TOWN OF MOORESVILLE

WATER AND WASTEWATER COMPREHENSIVE MASTER PLAN EXECUTIVE SUMMARY

TOWN OF MOORESVILLE

OCTOBER 2021

Water and Wastewater Comprehensive Master Plan

The Town of Mooresville (Town) has recognized the need for an overarching water and wastewater master plan to provide a consistent long-term vision for the entire utility system. This Water and Wastewater Comprehensive Master Plan (Plan) serves as a complement to the Town's OneMooresville Comprehensive Plan (OneMooresville) as a tool to strengthen Mooresville's utility infrastructure, resources, and staff organization.

The Plan supports the vision of the Town's Public Services Department - "Your Community Our Responsibility" - by examining water and wastewater infrastructure and responsibly planning to sustain and improve these facilities in a manner that will serve the community through a 2050 planning horizon.

The goal of comprehensive master planning is to maintain the Town's level of service to its customers, prepare for future drivers (regulatory, sustainability, growth), prioritize capital and operational improvements, and respond to the strong economic development environment.

This Executive Summary comprises content from the Water and Wastewater Comprehensive Master Plan and is organized by the following sections:

- Water & Wastewater Infrastructure Overview
- Water & Wastewater Forecast
- Distribution & Collection System Hydraulic Modeling and Capacity Planning
- Water Treatment Plant Planning
- Wastewater Treatment Plant Planning
- Capacity Expansion and Interbasin Transfer Alternatives
- Infrastructure Rehabilitation & Replacement Planning
- Programs & Initiatives
- Organizational Review
- Recommended Capital Improvement Plan

Water and Wastewater Infrastructure Overview

The Town operates two surface water supply intakes on Lake Norman in the Catawba River Basin with a total raw water supply allocation of 18 million gallons per day (MGD). Water withdrawal from Lake Norman is controlled by Duke Energy. Water from Lake Norman is transmitted to the Town's water treatment plants through three water transmission mains. The three lines travel together, split, and ultimately combine into two lines, one dedicated to each of the Town's two water treatment plants. Additionally, the Town's water system has a unidirectional emergency interconnection which allows potable water to flow from the City of Hickory water system into the Town's distribution system.

Both water treatment plants utilize conventional treatment including rapid mix, flocculation, sedimentation, filtration, and chlorination to produce high quality drinking water for all Town customers.

Treated water is distributed to approximately 18,300 metered residential, commercial, industrial, and institutional customer accounts within Town limits and the outside-Town service area.

WAR MEMORIAL POOL

The water distribution system includes five elevated storage tanks in two pressure zones (the main zone and the boosted zone) with a total storage capacity of 3.5 million gallons (MG) and 300+ miles of water distribution pipeline.

Wastewater is collected in the Town's sanitary sewer collection system, comprising nearly 300 miles of sewer pipeline and 49 wastewater pump stations conveying wastewater to the Town's Rocky River Wastewater Treatment Plant (RRWWTP).

The RRWWTP is a completely mixed activated sludge treatment facility, originally constructed in 1982 with a capacity of 5.2 MGD. In 2012, the plant was expanded through the addition of equalization tanks, a package plant, and a biosolids dryer. The current rated capacity of the plant is 7.5 MGD. It discharges treated wastewater under a NPDES permit into Dye Creek, a tributary of the Rocky River.

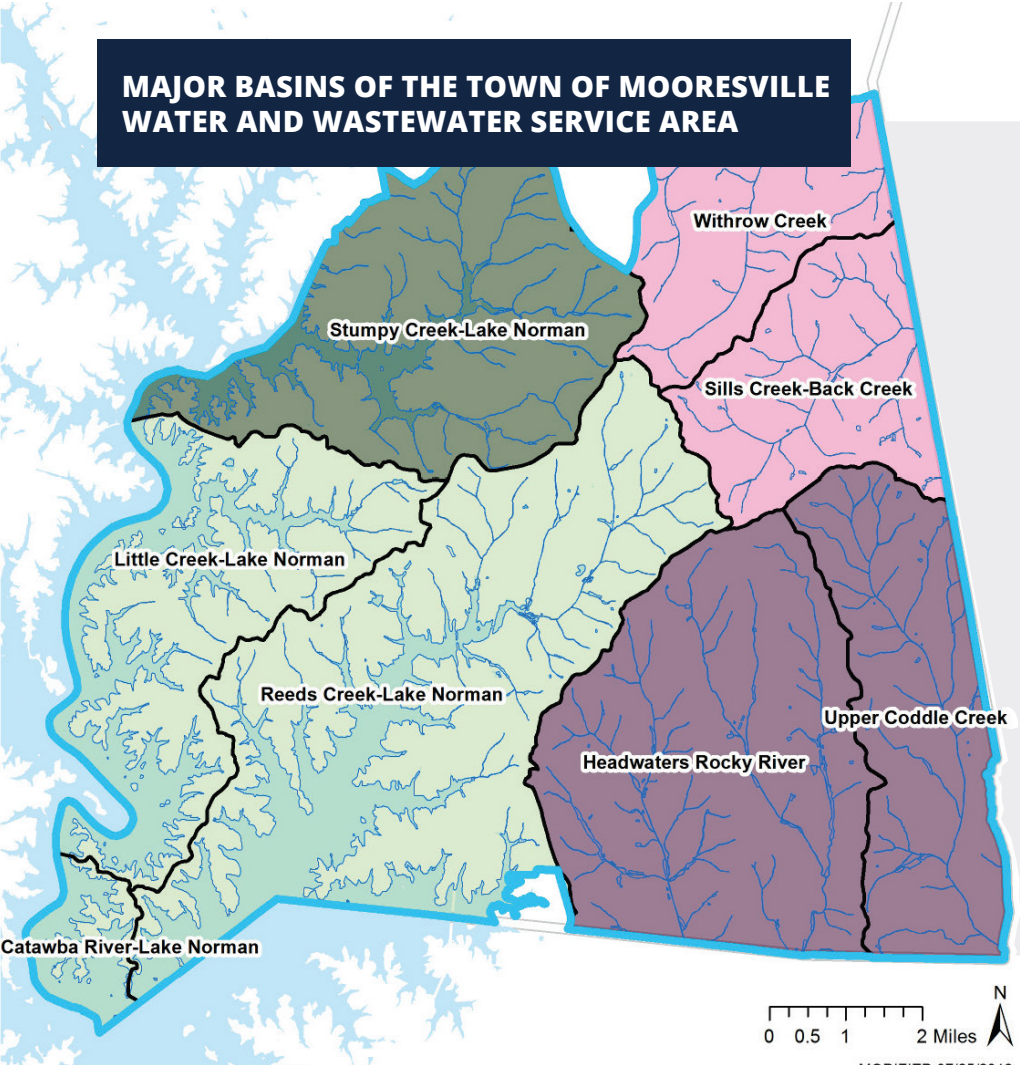
The Town previously disposed of biosolids on site via a monofill permit. The Town maintains the monofill permit, complies with its air and groundwater sampling requirements, and is actively working towards closure of the monofill by excavating and disposing of previously landfilled material at an offsite licensed landfill.

Water and Wastewater Forecast

Current and forecast water demands and wastewater flows are used in the Plan to evaluate the capacity of the Town's water supply, water treatment, wastewater treatment, water distribution system and sanitary sewer collection system infrastructure, as well as develop management strategies for the water and wastewater systems and plan for the Town's future needs. The forecast reflects a continuation of the Town's current programs and policies, allowing for the influence of new technology or regulatory changes.

Understanding the Town's geographic location relative to its customers and existing infrastructure is integral to planning to accommodate the Town's future water and wastewater capacity requirements. The Town's 18 MGD capacity water supply is Lake Norman in the Catawba River basin. The residential population of the Town's water and wastewater utility systems currently are divided nearly equally between the Catawba River basin and the adjacent Rocky River basin. The RRWWTP discharges into the Rocky River basin. The movement of water from the Catawba River basin to the Rocky River basin is an interbasin transfer currently regulated by the State of North Carolina.

MAJOR BASINS OF THE TOWN OF MOORESVILLE WATER AND WASTEWATER SERVICE AREA



LEGEND

Catawba River Basin

- Lower Lake Norman Watershed
- Upper Lake Norman Watershed

Yadkin-PeeDee River Basin

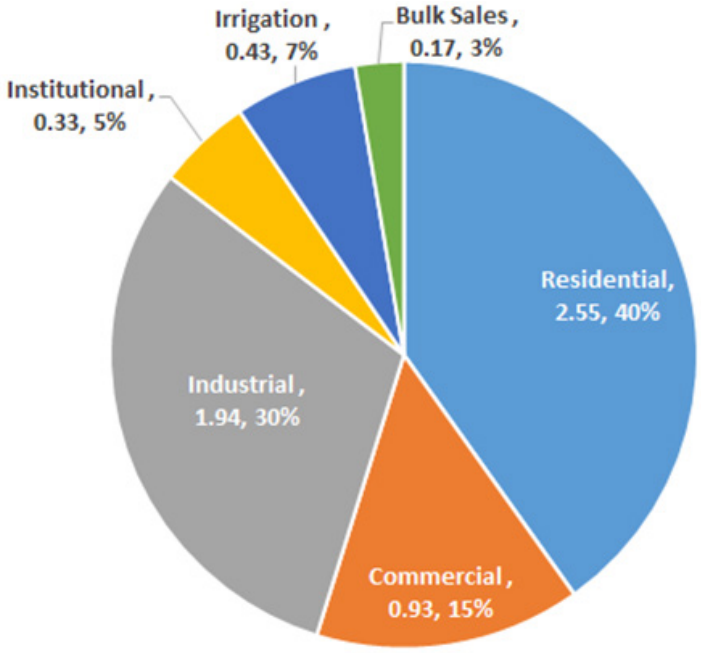
- Second Creek Watershed
- Upper Rocky River Watershed

- Subwatershed Boundaries
- Wetlands
- Lake Norman

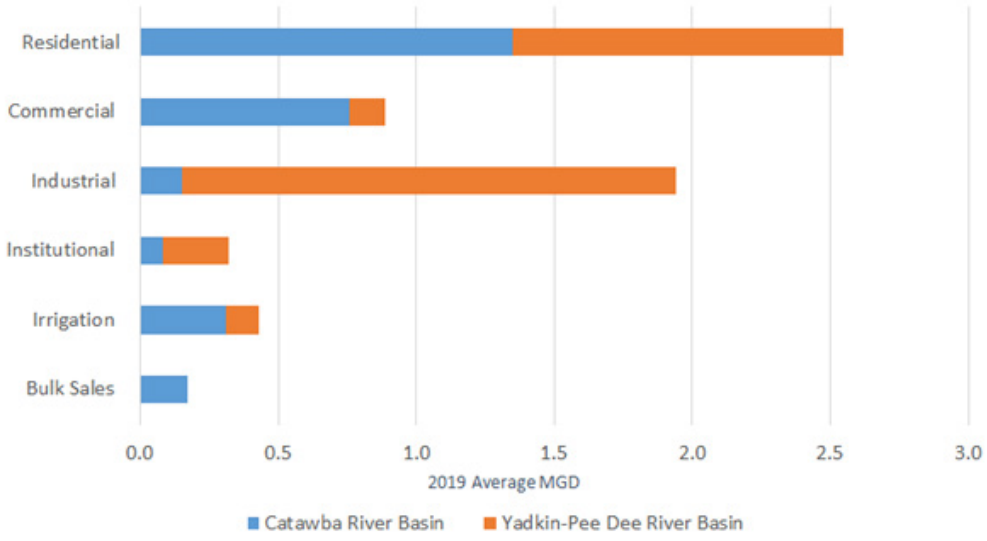
- Planning Area
- Iredell County

Planning for the Town's future capacity needs includes understanding the diverse customer base within the service area. Unlike many utilities dominated by residential customers, the Town serves significant industrial and commercial customers for whom water is a vital resource.

Uncertainty is inherent in any forecast; the water demand and wastewater flows for the Town's service area over the next 30 years will depend on a number of conditions that may vary from assumptions based on historical patterns.



The interlocal agreement between Mooresville and Troutman allows Troutman to discharge up to 2.0 MGD of wastewater on a 3-month average daily basis to the Town. The wastewater forecast does not consider the Town receiving greater than half of the contractual flow from Troutman within the planning horizon. To reflect continued growth in future flows from Troutman, the forecast average day flow is assumed to increase at a uniform rate to 1.0 MGD by 2050



Capturing the diversity of current and future land uses and customers within the Town's service area was an important part of the water and wastewater forecasting methodology employed for this Plan. Future water demands and wastewater flows were forecast through the 2050 planning horizon using the Metrolina CommunityViz Model (MCM), historic certificate of occupancy data, and development projects currently permitted or under review by the Town. The projected 2050 extent of the Town's water and wastewater service area was defined consistent with OneMooresville.

WATER DEMANDS & WASTEWATER FLOWS

Water demands and wastewater flows are analyzed and expressed in a variety of units to align with design and permitting criteria for elements of the water and wastewater systems:

- Raw water demand on the day of maximum demand is used to evaluate sufficiency of raw water supply.
- Finished water demand on the day of maximum demand is used to evaluate sufficiency of water treatment plant capacity.
- Average annual wastewater flow is used as a trigger for wastewater capacity planning.
- Average daily wastewater flow in the month with greatest total flow each calendar year (max month average day) is used to evaluate compliance with wastewater discharge permits.
- Maximum daily wastewater flow is used to evaluate the range of inflows to the wastewater collection system and treatment plant to aid in basin planning and evaluate flow equalization.
- Interbasin transfer on the day of maximum water withdrawal is used to evaluate compliance with the "grandfathered" interbasin transfer amount (9.54 MGD) established by the State of North Carolina based on 1993 infrastructure capacity.
- The amount of interbasin transfer is expected to increase. The Town is expected to exceed its grandfathered interbasin transfer amount in the near future. The Townmay choose to apply to the State of North Carolina for an interbasin transfer certificate.
- Current North Carolina law, revised in 2013, uses the average daily water withdrawal in the month with the greatest total withdrawal (max month average day) to determine compliance with interbasin transfer certificates.

The current and forecast water demands and wastewater flows developed for this plan are summarized in the table below.

CURRENT & FORECAST WATER DEMANDS & WASTEWATER FLOWS

	2019 (Actual)	2025	2035	2045	2050
Max Day Raw Water Demand	10.5	12.4	14.8	16.7	17.9
Average Day Finished Water Demand	6.9	8.2	9.7	11.0	11.8
Max Day Finished Water Demand	10.4	12.2	14.6	16.5	17.6
Average Day Wastewater Flow	4.7	5.9	7.7	8.8	9.5
Max Month Average Day Wastewater Flow Forecast	5.4	6.8	8.8	10.1	10.9
Max Day Wastewater Flow	8.0	11.8	15.3	17.6	19.0
Interbasin Transfer, Max Day Water Withdrawal Basis	8.95	10.3	Grandfathered Interbasin Transfer Amount Exceeded		
Interbasin Transfer, Max Month Average Day Water Withdrawal Basis	N/A	8.6	10.2	11.4	12.0

Distribution & Collection System Hydraulic Modeling and Capacity Planning

Planning and construction should begin for an additional 1.5 MG elevated storage tank in the recently expanded boosted pressure zone. The additional storage will satisfy storage capacity criteria and provide resiliency for fire protection and industrial demands.

Hydraulic models of the water distribution and the wastewater collection systems were created, calibrated, and used to evaluate the hydraulic capacity of the Town's water conveyance systems. The models were used to evaluate hydraulic function of booster pumps, water lines, elevated storage tanks, gravity sewer mains, forcemains, and sanitary sewer pump stations. The models were also used to simulate how the systems might function in the water and wastewater planning forecast years 2030, 2040, and 2050, and identify infrastructure improvements which will be necessary to maintain the desired level of service under future conditions.

It should be noted that the wastewater planning forecast for 2050 reflects the Town receiving half of the contractual flow from Troutman (1.0 MGD of the contractual 2.0 MGD). The wastewater flow forecast of 1.0 MGD in 2050 was used for planning of wastewater treatment capacity; however, planning of wastewater collection system capacity was based on flows from Troutman reaching only 0.4 MGD within the planning horizon. Flows from Troutman in excess of 0.4 MGD will require additional improvements within the wastewater collection system.

In addition to infrastructure planning, the wastewater collection system model was used to evaluate rainfall-derived infiltration and inflow and identify areas which warrant further investigation for rehabilitation or other improvements. Eliminating infiltration and inflow within the collection system has the potential to reduce peak flows at the RRWWTP and may help to minimize the needed equalization and treatment capacity at the plant. Both the water distribution system and wastewater collection system hydraulic models are established tools that the Town may continue to use for purposes such as fire flow analysis, energy optimization, operational planning, basin analysis, and sewer capacity allocation.

Planning and construction should begin for expansion of the Reeds Creek sewer pump station and the Dye Creek interceptor to accommodate continued growth.

MAZEPPA ROAD ELEVATED TANK

LAKE NORMAN AT HIGHWAY 150

Water Treatment Plant Planning

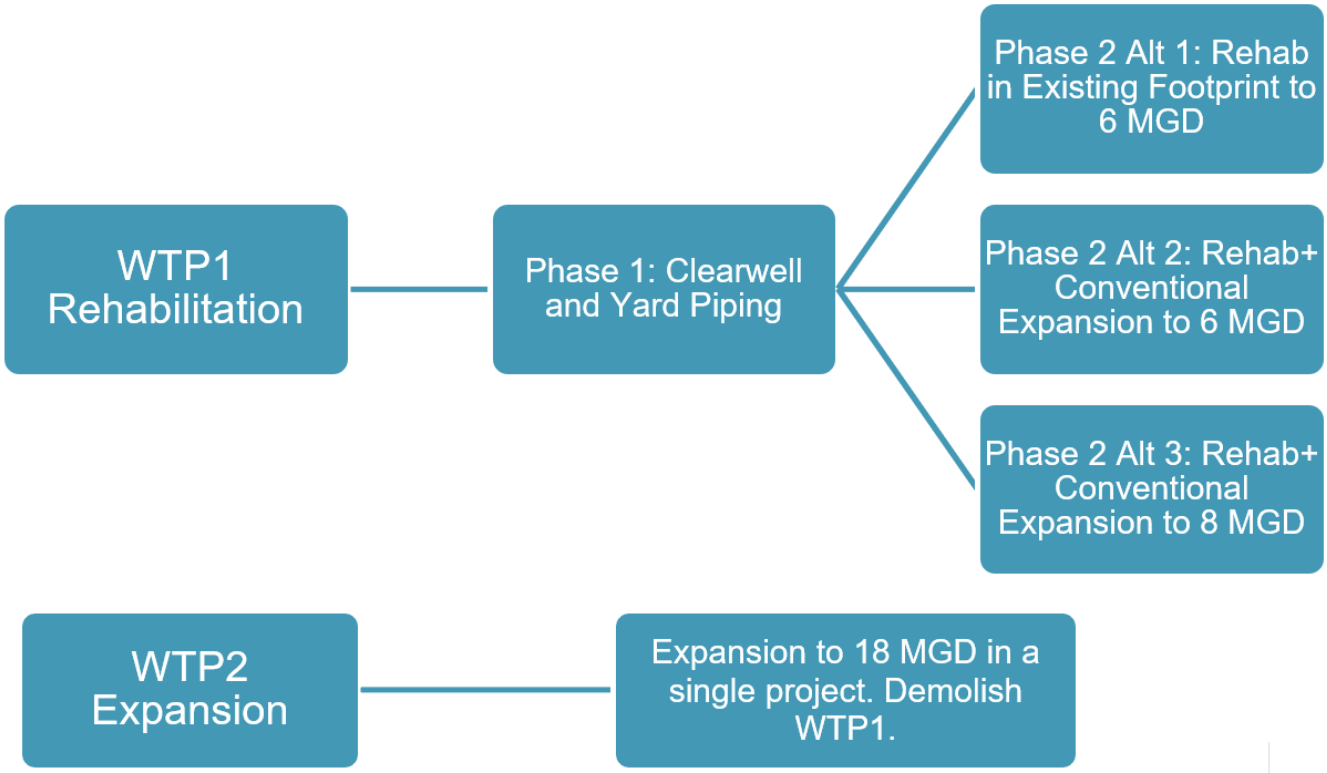
As part of the master planning effort, water treatment plant staff were shadowed and interviewed and both water treatment plants (WTP1 and WTP2) were reviewed to assess the operation and function of all treatment processes. The review included assessments of raw, inter-process, and finished water quality; residuals management; and regulatory compliance. Both plants produce high quality drinking water that meets all regulatory standards.

The greatest difference between the two plants is their age. WTP1 was originally constructed in 1961, underwent major upgrades in 1996, and currently has a rated capacity of 6 MGD. WTP2 was constructed in 2009 and has not had any major upgrades or expansion since that time. Its rated capacity is 12 MGD. Through the master planning process, options for rehabilitation, modernization, and possibly expansion of WTP1 were investigated. Alternatively, options to decommission WTP1 while expanding WTP2 were explored.

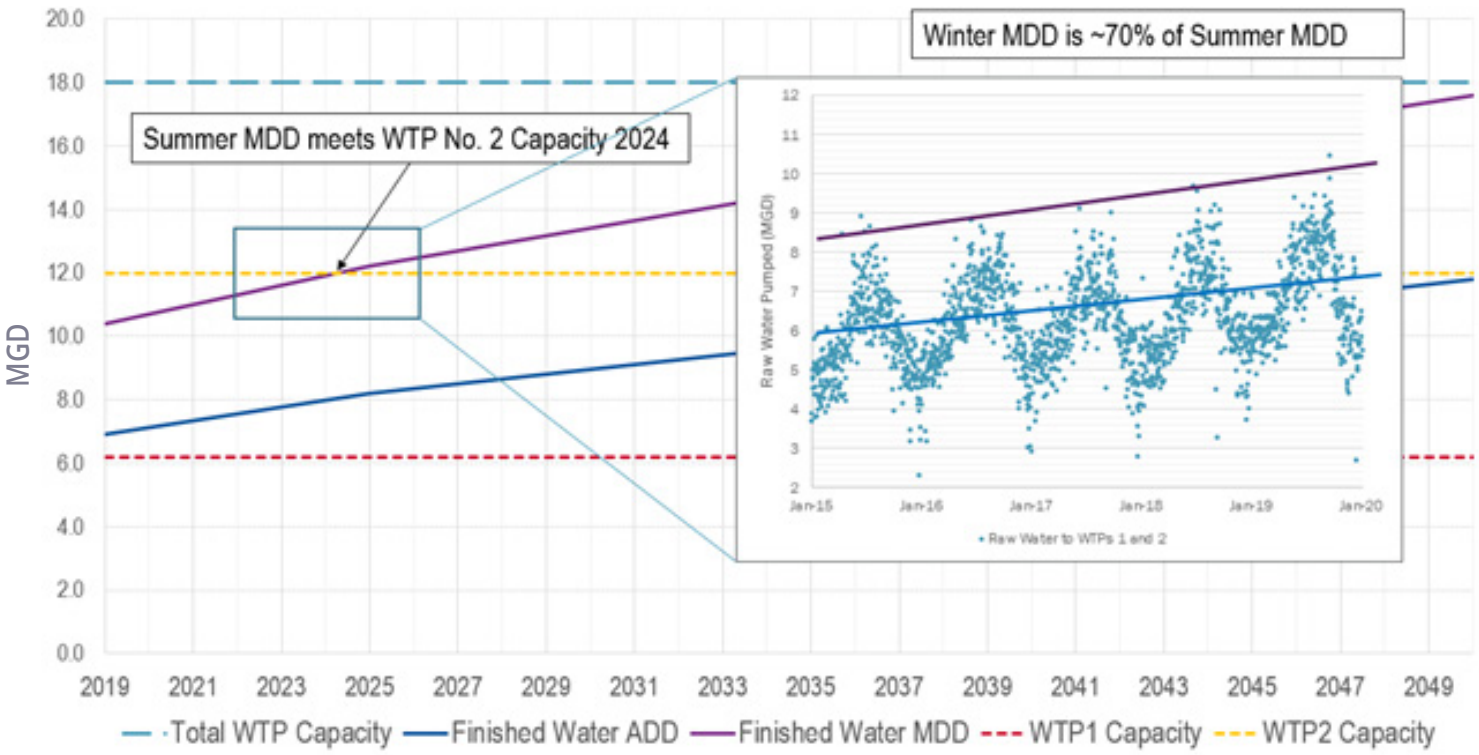
The following factors influence the timeline for initiation of the selected alternative(s):

- The plants have a combined rated capacity of 18 MGD, but process and hydraulic limitations limit capacity to approximately 15.5 MGD until completion of the proposed Phase 1 project.
- If WTP1 Rehabilitation is selected, it is recommended that the rehabilitation work occur during low-demand periods so that WTP1 can be offline or partially offline. It may not be possible to take WTP1 offline without activation of an emergency connection after 2024 (the point at which MDD exceeds 12 MGD in the figure on opposite page); however, phasing the work so that temporary shut-downs of WTP1 occur only in the winter may allow the expansion to be extended to 2040 (the point at which wintertime MDD exceeds 12 MGD).
- If WTP2 Expansion is selected, WTP1 cannot be taken out of service until the expansion at WTP2 is fully operational. WTP1 will require an increasing amount of annual maintenance to keep the plant operating through the WTP2 expansion. WTP2 expansion, without addressing hydraulic constraints at WTP1 or activation of an emergency connection, must be in place by 2040 (the point at which MDD exceeds 15.5 MGD in the figure on opposite page).
- The Town currently has an emergency connection agreement in place with the City of Hickory to provide up to 1.0 MGD of potable water on an emergency basis.

OPTIONS FOR WTP1 REHABILITATION AND EXPANSION AND WTP2 EXPANSION



THE ROLE OF OFF-PEAK DEMAND IN CAPACITY PLANNING



Wastewater Treatment Plant Planning

As part of the master planning effort, wastewater treatment plant staff were shadowed and interviewed and the RRWWTP was reviewed with a focus on plant performance, capacity, and biosolids management. During preparation of the master plan, a calibrated process model (BioWin process model) was developed to gain an understanding of wastewater influent quality and variability and its role in treatability and regulatory compliance. The process model will continue to be a useful tool for operational planning, troubleshooting, and evaluation of discharge permit requests.

The greatest need at the RRWWTP is for approximately 5 MGD of additional capacity; however, a need for improvements related to aging infrastructure and operational challenges was also identified.

Recommended improvements include:

- Influent pump station rehabilitation or replacement
- Finalize filter upgrades
- Package plant upgrades
- Expansion of solids treatment and dewatering

Preliminary design is recommended to identify an optimal influent configuration that considers equalization, streamlines the multiple influent lines into the RRWWTP, and accommodates possible expansion of the plant.

As identified though hydraulic modeling of the wastewater collection system, I/I reduction in the collection system may be possible with targeted investment; however, the Town must balance the probability and magnitude of those reductions with planning for RRWWTP capacity.

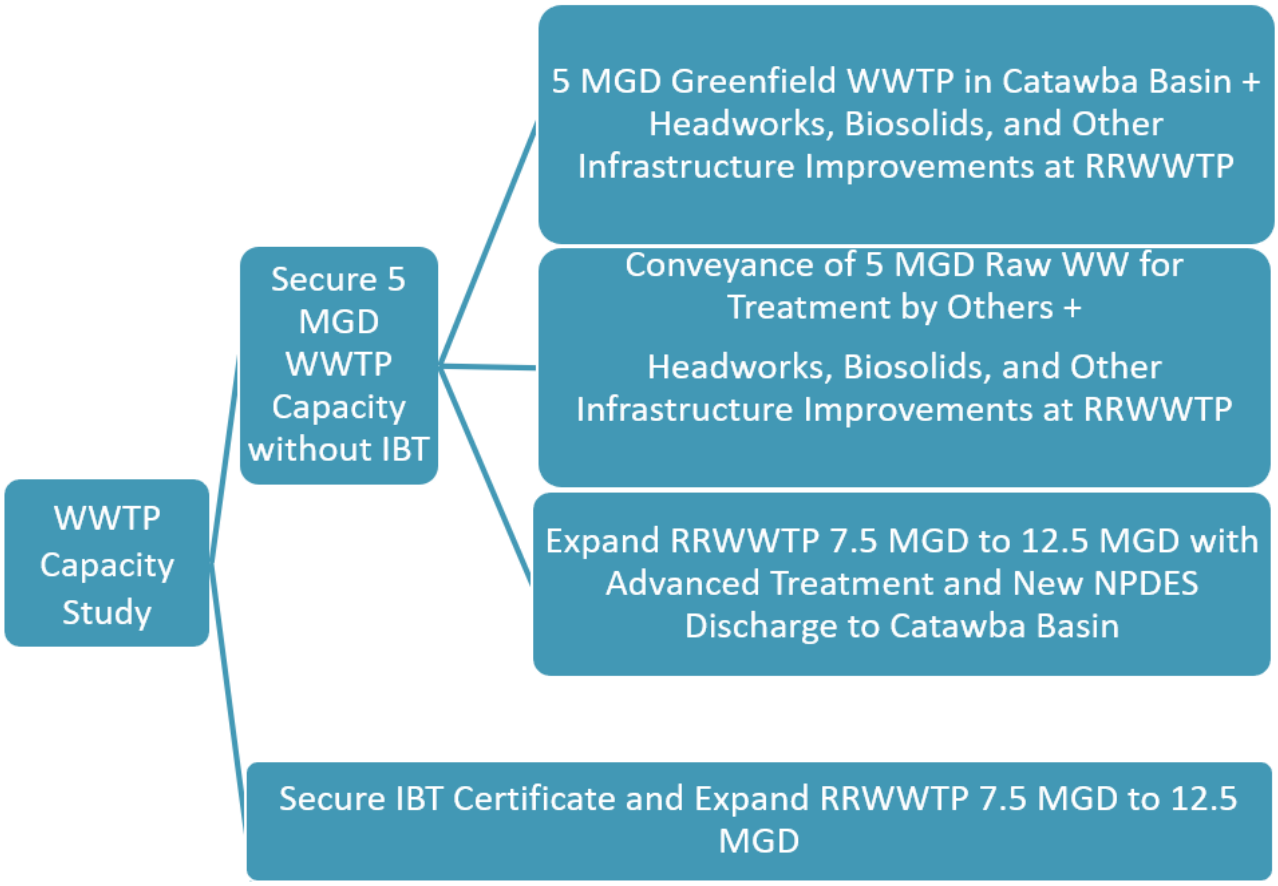
Capacity Expansion and Interbasin Transfer Management

Integral to the decisions related to wastewater treatment capacity, aging infrastructure, and operational challenges are the implications for interbasin transfer. Compliance will require eliminating 5 MGD of transfer, creating 5 MGD of transfer back to the Catawba basin, or seeking an interbasin transfer certificate. Whether to proceed with recommended infrastructure improvements at the RRWWTP independent of an overall plant expansion is another important decision point in planning for future wastewater treatment capacity.

If an interbasin transfer certificate is sought, the path to expansion of the RRWWTP and incorporation of the recommended improvements may be considered a single path. If compliance with the current interbasin transfer authorization is desired, there exists a spectrum of feasible capacity expansion alternatives as illustrated in the figure on the opposite page.

Major capacity expansion alternatives are described in greater detail later within this plan. All alternatives assume that discharges of treated wastewater within the Catawba basin will require advanced nutrient treatment while discharges within the Rocky River basin will not.

OPTIONS FOR WASTEWATER TREATMENT CAPACITY EXPANSION



ROCKY RIVER WASTEWATER TREATMENT PLANT

Capacity Expansion and Interbasin Transfer Alternatives

Regulatory compliance, management of aging infrastructure, and capacity requirements will impact the Town's water and wastewater systems over the next 20 years and specifically impact needs and decisions regarding water and wastewater treatment facilities and management of interbasin transfers. As the Town's utility service area continues to grow, compliance with its grandfathered IBT will become more difficult. If IBT compliance continues to be measured on a maximum-day basis and no mitigating action is taken, the current grandfathered IBT limit will likely be exceeded by 2025, and maximum day IBT could be as much as 4.6 MGD more than the current 9.54 MGD maximum day IBT limit by 2050.

Compliance with the current grandfathered IBT could require:

- Water use restrictions in the Rocky River basin.
- Construction of new facilities to treat and/or discharge wastewater in the Catawba River basin.
- Transfer of treated or untreated wastewater from the Rocky River basin back to the Catawba River basin.
- Development of a new water source in the Rocky River basin.

Simultaneously, the Town faces several potentially competing treatment capacity and aging infrastructure needs which require prioritization and resources within a timeline dictated by the forecasted growth in water demand and wastewater flow. The most pressing key decisions include addressing the imminent exceedance of the grandfathered IBT capacity, planning for future wastewater treatment capacity, and planning for the future of aging infrastructure at WTP1 and RRWWTP. Important milestones include:

- 2025: The current grandfathered IBT limit will likely be exceeded by 2025.
- 2025: RRWWTP flow will exceed 80% of the plant's permitted hydraulic capacity and trigger planning for expansion of treatment facilities.
- 2030: RRWWTP flow will exceed 90% of the plant's permitted hydraulic capacity. Permitting and expansion of the facility should be underway.

Decisions regarding IBT and water and wastewater facility planning are interrelated because the decision for future wastewater treatment capacity may be integrated with decisions regarding IBT and water supply and treatment. Six alternatives for future water and wastewater capacity and interbasin transfer management were screened and are described in the following pages.

ALT 1 - EXPAND ROCKY RIVER WWTP WITH DISCHARGE TO ROCKY RIVER BASIN

Alternative 1 expands the existing RRWWTP from its current 7.5 MGD capacity to 12.5 MGD capacity, which satisfies capacity needs through the planning horizon. Alternative 1 is the only of the six alternatives which requires that the Town secure an interbasin transfer certificate from the state of North Carolina. Significant considerations and assumptions include the following:

- A tremendous benefit of this alternative, and all alternatives which include expansion at the existing RRWWTP site, is the ability to address capacity needs while simultaneously addressing identified replacement and optimization needs.
- Alternative 1 assumes that NPDES permit limits for the expanded facility will not change from the current limits; however, it is acknowledged that hydraulic constraints in Dye Creek may require a change in the discharge location.
- Land is available for expansion at the existing site, although the terrain and existing monofill may impact site planning.
- Negotiation of an interbasin transfer certificate may present hurdles to the desired timeline for expansion.

Alternative 1 - Estimated Cost $133,000,000

ALT 2 - EXPAND ROCKY RIVER WWTP WITH DISCHARGE TO CATAWBA RIVER BASIN

Alternative 2 expands the existing RRWWTP from its current 7.5 MGD capacity to 12.5 MGD capacity, which satisfies capacity needs through the planning horizon. Additionally, this project provides additional nutrient removal capability to the treatment process to facilitate discharge to the Catawba River basin. Significant considerations and assumptions include the following:

- Like Alternative 1, a tremendous benefit of this alternative is the ability to address capacity needs while simultaneously addressing identified replacement and optimization needs at RRWWTP.
- Alternative 2 will require a new NPDES permit for the quality and the location of the discharge.
- New infrastructure is required to convey treated wastewater to a new discharge location in the Catawba basin.
- A goal of this project is to balance interbasin transfer in compliance with the existing grandfathered agreement.
- Identification of a new discharge location and negotiation of a new NPDES permit may present hurdles to the desired timeline for expansion.

Alternative 2 - Estimated Cost $158,900,000

ALT 3 - NEW WWTP IN ROCKY RIVER BASIN WITH DISCHARGE TO CATAWBA RIVER BASIN

Alternative 3 provides for permitting and construction of a new 5 MGD WWTP. This new plant would be located in the Rocky River to take advantage of existing conveyance infrastructure, but would discharge to the Catawba River basin. The combined capacities of the new WWTP and the existing RRWWTP will satisfy capacity needs through the planning horizon. Significant considerations and assumptions include the following:

- Alternative 3 requires land, public acceptance, and new NPDES permitting for the facility and the location of the discharge.
- New infrastructure is required to convey treated wastewater to a new discharge location in the Catawba basin.
- Identified replacement and optimization needs at RRWWTP are an additional cost.
- A goal of this project is to balance interbasin transfer in compliance with the existing grandfathered agreement.
- Acquisition of land to support the new facility, identification of a new discharge location, and negotiation of a new NPDES permit may present hurdles to the desired timeline for expansion.

Alternative 3 - Estimated Cost $159,500,000

ALT 4 - NEW WWTP IN CATAWBA RIVER BASIN

The concept for alternative 4 included permitting and construction of a new 5 MGD WWTP located in the Catawba basin and able to take advantage of existing conveyance infrastructure. The location screened for this option was shown not to be suitable for supporting a 5 MGD wastewater treatment facility and was eliminated as a feasible alternative.

ALT 5 - DEVELOP WATER SUPPLY IN ROCKY RIVER BASIN

Alternative 5 approaches the need to balance interbasin transfer by partnering with a neighboring utility to develop a water supply in the Rocky River basin. The conceptual water supply is a pipeline from a neighboring utility (Salisbury/China Grove area) to reduce and offset the Town's withdrawal from the Catawba River basin. Under this scenario the existing RRWWTP is expanded from its current 7.5 MGD capacity to 12.5 MGD capacity, as in Alternative 1, but no interbasin transfer certificate is required. Significant considerations and assumptions include the following:

- A goal of this project is to balance interbasin transfer in compliance with the existing grandfathered agreement.
- A tremendous benefit of this alternative is the ability to address wastewater treatment capacity needs while simultaneously addressing identified replacement and optimization needs at RRWWTP.

(continued at the top of the next page)

ALT 5 - DEVELOP WATER SUPPLY IN ROCKY RIVER BASIN (CONT.)

- Alternative 5 may allow decommissioning of WTP1 and save the costs of the planned modernization or expansion at the Town's water treatment facilities.
- Alternative 5 requires formation of an agreement with another utility and requires significant conveyance infrastructure outside of the Town's jurisdiction.
- The Town may lose some control over costs, drought response, and rate-setting.
- The water supply connection will provide additional resiliency for the water system.
- As in alternative 1, this alternative assumes that NPDES permit limits for the expanded RRWWTP will not change from the current limits; however, it is acknowledged that hydraulic constraints in Dye Creek may require a change in the discharge location.
- Land is available for RRWWTP expansion, although the terrain and existing monofill may impact site planning.

Alternative 5 - Estimated Cost $158,600,000

ALT 6 - DIVERT WASTEWATER TO NEIGHBORING UTILITY FOR TREATMENT AND DISCHARGE IN CATAWBA RIVER BASIN

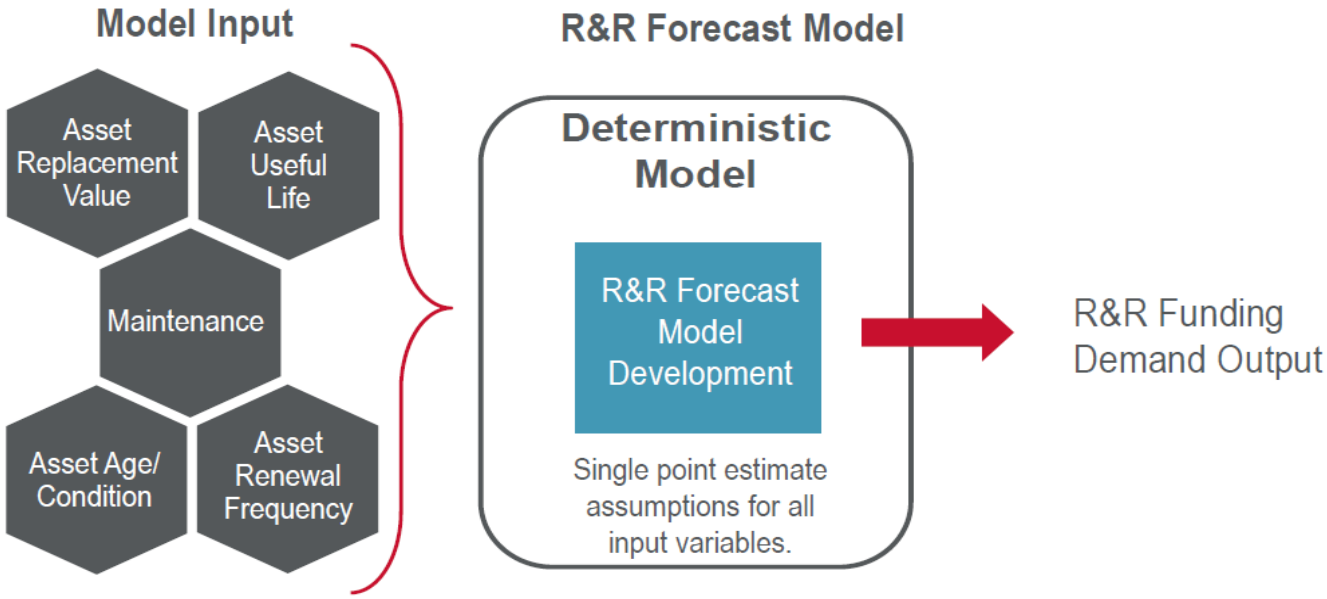
Alternative 6 approaches the need to balance interbasin transfer by partnering with a neighboring utility to divert raw wastewater from the Rocky River basin to the Catawba River basin for treatment and discharge. This concept includes conveying raw wastewater from the RRWWTP to a neighboring utility (Charlotte Water infrastructure in the McDowell WWTP basin/ Cornelius area) to offset the Town's interbasin transfer. Under this scenario expansion of the RRWWTP is not necessary. Significant considerations and assumptions include the following:

- A goal of this project is to balance interbasin transfer in compliance with the existing grandfathered agreement.
- Identified replacement and optimization needs at RRWWTP are an additional cost.
- Alternative 6 requires formation of an agreement with another utility and requires significant conveyance infrastructure outside of the Town's jurisdiction.
- The Town may lose some control over costs, future wastewater allocations, and rate-setting.
- The timeline and availability of treatment plant capacity are unknown.

Alternative 6 - Estimated Cost $164,000,000

Infrastructure Rehabilitation & Replacement Planning

The figure below provides an overview of the approach taken to develop funding levels for replacement and rehabilitation (R&R) of facility and linear infrastructure.



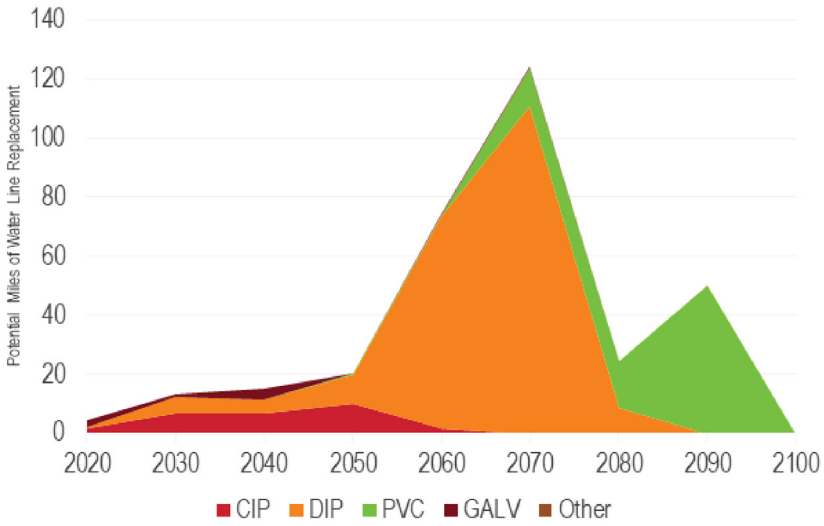
The R&R forecast model output is used as an estimate of funding needs and a means to generate a list of potential R&R projects. The confidence and reliability of R&R forecasts increases as experience and standardization of data input into the model are refined and uncertainty related to the data is reduced.

Long-term increasing investment will be essential for maintaining the desired level of service as infrastructure continues to age. For example, assuming an average annual escalation in costs of 2.5 percent per year, a 13 percent increase in annual funding is needed every 5 years just to keep up with increasing costs for asset rehabilitation and replacement to maintain the current replacement cycle duration.

The Town will deliver facility R&R in separate projects at the water facilities, RRWWTP, and pump stations, organized by location or asset type. The Town may deliver these replacement projects by risk rating but will also consider bundling of projects and coordination of projects with other work.

The Town will deliver linear infrastructure R&R largely on a schedule defined with an understanding of the expected service life of the pipe materials present in the distribution and collection systems. The service life of pipe materials utilized in the Town's water distribution and sanitary sewer systems ranges from 50 years (for galvanized pipe) to as much as 90 or 100 years for cast iron or PVC pipe. Because the bulk of the Town's system is relatively new compared with pipe service life, the level of investment required in the early years of the planning horizon is less than will be needed in years after the planning horizon, (e.g., 2060-2100) when the pipes installed in the years of Mooresville's rapid growth begin to reach the end of their service lives as illustrated in the figures on the opposite page. A consistent gradual increase in annual linear asset R&R funding is recommended. When combined with consistent, proactive funding in condition assessment for linear assets, this approach offers the best chance to optimize infrastructure investments and avoid a sudden need for massive programs to replace aging piping systems.

WATER MAIN R&R NEEDS BY MATERIAL TYPE

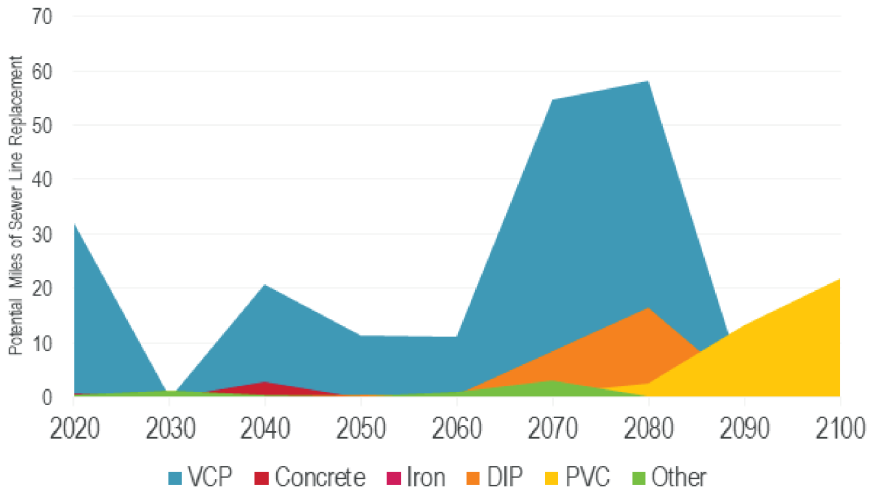


Recommended R&R funding is summarized in the table below by asset location. All replacement values are in 2020 dollars and are marked-up for contractor overhead and profit, mobilization, site civil work, contingency and engineering costs.

R&R FUNDING DEMAND OUTPUT

Infrastructure System	Years 1 - 5	Years 6-10	Years 11-15	Years 16-20
Raw Water Intakes	$1,602,000	$136,800	$1,000,000	$1,678,800
WTP 1	$1,578,000	$1,236,000	$216,000	$1,428,000
WTP 2	$2,301,000	$2,964,000	$5,146,000	$1,812,000
WWTP	$5,867,000	$8,597,700	$4,023,000	$2,054,000
Pump Stations	$3,033,000	$3,917,000	$4,750,000	$2,695,000
System-wide Water Main	$4,500,000	$4,500,000	$12,700,000	$12,700,000
System-wide Gravity Sewer	$32,250,000	$32,250,000	$1,150,000	$1,150,000
Total	**$51,131,000**	**$53,601,500**	**$28,985,800**	**$23,518,600**

GRAVITY SEWER R&R NEEDS BY MATERIAL TYPE



Programs & Initiatives

The Town continues to proactively implement several programs and initiatives for continued maintenance, renewal, and improvement of the water and wastewater facilities and the wastewater collection the water distribution systems. During the master planning process the following tools were created:

- vertical facility risk prioritization model
- linear asset risk prioritization model
- water distribution hydraulic model
- wastewater collection system hydraulic model
- wastewater treatment process model

It is recommended that these tools be maintained to assist with project identification, planning, and prioritization and system operation and analysis. Recommendations related to programs for continued maintenance, renewal, and improvement of the water and wastewater systems are described in the Plan.

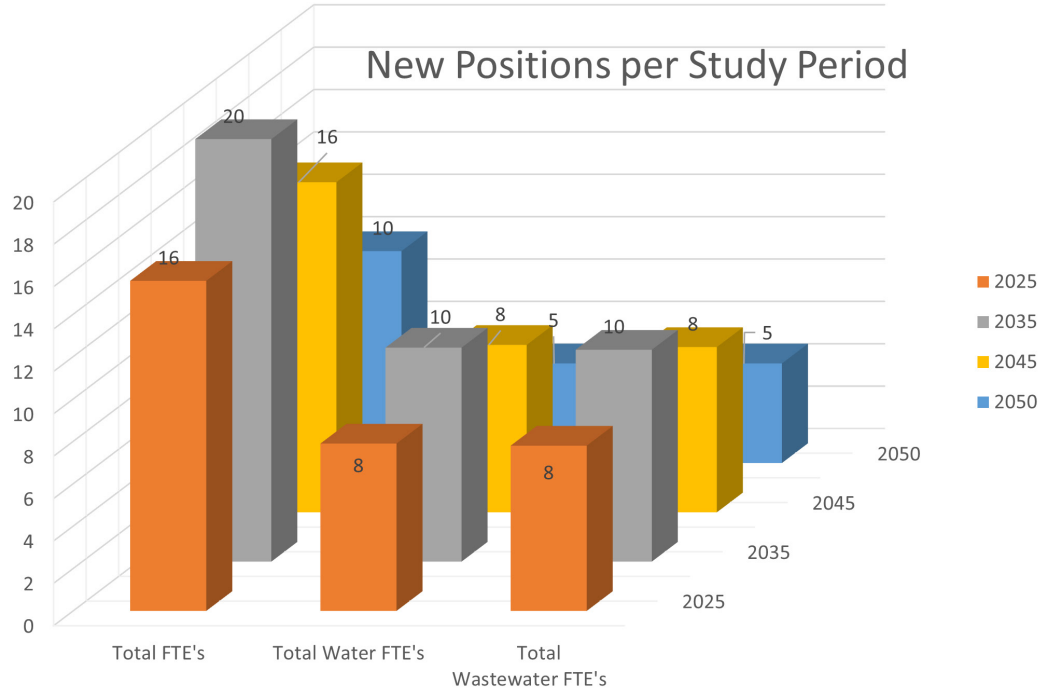
REEDS CREEK PUMP STATION

Organizational Review

The majority of the master planning effort focused on evaluating physical infrastructure of the water and wastewater systems and planning future capital needs related to capacity expansion, rehabilitation, and replacement. It is recognized that growth, expansion, and modernization of physical assets also necessitates growth and modification of the utility's workforce to enhance operational and organizational effectiveness. Therefore, as part of the master planning effort, an organizational review of the utility department was conducted.

The organizational review began with analysis of the department's existing structure and staff duties and included interviews with Mooresville staff engaged in utility operations management to identify core functions for each operations work group, work group composition/organization, challenges to delivering these functions, work group strengths, and potential areas for improvement. The organizational review explored the origins of the current utility operations organization; finance/budget factors which influence organizational structure; and provided comparisons with peer utilities to illustrate possible alternatives to enhance the organization's effectiveness.

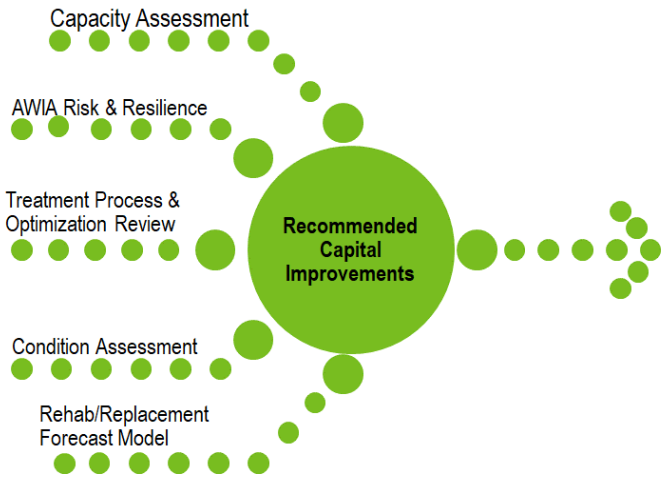
Projected flows were used to predict aggregate staff growth over the master planning period. Future staff needs are projected for each study year, indexed to flow predictions using current staffing ratios. The figure below illustrates the organizational staffing needs which may be required to expand and adequately serve the anticipated growth in water and wastewater service demands. These needs will affect both staffing and organizational development.



Not captured in the figure above is the administrative staffing effort required to execute and manage the major capital expenditures required in the near-term of the proposed capital improvement plan. It is recommended that the Town begin to recruit administrative and support staff knowledgeable in capital projects management, management of consulting services, professional services contracts, construction services contracts, GIS, and accounting in preparation for the upcoming financial investments and major projects.

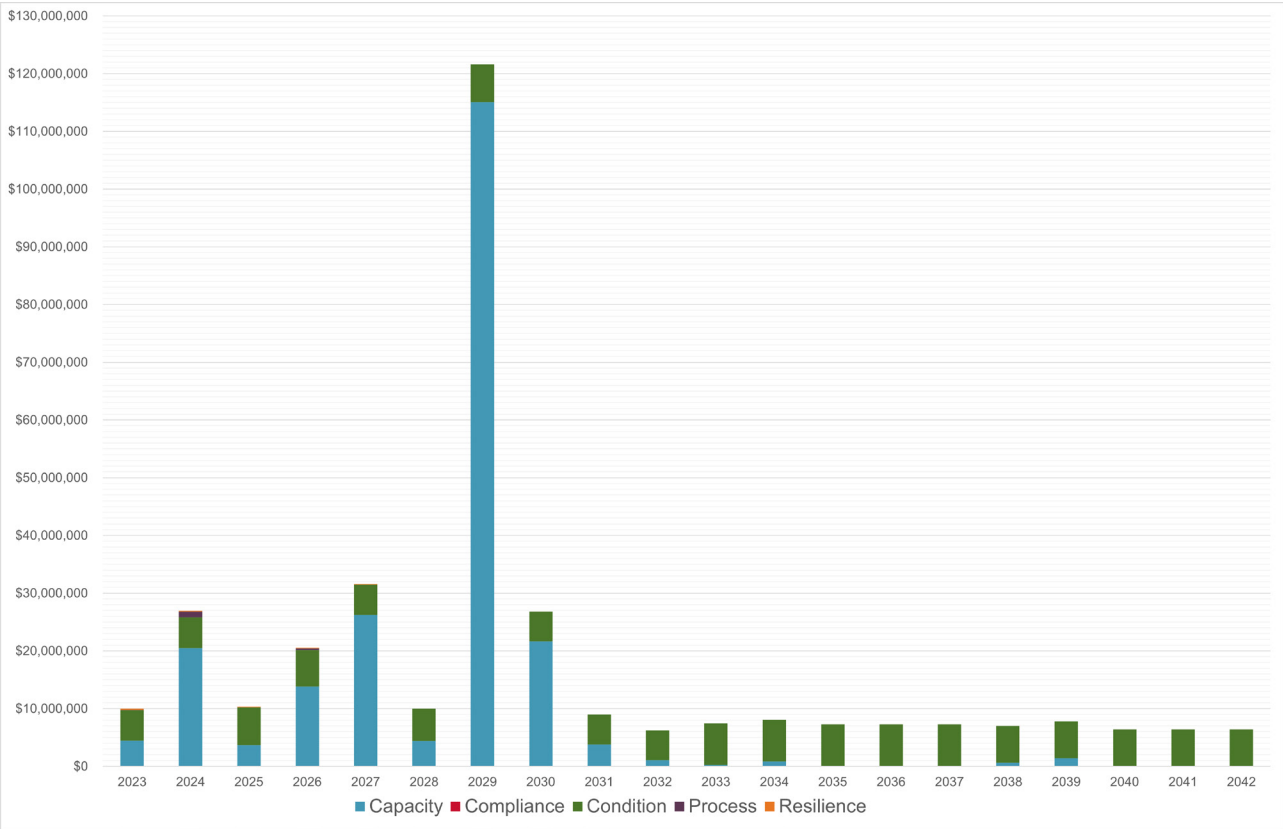
Recommended Capital Improvement Plan

The recommended 20-year program of Town of Mooresville water and wastewater capital projects considers the full range of water and wastewater needs, based on the whole of the preceding investigations and analyses. The recommended projects are identified as either “Near-Term”, to be completed within the first five years of the capital plan, or “Mid-Term” to “Long-Term” to be completed in years 6-20 of the capital plan. A total of $344.2 million in capital projects are recommended for the 20-year planning horizon; of these, approximately $273 million are needed within the next 10 years for modernization and expansion of water and wastewater treatment facilities. “Near-Term” projects comprise a funding need of $99.4 million in the next five years. A funding need of approximately $71.3 million is identified for “Long-Term” projects (projects needed in the last 10 years of the planning horizon).



Renewal needs for equipment, roof, and HVAC assets and water distribution and wastewater collection assets are ongoing. It is anticipated that annual funding through the CIP for these projects will enable a stable funding source which can fund the projects most needed for the coming year, based on the Town’s ongoing assessment of critical asset condition

RECOMMENDED ANNUAL CIP FUNDING, BY PROJECT DRIVER, FY2023-2042



TOWN OF MOORESVILLE RECOMMENDED 20-YEAR CAPITAL IMPROVEMENT PLAN

CIP ID	Facilities	Project Recommendation	Project Driver	Capital Cost			
				2023-2027	2028-2032	2033-2037	2038-2042
RR-1	Multiple Water and Wastewater Facilities	Water/Wastewater Facilities Equipment Service Life Replacements	Condition	$8,920,000	$8,349,000	$1,861,000	$5,750,000
RR-2	Multiple Water and Wastewater Facilities	Water/Wastewater Facility Structural & Roof Repairs	Condition	$1,100,000	$600,000	$600,000	$600,000
RR-3	System-wide	Water Distribution System Rehabilitation and Replacement	Condition	$5,000,000	$5,000,000	$10,000,000	$10,000,000
RR-4	System-wide	Wastewater Collection System Rehabilitation and Replacement	Condition	$5,000,000	$5,000,000	$10,000,000	$10,000,000
RR-5	System-wide	System-wide Generator Replacements	Condition		$2,100,000	$7,100,000	$1,830,000
WT-1	WTP1, WTP2, Raw Water Intake+PS	Water System SCADA Replacement	Process	$1,050,000			
WT-3	WTP1	WTP No. 1 Rehabilitation Phase 1: Clearwell and High Service Pump Project	Capacity	$9,161,000			
WT-4	WTP1	WTP No. 1 Rehabilitation Phase 2, Alternate 3: 8 MGD Rehab using Conventional Treatment	Capacity		$20,696,000		
WT-5	WTP2	WTP No. 2 Backwash Basin Pumps	Process	$285,000			
WT-6	WTP1 and WTP2	WTP No. 1 and WTP No. 2 Clearwell Connection Study	Resilience	$50,000			
WT-7	WTP2	WTP No. 2 Pump Replacements	Condition				$1,608,000
WT-8	WTP1, WTP2, Raw Water Intakes	Water Facilities Mechanical Equipment Replacements	Condition	$3,054,000	$1,728,000	$1,210,000	$1,104,000

TOWN OF MOORESVILLE RECOMMENDED 20-YEAR CAPITAL IMPROVEMENT PLAN

CIP ID	Facilities	Project Recommendation	Project Driver	Capital Cost			
				2023-2027	2028-2032	2033-2037	2038-2042
DS-1	Main Zone	30" WM on Charlotte Hwy	Capacity	$1,091,000	$819,000		
DS-2	Boosted Zone	1.5 MG Elevated Storage Tank	Capacity	$4,545,000			
DS-3	Boosted Zone	18" WM on Mazeppa Rd.	Capacity	$3,740,000			
DS-4	Main Zone	1.5 MG Elevated Storage Tank	Capacity		$4,545,000		
DS-5	Main Zone	16" WM on N Main St.	Capacity		$4,190,000		
DS-6	Boosted Zone	12" WM through Goodwin Circle	Capacity		$1,220,000		
WWT-1	RRWWTP	RRWWTP Regulatory Consultation and Capacity and Optimization Study	Capacity	$300,000			
WWT-2	RRWWTP	Influent Pump Station Rehabilitation or Replacement	Condition	$1,300,000			
WWT-4	RRWWTP	RRWWTP Package Plant Upgrades	Capacity	$450,000			
WWT-5	RRWWTP	RRWWTP Solids Treatment and Dewatering Expansion Project	Capacity	$13,500,000	$4,500,000		
WWT-6	RRWWTP	RRWWTP Chemical Feed Building Improvements	Condition	$50,000			

TOWN OF MOORESVILLE RECOMMENDED 20-YEAR CAPITAL IMPROVEMENT PLAN

CIP ID	Facilities	Project Recommendation	Project Driver	Capital Cost			
				2023-2027	2028-2032	2033-2037	2038-2042
WWT-7	RRWWTP	RRWWTP Site and Grading Improvements for Flooding Prevention	Condition	$500,000	$1,500,000		
WWT-8	RRWWTP	RRWWTP Equalization Tank Access and Cleaning Upgrades	Condition		$280,000		
WWT-9	RRWWTP	Wastewater Regulatory Permitting	Capacity	$5,000,000			
WWT-10	RRWWTP	Expansion of the existing Rocky River WWTP by 5 MGD to a total treatment capacity of 12.5 MGD	Capacity	$19,200,000*	$108,800,000*		
WWT-11	RRWWTP	RRWWTP Pump Replacements	Condition		$1,683,000	$1,188,000	
WWT-12	RRWWTP	RRWWTP UV System Replacement	Condition	$1,200,000			
WWT-13	RRWWTP	RRWWTP Mechanical Equipment Replacements	Condition	$1,210,000		$1,041,000	
CS-2	Collection System	Dye Creek Interceptor	Capacity	$614,000			
CS-3	Collection System	Reed's Creek PS Upgrades	Capacity	$4,230,000			
CS-4	Collection System	West Branch Rocky River Improvements	Capacity	$2,370,000			
CS-5	Collection System	Rolling Hill Road	Capacity	$1,040,000			

*Assumes selection of Capacity and IBT Alternative 1. Total capital costs of other alternatives range from $158,600,000 to $164,000,000

TOWN OF MOORESVILLE RECOMMENDED 20-YEAR CAPITAL IMPROVEMENT PLAN

CIP ID	Facilities	Project Recommendation	Project Driver	Capital Cost			
				2023-2027	2028-2032	2033-2037	2038-2042
CS-6	Collection System	Cypress Landing Reconnect	Capacity	$1,845,208			
CS-7	Collection System	Hospital/Lowes PS Upgrades	Capacity	$1,380,000			
CS-8	Collection System	Shinville PS Upgrades	Capacity				$230,000
CS-9	Collection System	Gabriel Dr Improvements	Capacity				$730,000
CS-10	Collection System	Basin Monitoring	Capacity	$150,000	$150,000	$150,000	$150,000
CS-11	Collection System	Lift Station Expansions	Capacity		$1,000,000	$1,000,000	$1,000,000
CS-12	Collection System	Lift Station Pump Replacements	Condition	$1,416,000	$1,440,000	$1,710,000	$1,008,000
CS-13	Collection System	Lift Station Mechanical Equipment Replacements	Condition			$1,390,000	

A twenty-year capital improvement plan necessarily involves a level of uncertainty. These uncertainties include future economic conditions, the pace of future growth, the timing of required projects, the cost of projects, and available technologies. Mooresville may elect to implement certain project recommendations with operating budget rather than with CIP budget. This is a particular possibility with service-life related asset replacements. Studies may in some cases be required to further define the required project before a capital budget can be defined with high confidence. The table below identifies several projects which may be affected by uncertainty and the additional actions which are recommended to further define the capital project.

Category	Facility	Project	Additional recommended actions
Process	All water facilities	Water System SCADA Replacement	Conduct recommended study to identify SCADA options prior to replacement.
Capacity	WTP1	Rehabilitation Phase 2, Alternate 3: 8 MGD Rehab using Conventional Treatment	Additional consideration is recommended prior to selection of Phase 2 Alternate.
Capacity	RRWWTP	Capacity Expansion, Influent, Headworks, and Flow Equalization Optimization Study	Regulatory consultation related to basin transfer status may be required.

PREPARED FOR THE TOWN OF MOORESVILLE
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