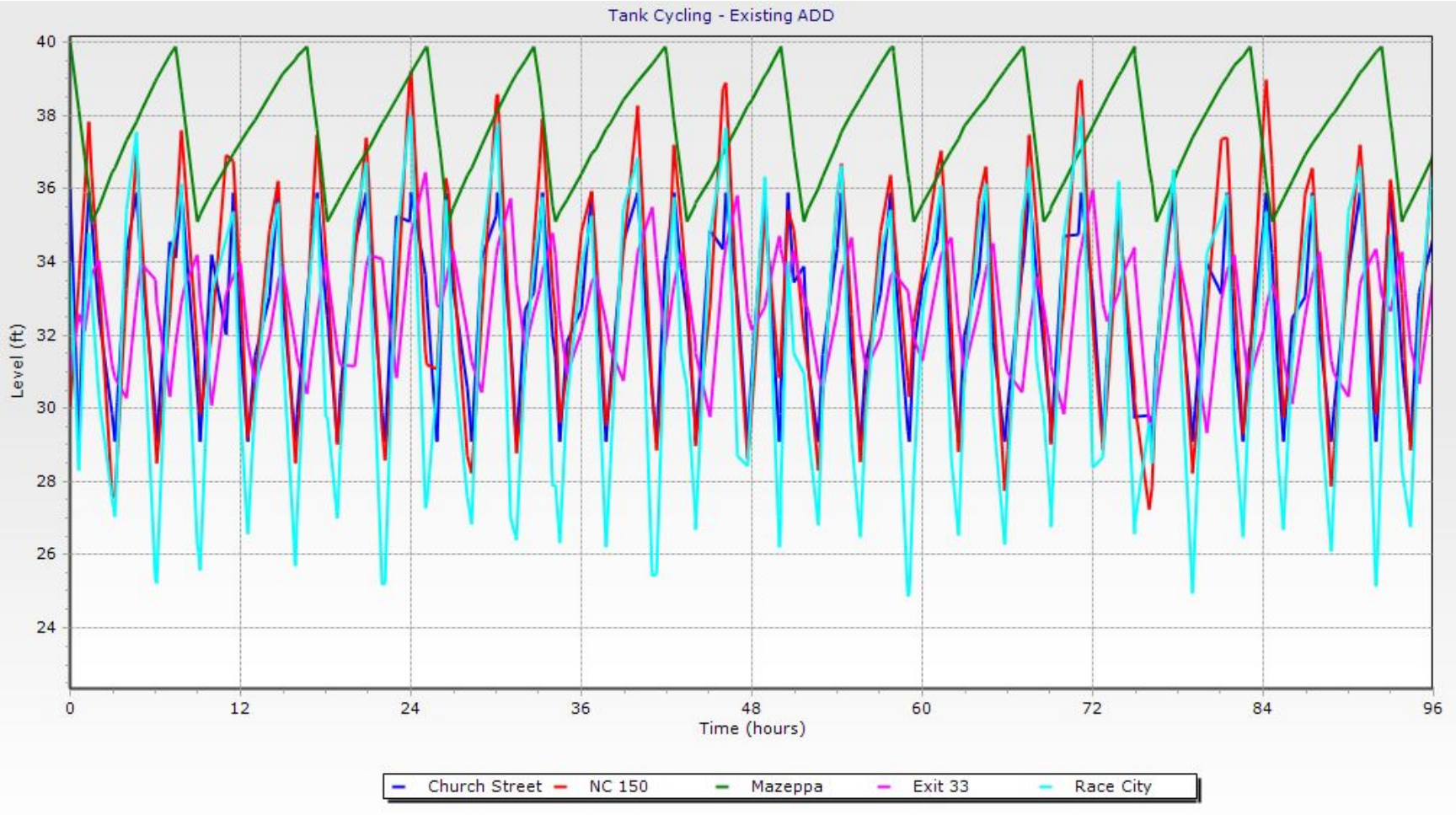
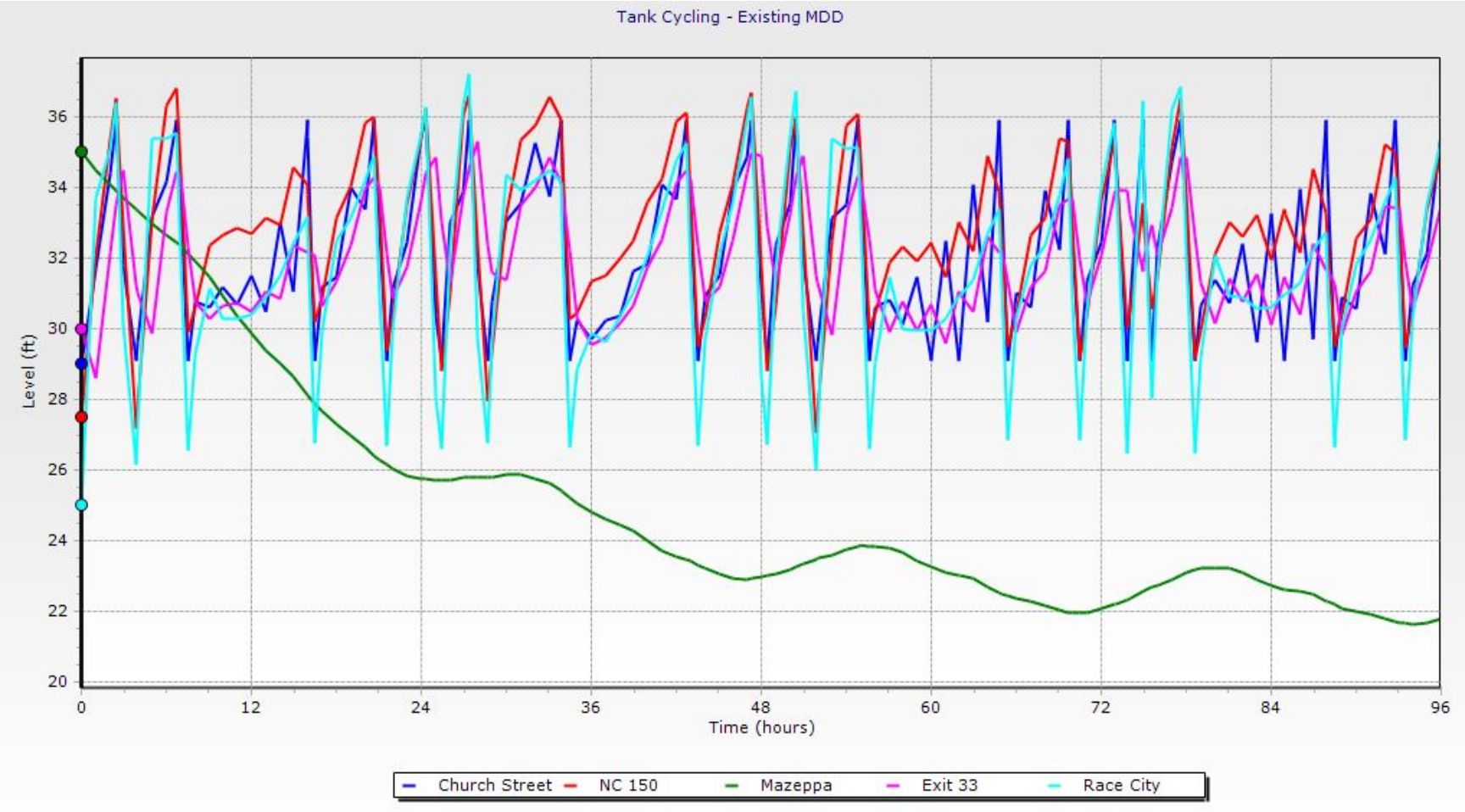


Figure 1.4 – Existing MDD Tank Cycling



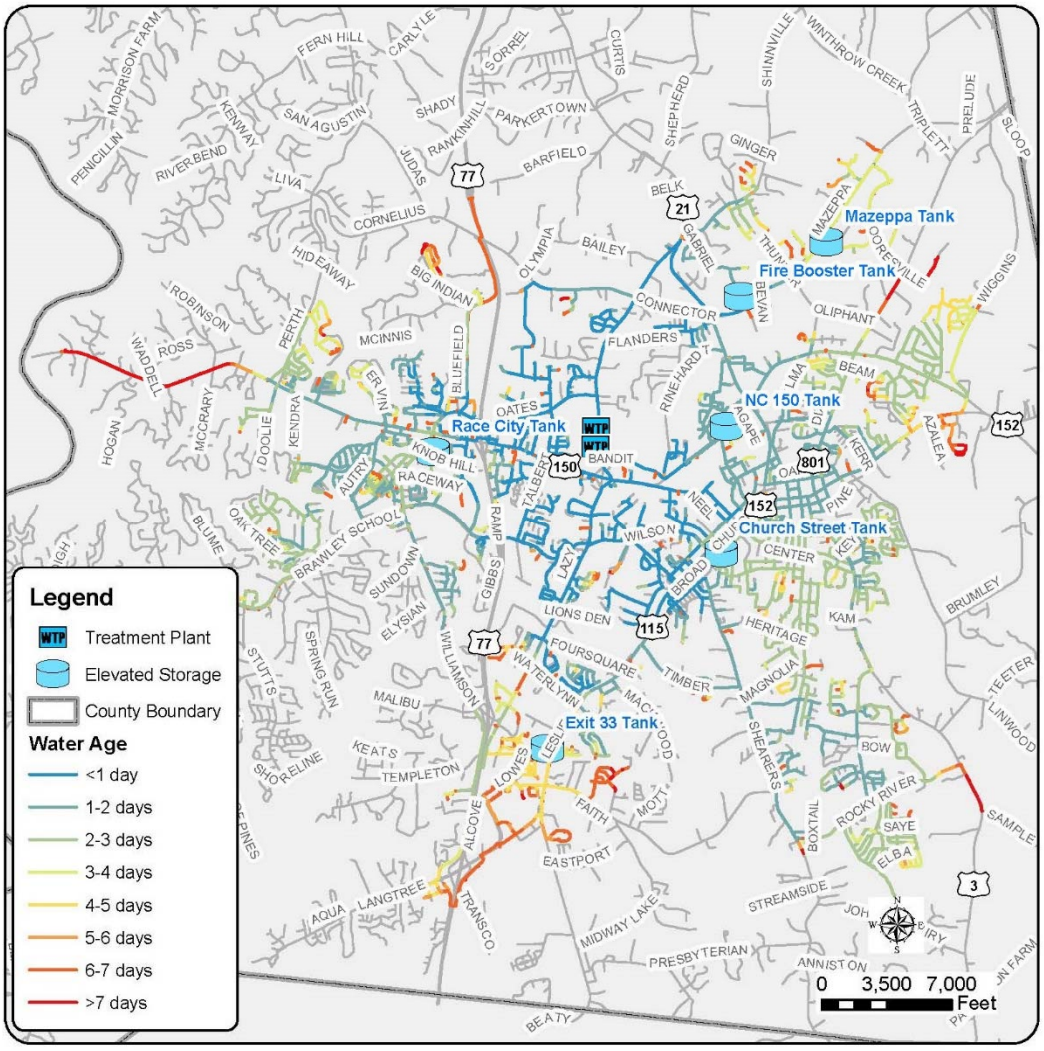
* Note: "Existing MDD Tank Cycling" is a theoretical simulation of tank levels during MDD occurring over a multi-day timeframe.

An extended period water age simulation was also performed for the existing system. Table 1.3 contains the results of the simulation, and Figure 1.5 shows the location of higher water ages within the system at the end of a seven (7) day simulated period.

Table 1.3 – Existing System Water Age

Age	Total Length (LF)	Percent of Total
<1 day	285,239	19%
1-2 days	430,024	29%
2-3 days	417,915	28%
3-4 days	107,410	7%
4-5 days	70,779	5%
5-6 days	29,938	2%
6-7 days	108,030	7%
>7 days	26,344	2%

Figure 1.5 – Existing System Water Age



2.0 Future Conditions

In order to prepare for continued development in the Town of Mooresville, a population projection was completed based on Traffic Analysis Zones (TAZ) population output data from the Metrolina Community Viz Model version 1.0 (MCMv1.0). This model uses data from three metropolitan planning organizations and two rural planning organizations to compare alternate development scenarios and to project population through 2045. For TAZ areas already included in the Mooresville water system service area ("TAZ – Population Growth" in Figure 2.1), a growth factor was developed and applied to the existing demand in each respective TAZ. The water system service area will likely continue to expand, so the TAZ areas adjacent to the current service area were used to capture potential new customers that may be added to the system through 2045. Those areas are shown in Figure 2.1 as "TAZ – Expansion". Tables 2.1 and 2.2 reveal the projected demand increases for the existing service area as well as from the expanded service area.

Figure 2.1 – Selected Traffic Analysis Zones (TAZ)

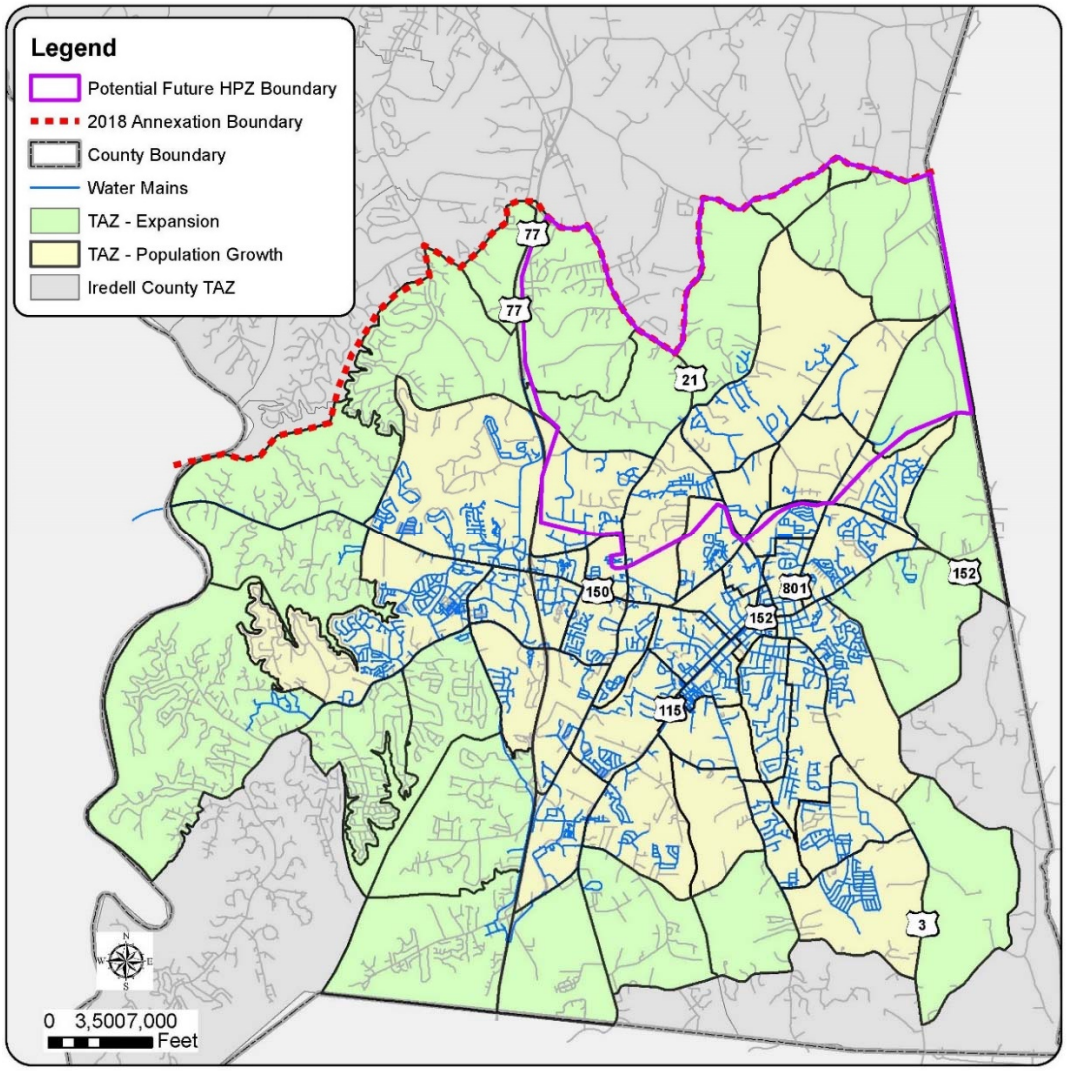


Table 2.1 – TAZ - Population Growth Area Projections

Year	TAZ Population (Figure 2.1)*	Mooresville Customer Base (Projected)	Growth Factor	Residential + Commercial Demand (MGD)
Existing	46,723	31,711	1.00	4.71
2025	54,573	37,039	1.17	5.50
2035	62,297	42,281	1.33	6.28
2045	69,895	47,438	1.50	7.04

* The selected TAZ extend beyond the Town of Mooresville limits, and therefore the existing population is higher than the recorded Town of Mooresville population or the Mooresville water customers. Only the growth factors were used when projecting increased demand, not the raw population.

Table 2.2 – TAZ - Expansion Area Projections

Year	TAZ Population (Figure 2.1)	New Demand (MGD) (148 GPD/Capita x Population)**
2025	24,403	3.62
2035	26,529	3.94
2045	31,135	4.62

** Per capita demand was calculated by subtracting average industrial demand (1.5 MGD per billing records) from average total demand (6.21 MGD) and dividing by the population served (31,711 per the 2017 Local Water Supply Plan).

Table 2.3 outlines the total projected demand for the entire system, including a 1.5 MGD industrial reserve in the current High Pressure Zone, and a 0.13 MGD industrial reserve in the Business Park East area.

Table 2.3 – Overall Average Day Demand Projections

Year	Existing Service Area Residential + Commercial Demand (MGD)	Expansion Area Demand (MGD)	Industrial Demand (MGD)	Total Demand (MGD)
Existing	4.71	0.00	1.50	6.21
2025	5.50	3.62	3.13	12.25
2035	6.28	3.94	3.13	13.35
2045	7.04	4.62	3.13	14.79

Table 2.4 details the total projected demand for each pressure zone. The majority of the increase in High Pressure Zone demand is due to a 1.5 MGD industrial reserve in the current High Pressure Zone, and a 0.13 MGD industrial reserve in the Business Park East area. Main Zone Demand is primarily driven by population increase and assumed water system service area expansion to the south.

Table 2.4 – Pressure Zone Average Day Demand Projections

Year	**Main Zone Demand (MGD)**	**High Pressure Zone Demand (MGD)**	**Total Demand (MGD)**
Existing	4.27	1.94	6.21
2025	7.82	4.43	12.25
2035	8.65	4.70	13.35
2045	9.83	4.96	14.79

3.0 Capital Improvement Project Plan

The following improvements were analyzed and selected to meet the project objectives. Completing the projects by 2025 would provide industrial reserve while allowing the tanks in the High Pressure Zone to cycle during average and peak demand periods, and also accommodate potential growth through 2045 to the north of the existing water system service area. The existing high service pump station at the New WTP, as well as the Old WTP could then be dedicated to meeting increased demand through the existing Main Zone, as well as potential water system expansion to the south, thereby increasing the overall reliability of the system. Although not included in the CIP Plan, it should be noted that utilizing larger motors at the existing high service pump station and replacing the pumps at the Old WTP to match those at the existing high service pump station may be necessary as demand increases in the Main Zone.

Appendix A contains detailed cost estimates and phasing for each project. Table 3.1 outlines the recommended order of improvements.

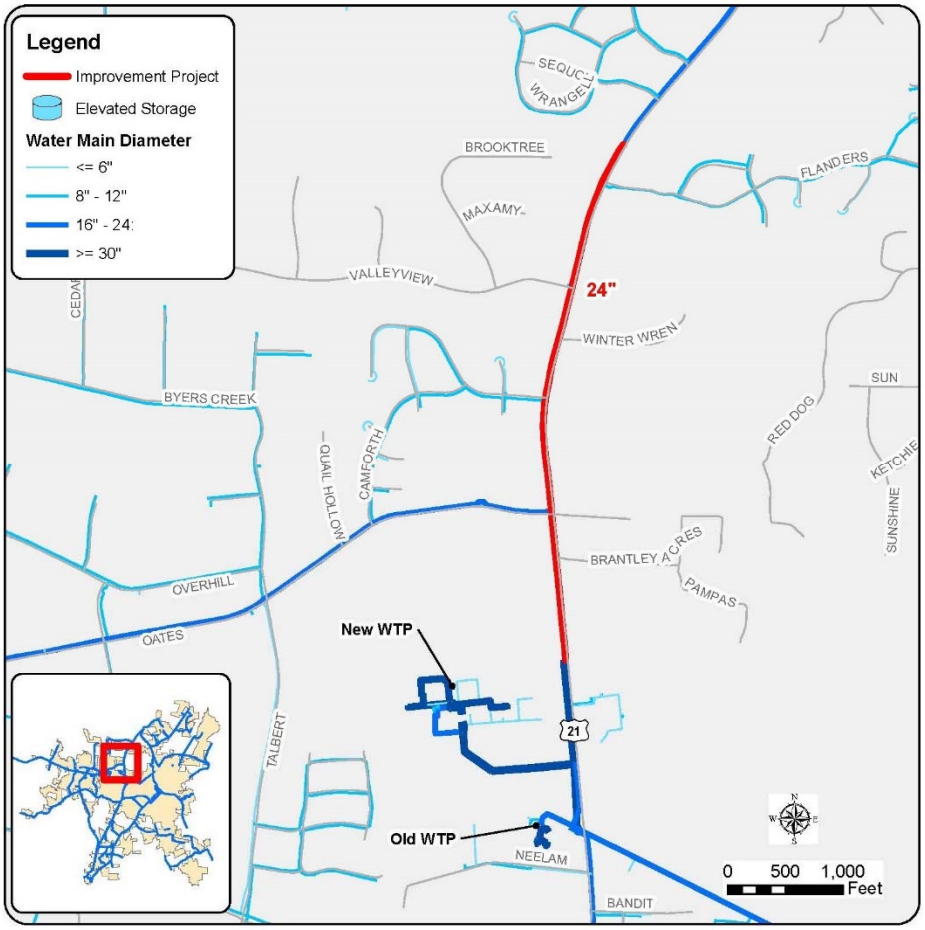
Table 3.1 – Capital Improvement Project Construction Sequence

Project Number	Project Name	Prerequisite Projects
3.1	Highway 21 Water Main Upsize	-
3.2	Connector Road Water Main Connection	-
3.3	New High Service Pump Station at New Water Treatment Plant	3.1 – 3.2
3.4	Reconfigure High Pressure Zone	3.1 – 3.3
3.5	Abandon Mazeppa Booster Station	3.1 – 3.3
3.6	Business Park East Water Main Connection	3.1 – 3.4
3.7	Shinnville/Mazeppa Water Main Connection	3.1 – 3.4
3.8	Shepherds Volunteer Fire Department Elevated Storage Tank	3.1 – 3.7

3.1 Highway 21 Water Main Upsize

3.1.1 Scope of Improvement

Approximately 4,600 LF of existing 16-inch water main north along Highway 21 from the discharge of the New Mooresville WTP is recommended to be upsized to 24-inch. The proposed upsized section continues north from the New WTP to the intersection of Highway 21 and Flanders Drive to meet the existing 24-inch main.



3.1.2 Project Objective, Benefit, and Cost

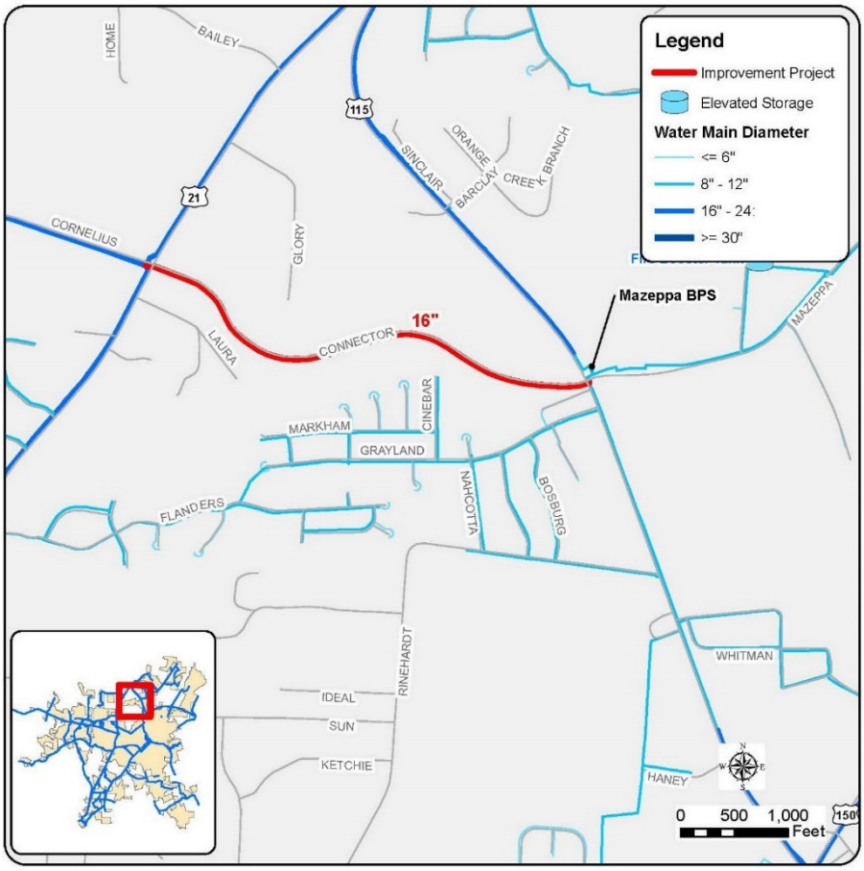
This project would provide additional hydraulic capacity from the discharge of the water treatment plant to the main zone in the short term and would be a critical link in accommodating increased long-term industrial demands in the High Pressure Zone.

Estimated Project Cost - $1,900,000

3.2 Connector Road Water Main Connection

3.2.1 Scope of Improvement

Approximately 4,600 LF of 16-inch water main is recommended to begin at the existing 24-inch main at the intersection of Cornelius Road and Highway 21. The new main would continue east along Connector Road to tie to the existing 12-inch main at the intersection of Statesville Highway and Mazeppa Road.



3.2.2 Project Objective, Benefit, and Cost

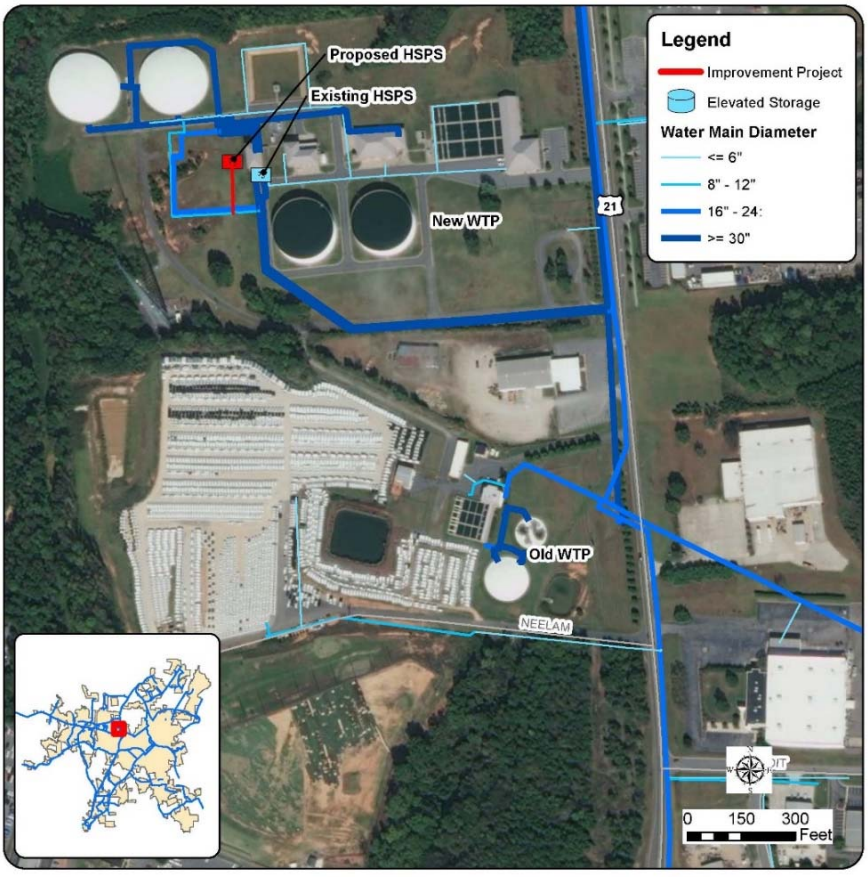
This project would provide additional hydraulic capacity between the main zone and the existing High Pressure Zone by providing a direct flow path from the water treatment plant to Mazeppa BPS. Completing the Highway 21 Upsize and the Connector Road projects would likely provide a small increase in suction pressure at the Mazeppa Booster Station in the short term. However, in periods of high industrial demand, the Mazeppa BPS would still struggle to supply water to the Industrial Park and simultaneously fill the Mazeppa Tank. If a new high service pump station at the New WTP is constructed (Project 3.3), the new main would be a critical link to carry the increased supply into the High Pressure Zone.

Estimated Project Cost - $1,200,000

3.3 New High Service Pump Station at New Water Treatment Plant

3.3.1 Scope of Improvement

New high service pump(s) are recommended to be installed on the New WTP property, capable of delivering flow to the High Pressure Zone at an HGL of 1,070 ft. Pump and pump station configuration would determine the selected location within the New WTP property. A wetwell configuration is recommended, thus a new location would have to be selected to match the elevations of the existing high service pump station wetwell and pumps. The new pump station would include a brick enclosure with a metal roof to match the existing high service pump station. The new HSPS should be dedicated to the High Pressure Zone allowing treated water from the water treatment plant to be pumped directly to the High Pressure Zone without requiring subsequent boosting. The pumps would be sized to meet projected demand in the High Pressure Zone (see Table 2.4). If demand is consistent with the projections, a pump(s) similar in performance to the existing high service pumps with an 800 HP motor may be necessary to meet periods of high demand by 2025. Once the new high service pump station reached the design stage, more analysis would be needed to determine whether VFD's or swapping motors would best address the long term needs of the High Pressure Zone.



3.3.2 Other Alternatives Considered

Three alternatives for the dedicated high pressure zone pump station were also considered.

- Split New WTP into two separate zones. The existing New WTP would include four identical pumps feeding two 36-inch distribution mains. By closing several existing valves, the plant could be separated so that two pumps and one 36-inch main supply only the high pressure zone, while the remaining two pumps and 36-inch main supply the main zone. While the water quality and hydraulic performance were sufficient, the loss of redundancy from the current configuration was deemed undesirable.
- Construct new high pressure zone booster station on Highway 21 just to the east of the New WTP. Constructing the booster station in close proximity to the treatment plant without closing valves at the plant leads to imbalanced tank cycling in the main zone, and still leaves the high pressure zone vulnerable in the event of a booster station failure.
- Construct new high pressure zone booster station on Mooresville Boulevard adjacent to the Business Park East. While the water quality and hydraulic performance were sufficient, this alternative would require additional property acquisition and would still leave the high pressure zone vulnerable in the event of a booster station failure.

3.3.3 Project Objective, Benefit and Cost

Constructing a new HSPS at the New WTP to supply water directly to the High Pressure Zone would increase supply to the High Pressure Zone, providing capacity for industrial expansion. The current Mazeppa Booster Station is vital to maintaining water supply to the industries in the High Pressure Zone. The existing system does not have the desired redundancy in the event of a failure at Mazeppa Booster Station. Once the new HSPS is constructed, simple valving at the WTP would allow for the existing WTP pumps to supply the High Pressure Zone at the correct HGL in event of a failure of the New HSPS, providing additional redundancy to the system as a whole.

Projected cost is based on 2008 construction cost data provided by the Town of Mooresville for the existing high service pump station at the New WTP. The new HSPS would mimic the enclosure and to the existing HSPS but would house two pumps instead of six. Therefore, material and equipment costs were pro-rated accordingly and adjusted to 2018 dollars.

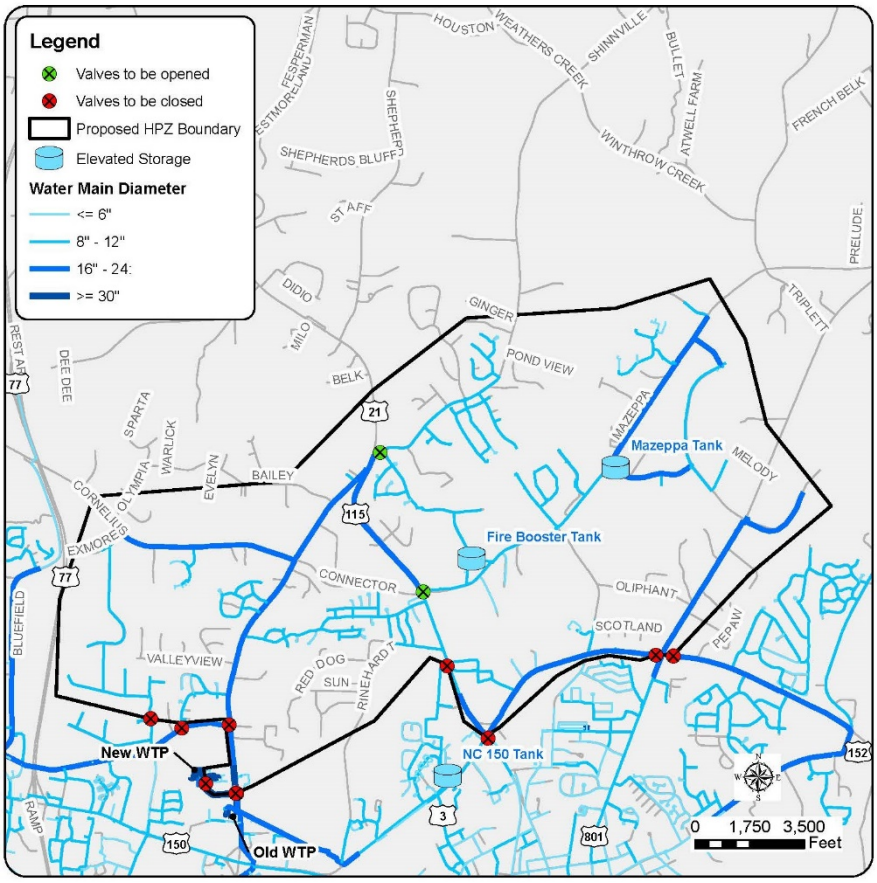
Estimated Project Cost - $2,800,000

3.4 Reconfigure High Pressure Zone

3.4.1 Scope of Improvement

Upon completion of the new HSPS at the New WTP, the high pressure zone is recommended to be expanded by changing the status of a number of valves, as listed and shown in the figure below.

- Close valve at intersection of Oates Road and Highway 21, on 16-inch along Oates Road
- Close valve at intersection of Oates Road and Camforth Drive, on 8-inch along Camforth Drive
- Close valve at intersection of Talbert Pointe Drive and Poplar Pointe Drive, on 8-inch along Talbert Pointe Drive
- Close valve at intersection of Statesville Highway and Deward Loop, on 12-inch along Deward Loop
- Close valve at intersection of North Broad Street and East Plaza Drive, on 16-inch along North Broad Street
- Close valve at intersection of Mount Ulla Highway and Oakridge Farm Highway, on 16-inch along Oakridge Farm Highway
- Close valves at New WTP to direct flow from New HSPS to the High Pressure Zone, and flow from existing pumps to Main Zone.
- Open valve at Mazeppa BPS on 12-inch along Mazeppa Road
- Open valve at intersection of Shinnville Road and Charlotte Highway, on 12-inch along Shinnville Road



3.4.2 Project Objective, Benefit and Cost

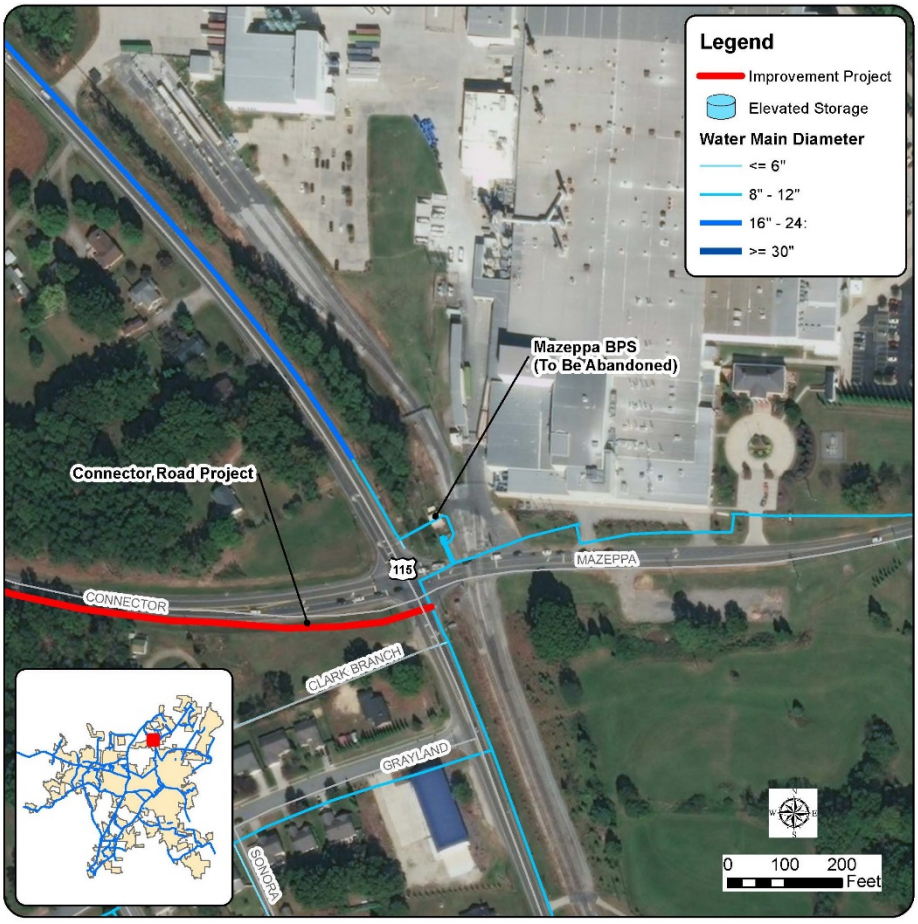
Reconfiguring the High Pressure zone is recommended to allow all other recommended projects to function as a system and provide increased reliable supply to the Industrial Park. Shifting demand away from the Main Zone would also aid in accommodating anticipated Main Zone population growth. Finally, reconfiguring the high pressure zone would allow for future growth of the Mooresville water system to the north along Highway 21 and Shinnville Road.

Estimated Project Cost – No construction required, valve operation could be performed by Mooresville maintenance personnel.

3.5 Abandon Mazeppa Booster Pump Station

3.5.1 Scope of Improvement

The existing Mazeppa BPS is recommended to be abandoned following the completion of the new HSPS at the New WTP.



3.5.2 Project Objective, Benefit and Cost

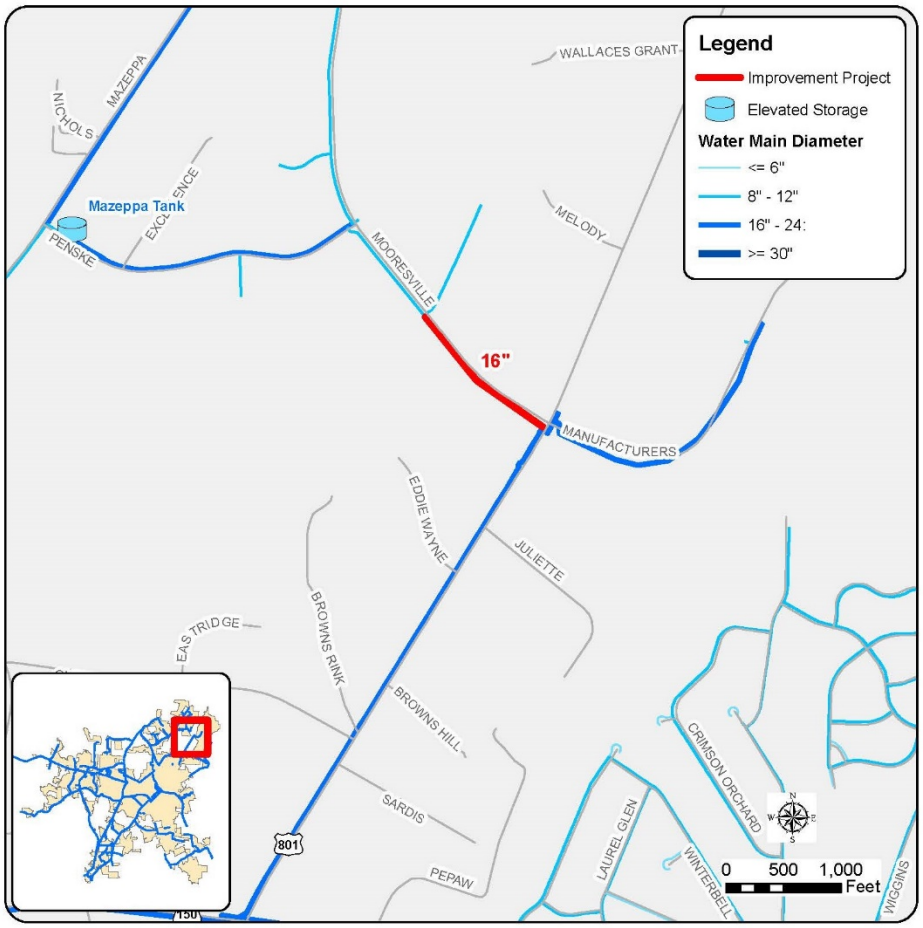
Constructing a new HSPS at the New WTP to supply water directly to the High Pressure Zone would make the existing Mazeppa Booster Station obsolete. To realize cost savings on operation and maintenance, Mazeppa BPS should be decommissioned and removed entirely once the new HSPS is in service. The bypass connection in front of the existing BPS used for emergency pumping would be left in place for emergency situations.

Estimated Project Cost - $150,000, but could be partially offset by salvaging equipment and materials.

3.6 Business Park East Water Main Connection

3.6.1 Scope of Improvement

Approximately 1,400 LF of 16-inch water main is recommended to begin at the existing 16-inch main at the intersection of Mooresville Boulevard and Mt. Ulla Highway. The new main would continue northwest along Mooresville Boulevard to the existing 12-inch main.



3.6.2 Project Objective, Benefit and Cost

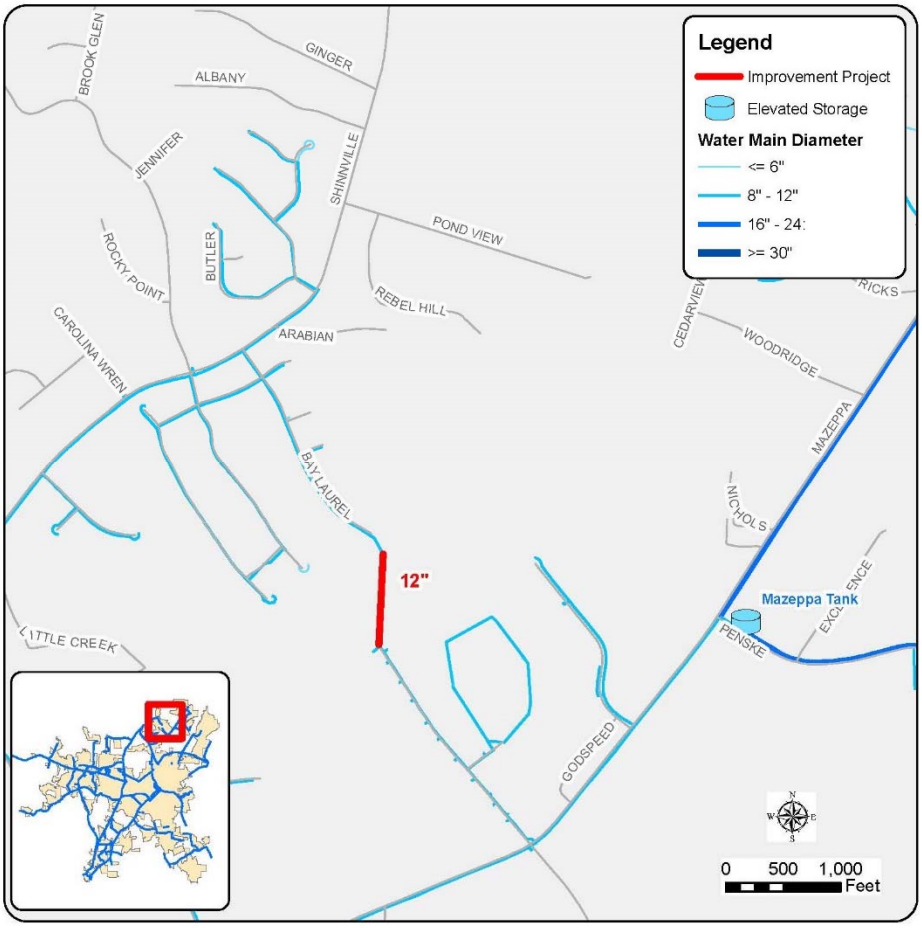
This project would increase water supply and quality to customers in the Business Park East vicinity by providing a new loop from the High Pressure Zone. The new main will also enable the expansion of the High Pressure Zone to include Highway 801 and Highway 150.

Estimated Project Cost - $360,000

3.7 Shinnville/Mazeppa Water Main Connection

3.7.1 Scope of Improvement

Approximately 800 LF of 12-inch water main is recommended to begin at the existing 12-inch main at the end of Bay Laurel Drive. The new main would continue southwest to the existing 12-inch main at the end of Thunder Road.



3.7.2 Other Alternatives Considered

An alternate route along Pond View Road and Woodbridge Lane was considered. However, that alignment would be much longer, and would require additional easement acquisition. The material and easement cost would likely increase the project cost by a factor of ten.

3.7.3 Project Objective, Benefit and Cost

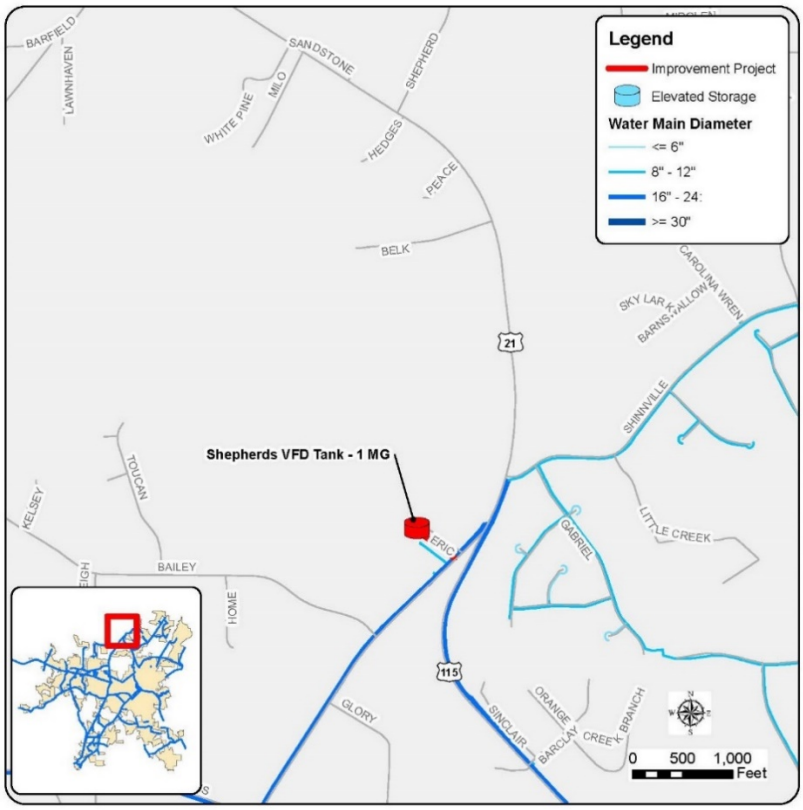
This project would increase water supply and quality to customers along Shinnville Road by providing a new loop from the larger Mazeppa Road main. As industrial demand in the High Pressure Zone increased and necessitated additional elevated storage (Project 3.8), the new 12-inch main would help minimize water age and balance flow between the new tank and the existing Mazeppa Tank.

Estimated Project Cost - $158,000

3.8 Shepherds Volunteer Fire Department Elevated Storage Tank

3.8.1 Scope of Improvement

A new 1.00 MG elevated tank located behind the Shepherds Volunteer Fire Department near the intersection of Highway 21 and Statesville Highway in the western portion of the High Pressure Zone. The exact location of the elevated tank would be determined by the Town of Mooresville based on the availability of property in the vicinity and topographic constraints. The new tank is proposed to be connected to the existing 16-inch main along Highway 21 by an assumed 400 LF of new 16-inch main.



3.8.2 Other Alternatives Considered

Constructing the tank next to the existing Mazeppa Tank was considered, but is a less desirable alternative because of the lack of available property. The existing Mazeppa site is also not as beneficial to future expansion of the water system service area to the north along Highway 21 and Shinnville Road.

3.8.3 Project Objective, Benefit and Cost

Industrial demand in the existing High Pressure Zone is anticipated to increase due to development of the Business Park East and additional production by existing industries. Additionally, demands will increase as a result of potential future growth within a reconfigured high pressure zone (Project 3.4). The new tank will increase system reliability, water quality, and emergency backup by providing additional water reserves. The new tank would also be located to allow expansion of the water system service area to the north along Highway 21 and Shinnville Road. Note that all recommended water line improvement projects should be coordinated to be complete before this tank comes on-line.

Estimated Project Cost - $4,100,000

Appendix A

Mooresville Capital Improvement Plan Cost Summary

Project Number	Project Description	Pipe Diameter (in)	Pipe Length (ft)	Construction Unit Cost ($/ft)	Planning/Design Cost (15%)	Construction Cost	Construction Cost Contingency (20%)	Total
3.1	Highway 21 Water Main Upsize	24	4,613	$368.52	$200,000	$1,400,000	$300,000	$1,900,000
3.2	Connector Road Water Main Connection	16	4,601	$239.08	$100,000	$900,000	$200,000	$1,200,000
3.3	New HSPS at New WTP				$300,000	$2,100,000	$400,000	$2,800,000
3.4	Reconfigure High Pressure Zone				$0	$0	$0	$0
3.5	Abandon Mazeppa Booster Station				$0	$125,000	$25,000	$150,000
3.6	Business Park East Connection	16	1,420	$225.35	$40,000	$270,000	$50,000	$360,000
3.7	Shinnville/Mazeppa Connection	12	786	$178.12	$18,000	$120,000	$20,000	$158,000
3.8	Shepherds Volunteer Fire Dept Tank				$500,000	$3,000,000	$600,000	$4,100,000

Mooresville Capital Improvement Plan Project Phasing

Project Number	Project Description	2019	2020	2021	2022	2023	2024	Project Total
3.1	Highway 21 Upsize	P $200,000	C $1,700,000					$1,900,000
3.2	Connector Road	P $100,000	C $1,100,000					$1,200,000
3.3	New HSPS at New WTP		P $300,000	C $2,500,000				$2,800,000
3.4	Reconfigure High Pressure Zone				C $0			$0
3.5	Abandon Mazeppa BPS				C $150,000			$150,000
3.6	Business Park East Connection			P $40,000	C $320,000			$360,000
3.7	Shinnville/Mazeppa Connection				P $18,000	C $140,000		$158,000
3.8	Shepherds Volunteer Fire Dept Tank					P $500,000	C $3,600,000	$4,100,000
	Fiscal Year Total Cost	$300,000	$3,100,000	$2,540,000	$488,000	$640,000	$3,600,000	

P = Planning
C = Construction

Mooresville Capital Improvement Plan Objective Matrix

Project Number	Project Description	Total Cost	Increase Industrial Supply	Reliability	Expand HPZ	Add Storage
3.1	Highway 21 Upsize	$1,900,000	X			
3.2	Connector Road	$1,200,000	X	X		
3.3	HSPS at New WTP	$2,800,000	X	X	X	
3.4	Reconfigure High Pressure Zone	$0	X	X	X	
3.5	Abandon Mazeppa BPS	$150,000				
3.6	Business Park East Connection	$360,000	X	X	X	
3.7	Shinnville/Mazeppa Connection	$158,000	X	X		
3.8	Shepherds Volunteer Fire Dept Tank	$4,100,000		X		X

Mooresville Capital Improvement Plan Detailed Construction Cost Estimates

Water Main Projects

Project Number	Project Description	Pipe Diameter	Length	Material Cost	Labor Factor	Contingency Factor	Cost Per Linear Foot	Total Pipeline Cost
3.1	Highway 21 Upsize	24	4,613	$215	1.40	1.20	$369	$1,700,000
3.2	Connector Road	16	4,601	$135	1.40	1.20	$239	$1,100,000
3.6	Business Park East Connection	16	1,420	$135	1.40	1.20	$225	$320,000
3.7	Shinnville/Mazeppa Connection	12	786	$105	1.40	1.20	$178	$140,000

Pump Station Projects

		Pumps	Piping/Valving	Building	Sitework	Electrical	Subtotal	Contingency	Total
3.3	New HSPS at New WTP	$400,000	$200,000	$950,000	$150,000	$400,000	$2,100,000	20%	$2,500,000

Elevated Storage Projects

		MGD	Tank	Foundation	Painting	Sitework	Electrical	Subtotal	Contingency	Total	Cost per Gallon
3.8	Shepherds Volunteer Fire Dept Tank	1	$1,800,000	$450,000	$400,000	10%	3%	$3,000,000	20%	$3,600,000	$3.60