catawba county
north carolina

MAKING. LIVING. BETTER.

SOUTHEAST WATER / WASTEWATER

Master Plan.

2020

MAKING.
LIVING.
BETTER.

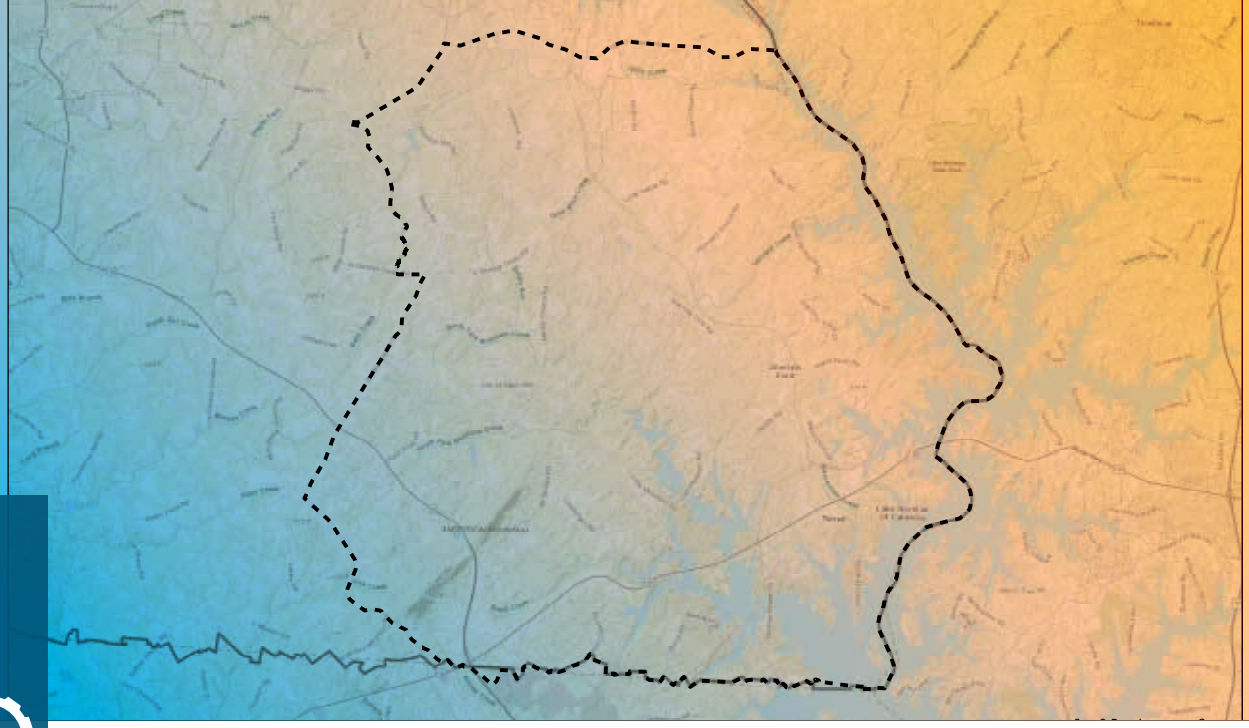
Catawba County, North Carolina is ideal for those who have a sense of adventure and a heart for hard work: for people with a passion for making something of themselves, their community, and the future. We are actively crafting a living and a life rich in both tradition and promise.

Table of contents.

PURPOSE AND SCOPE

During the past twenty years, Catawba County has created a system to provide water and sewer services to the southeast portion of the county, dubbed the SECC Service Area. In an effort to promote sustainable quality growth, consistent with initiatives in its recent Strategic Plan, this study was commissioned to evaluate actions to provide for a path to both economic vitality and financial sustainability and self-sufficiency. Specifically, to forecast anticipated and desired growth, plan for the infrastructure improvements necessary to support that growth, evaluate the financial underpinnings and requirements to finance that growth while aligning costs with beneficiaries, and consider changes in policy and governance to better achieve these goals.

The origins and development of the SECC service area is discussed in Section 1.0 Historical Context. ▶



EXECUTIVE SUMMARY

EXISTING CONDITIONS

Significant investments were made in the Southeastern Catawba Co. (SECC) area to create a foundational water and sewer system. It is configured in a linear fashion, principally serving corridors (consistent with previous Small Area Plans) originating near NC Hwy 16 in the west, then eastward along NC Hwy 150 to Lake Norman, and northward along Sherrills Ford Road to the Claremont/Catawba areas. The graphic above illustrates this service area.

The SECC system serves just over 1000 water customers and less than 200 sewer customers – utilizing a small fraction of current physical and contractual capacity. This capacity is provided through interlocal agreements with the City of Hickory – purchasing finished water (up to 1.7 MGD) from the City, and jointly owning/operating the Hickory-Catawba wastewater treatment plant (0.75 MGD committed in this 1.50 MGD facility).

As an enterprise fund, it requires transfers from the General Fund to balance its revenue and expenses.

Operational and financial conditions of the SECC are discussed in Section 2.0 Current Status.

FUTURE CONDITIONS

Prior to the Great Recession of the late 2000's, this area was poised for significant growth. With the resurgence of the economy, it is once again poised for new residential and commercial development. Approximately 15 development projects are approved or pending, with many more in very early stages. The infrastructure investments made can support this known growth potential, and some additional growth yet to be proposed for the immediate future. Models indicate additional investments would be required to support further growth over a forecast period of 5-10 years. More significant investments to bolster and expand the infrastructure will be required if additional growth is accelerated and continued during or beyond that window, but that growth will provide significant revenues to support the necessary investments.

> **This project provides tools for monitoring and adapting to the inevitability of changing conditions in both physical infrastructure and financial perspectives.**

Demographic, physical, organizational, and financial forecasts are discussed in Section 3.0 Predicted Futures and Section 4.0 Strategies to Support Predicted Futures.

SUMMARY RECCOMENDATIONS

Measures to accommodate forecast growth while achieving the goal of sustainability and self-sufficiency are discussed in Section 4.0 Strategies to Support Predicted Futures and Section 5.0 Conclusions & Recommendations. These conclusions and recommendations are characterized in four themes – Infrastructure, Finances, Governance, and Policy Development. **Key items are summarized below.**

SUMMARY SHORT-TERM AND LONG-TERM IMPROVEMENTS

As noted above, capacity generally is sufficient in the near and short term (less than 5 years). There are some short-term water improvements focused on operational efficiency, water quality maintenance, and fire flow capability. There are short-term wastewater capacity development improvements at two locations. Current rates, fees and fiscal practices appear to be sufficient to support these improvements.

Intermediate-term improvements (5 to 10 years) are more significant in both the water and sewer systems, and are focused on capacity development sufficient to accommodate projected growth. This includes water storage and transmission, and wastewater conveyance and pumping system expansions. It also could include wastewater treatment capacity expansion, but is dependent upon the status of excess unused capacity available to the County. Current rates, fees, and fiscal practices appear to be sufficient to support these improvements - as long as these improvements are paced and executed in a way that is reasonably concurrent with actual development for which they are required.

With and contingent upon continuation of growth and development beyond 10 years, projects to expand and significantly increase the capacity of both water and wastewater systems will be required. These projects would most likely impact water supply, storage, and transmission; and wastewater pumping, conveyance, and treatment. Some projects, perhaps most notably expansions of water supply and wastewater treatment capacity, can only be phased to an extent and are generally necessary to precede growth. Updating physical and financial models will equip the County with information which may indicate a need to modify rates, fees, or certain fiscal practices. Nonetheless, it is reasonable to accomplish this within the context of a sustainable and self-sufficient utility.

Detailed discussion and itemization of these improvements is presented in Section 4.0 Strategies to Support Predicted Futures and Section 5.0 Conclusions & Recommendations.

FINANCE

The Revenue Sufficiency Analysis (RSA) applied a very conservative (slow) growth in customer base, coupled with an over-aggressive capital improvement program (sooner than required for the conservative growth scenario). Under this forecast, the SECC was able to achieve self-sufficiency – incorporating reduction and eventual elimination of Property Tax Revenue transfers in less than ten years without any non-inflationary rate or fee increases. More rapid growth or more conservative timing of capital improvements would improve and accelerate achieving this goal.

GOVERNANCE

The County should consider formation of an alternative organizational structure, and a County Water & Sewer District appears to be the most logical and advantageous option. This will allow for optimizing strategies to transition the SECC to a self-sufficient enterprise and more closely align benefits and cost burdens with direct beneficiaries.

POLICY

The County/District should consider modification of select current policies/ordinances, and creation of select new ones. These deal with enhancements in the areas of service provision connections and prohibitions, and allocation and recovery of costs – both private and public.

Continued and detailed discussion of these items is found in the remainder of this report text, and further detailed analyses of physical facilities and finances are presented in the Appendices.

SECTION 1.0
HISTORICAL CONTEXT

1.1 HISTORY OF SECC

The Catawba County Board of Commissioners (BOC) has long recognized the role of proactive infrastructure planning in establishing and maintaining a climate conducive to fostering quality growth and development. Over time, the BOC has governed in such a way that acknowledges the support role played by water and sewer infrastructure in facilitating and enabling market-driven development, rather than pushing or propelling that growth. In the early 2000's, through an extensive public process involving design charrettes and citizen-based committees, Catawba County developed the Sherrills Ford Small Area Plan that explicitly illustrates the need for water and sewer investment and the notion of land use driving infrastructure requirements.

The BOC also has a strong and long-standing tradition of partnership and collaboration. As such, Catawba County operates a water and sewer utility system through a series of partnership agreements involving municipalities within the region. Catawba County offers these services to its citizens through contract with partner jurisdictions for maintenance and operation of water and sewer systems, participating in various cost-share models for the funding of line extensions and infrastructure investments to support this approach. This series of agreements, some of which are specifically discussed below, has evolved over time to yield a service delivery system whereby County residents and businesses are afforded access to utilities provided by the County's municipal partners on behalf of the County.

Table 1.1 shows a timeline of municipal agreements related to SECC water and sewer.

Table 1.1 – Timeline of SECC Agreements

YEAR	EVENT
8/21/2000	Agreement with Hickory for operation, maintenance, and management of water distribution system through 2040.
5/15/2001	Established SECC service area.
5/23/2001	Amendment with Hickory expanded the SECC service area.
9/17/2001	Pass through contract with Conover to transfer water from Hickory's system to SECC.
6/16/2003	Purchase of water plant capacity, 1.7 MGD, from Hickory.
6/16/2003	Purchase of 100,000 GPD wastewater plant capacity from Hickory in the Hickory-Catawba Wastewater Treatment Facility.
7/7/2003	Amendment with Hickory allowed Hickory to provide water to Mooresville.
8/21/2006	Amendment with Hickory transferred the 100,000 GPD to Hickory's Henry Fork Wastewater Treatment Plan.
9/20/2006	Amendment with Hickory added operations, maintenance, and management for wastewater collection system.
9/20/2006	Amendment with Hickory to clarify portions of the agreement for sale of wastewater plant capacity and treatment services.
12/3/2012	Agreement with Hickory for shared costs for the upgrade and expansion of the Hickory-Catawba Wastewater Treatment Facility.

*WATER AGREEMENTS SHADED BLUE

1.1.1 WATER

The City of Hickory is the primary supplier of drinking water to the citizens of Catawba County. Catawba County entered into a contract with the City of Hickory in August of 2000 for the provision of long-term supply of municipal water to Southeastern Catawba County (SECC) through 2040. Thus, the SECC water distribution loop benefited the citizens of the SECC area, the towns of Maiden and Catawba, and the cities of Claremont and Conover, ensuring the continuous flow of drinking water by providing a fortified distribution system. All cities could benefit from the SECC loop in the event of a catastrophic incident involving their water distribution systems.

The SECC water distribution loop was developed in three separate but co-dependent phases. Between 2000 and 2016, Catawba County and the City of Hickory partnered to construct the water loop from the Conover interconnect, which is south along Sherrills Ford Road to NC Highway 150. From NC Highway 150, the waterline continued to East Maiden Road and Olivers Cross Roads, eventually interconnecting with Hickory's water system on Startown Road. **Table 1.2 shows a timeline of all water projects related to the SECC system.**

Table 1.2 – Water Projects

COMPLETION DATE	PROJECT NAME	COUNTY INVESTMENT
1999	SHERRILLS FORD ELEMENTARY WATER	$1,557,077
2000	ANCHOR'S LANDING WATER	$277,020
2000	TED LANE WATER	DEVELOPER PAID
2000	WHITE DOVE WATER	$92,856
2000	ISLAND POINT ROAD WATER	$325,785
2001	SHERRILLS FORD LIBRARY WATER	$95,000
2002	SHILOH ROAD	$365,296
2002	NORTHVIEW HARBOR WATER PHASES 2-9	DEVELOPER PAID
2003	SECC INTERCONNECT WATER	$157,700
2003	JOE JOHNSON ROAD WATER	$61,586
2004	NORTHVIEW HARBOR WATER	$280,262
2005	MT. PLEASANT UMC WATER	$94,000
2005	RUSSELL RIDGE WATER	DEVELOPER PAID
2005	SHERRILLS FORD FIRE DEPARTMENT	$22,241
2005	BACH ROAD WATER	$151,260
2005	SECC WATER LOOP PHASE I	$2,771,854
2006	EDGE WATER SUB WATER	$100,000
2008	SECC WATER LOOP PHASE II	$4,018,845
2009	SECC WATER LOOP PHASE III	$6,631,494
2018	DUKE ENERGY WATER	$510,020 (REIMBURSED BY DUKE ENERGY)
	TOTAL	$17,002,277

1.1.2 SEWER

While the final phase of water was under construction, the County began to extend sewer lines in the SECC area in an effort to expand service and spur economic development, primarily along the NC Highway 150 corridor. Sewer infrastructure began with the northern section, a series of pump stations and force mains from Sherrills Ford Elementary School along Mollys Backbone Road, then along Hudson Chapel Road, eventually connecting with City of Hickory's sewer system at the Hickory-Catawba Wastewater Treatment Plant. Sewer service then expanded along the NC Highway 150 corridor with a series of gravity sewers, pump stations, and force main sewers connecting to the northern project at Sherrills Ford Elementary School.

While the sewer system along NC Highway 150 was under construction, the Hickory-Catawba Wastewater Treatment Facility expanded to 1.5 million gallons per day (MGD). **Table 1.3 shows the timeline of SECC sewer projects.**

Table 1.3 – Sewer Projects

COMPLETION DATE	PROJECT NAME	COST
2010	SECC Wastewater (Northern)	$ 7,996,619.54
2015	Hickory-Catawba WWTP expansion	$ 5,920,154.00
2016	SECC Wastewater (Hwy 150 Sewer)	$ 8,905,470.72
2019	SECC Wastewater (Hwy 150 Sewer East)	$ 1,451,500
	TOTAL	$ 24,273,744.26

1.1.3 FUNDING

In fiscal year 1995/1996, the BOC dedicated two cents of the ad valorem tax rate for expanding the County's water and sewer infrastructure. This investment intended to have an immediate impact on County schools by enabling extension of water lines to those schools without public water. This effort also allowed the BOC to increase the County's ability to work with cities to provide water and sewer services to support development of housing and industry in targeted areas, and improved fire protection and insurance ratings.

Since that time, ad valorem taxes have supported development of water and sewer infrastructure. In fiscal year 2008/2009, the Catawba County Water and Sewer Fund was established, with the practice of dedicating ad valorem revenues continuing to the present day. In July 2009, a countywide referendum instituted a quarter-cent sales tax, of which 31% is dedicated annually to water and sewer infrastructure.

DEBT SERVICE TO SUPPORT MAJOR SECC INVESTMENTS

Customarily the County funds a portion of each project from set-aside fund balances to enable the debt instruments provides the balance of the funds to enable the design and construction of the infrastructure projects listed on Table 1.3. Typically, debt instruments are issued in advance of project initiation.

The County borrowed $7 million in 2008, payable over 20 years, for the construction of the SECC Wastewater Collection System (Northern) Project. Average annual payment for principal and interest is $473,039 through 2028.

The County borrowed $8 million in 2013, payable over 12, years for the construction of the NC Highway 150 Sewer Project. Average annual payment for principal and interest is $746,010 through 2025.

Since the County and the City of Hickory agreed to "shared costs for the upgrade and expansion" of the Hickory-Catawba Wastewater Treatment Facility, with each paying 50 percent of expansion costs, the City of Hickory financed $9.9 million in 2013, payable over 15 years. The County's 50 percent annual payment for principal and interest is $391,216 through 2028.

SECTION 2.0
CURRENT STATUS

2.1 CURRENT SYSTEM OPERATION

2.1.1 WATER SYSTEM

The SECC System obtains its potable water supply from the City of Hickory through a contractual agreement to provide the County with 1.7 MGD with an option for acquiring an additional 3.3 MGD, for a total available capacity of 5.0 MGD.

The Southeast Catawba County water system is split into two regions: the South/West pressure zone (SWPZ), serving the western and southern portions of the SECC, and the North/East pressure zone (NEPZ), serving the eastern and northern portions of the SECC. The two separate zones are divided by a closed isolation valve on the SECC loop at the intersection of Sherrill's Ford Road and Beatty Road. Water supply is delivered via a booster pump station near each of their own respective municipal connection points (to the Hickory 36-inch transmission main in the west near Startown Road at Kirsten Street, and the Conover 12-inch water main near NC Hwy 10 at Shiloh Road). Pressures are maintained by the Anderson Mountain ground storage tank (GST) in the SWPZ and the Bandy's elevated storage tank (EST) in the NEPZ.

Figure 2.1 illustrates the existing SECC water system. This figure shows the location of the water storage tanks, booster pump stations and general pipe layout.

The existing water demands by region are summarized in Table 2.1.

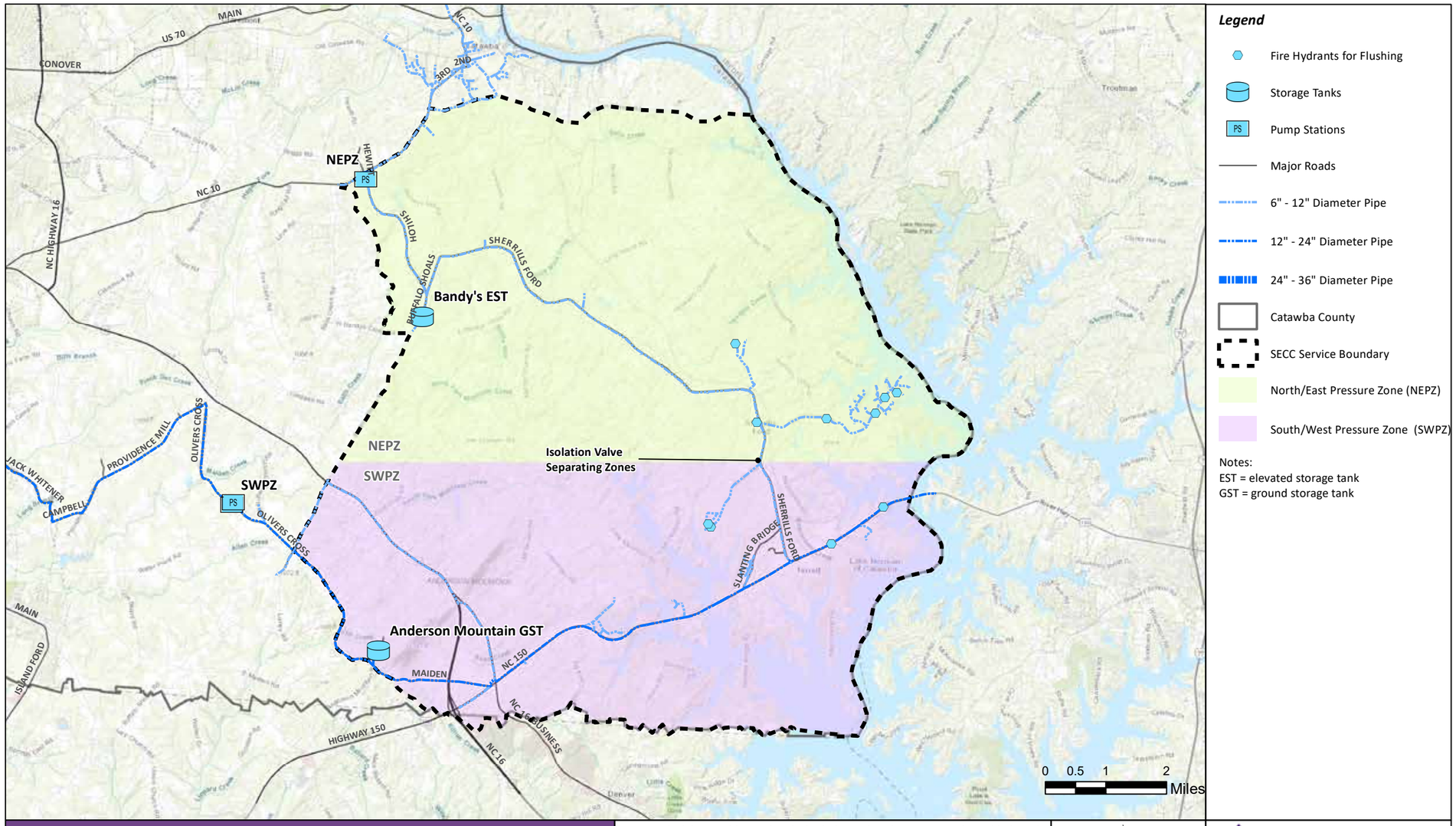
Table 2.1 – Existing Water Demands

SWPZ Average Daily Flow (ADF)	65 GPM
NEPZ ADF	99 GPM
Total SECC ADF	164 GPM

Total water volume delivered into the entire SECC service area averaged 236,000 gallons per day (gpd) during calendar year 2017 (approximately 40% into the southwest pressure zone and 60% into the northeast pressure zone). Of this, approximately 85% was metered and sold to customer connections. While the unbilled volume is consistent with national averages, a significant portion was consumed by necessary flushing operations for water quality maintenance purposes, which is expected to decrease with increased future demand; this is discussed in Section 3.1 Operations. Current available capacity exceeds current demand and is expected to continue exceeding demand for some time, as discussed in Section 3.0 Predicted Futures.

These facilities are more than adequate to supply the required average and peak demands, while maintaining satisfactory water pressures. The expansive and linear nature of the water system loop, combined with very modest usage, results in excessive water age as it moves through the system. This can result in water quality degradation (in terms of reduced chlorine residual levels and increased formation of undesirable chlorinated organic compounds). There are four automated flushing stations that are operated to reduce water age in the system and minimize these negative effects. The service area's geography limits any opportunities to improve circulation patterns using this method, so the principal opportunity for improvement will be realized as a matter of course, as water demands increase due to additional growth in the system.

Figure 2.1 – SECC Existing Water System



Southeast Catawba County Existing Water System

Prepared For: Catawba County

October 2019

Map Disclaimer: This product is for informational purposes only and is based on some unverified information provided by others. This product has not been prepared for nor is it suitable for legal, engineering, or surveying purposes. It represents only the approximate relative location of property boundaries. McKim & Creed, Inc. assumes no liability or damages due to inaccuracies, errors or omissions.

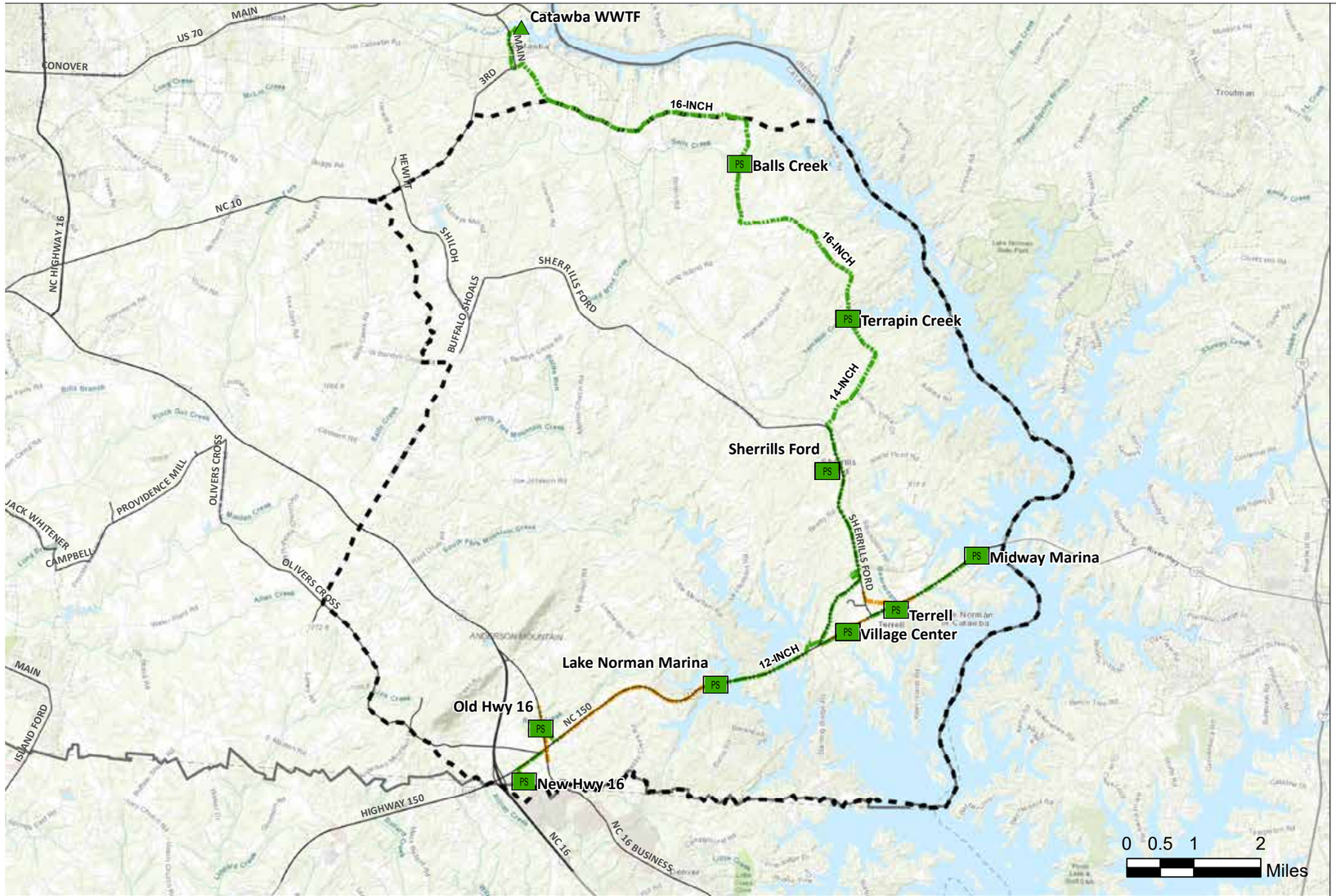
N

1 inch = 1.5 miles

McKIM&CREED
1730 Varsity Drive, Suite 500
Raleigh, NC 27606
Ph: (919) 233-8091

The current water system model development, calibration, and analysis is discussed in detail in Appendix A.

Figure 2.2 – SECC Existing Wastewater System



Southeast Catawba County Existing Sewer System				
Prepared For: Catawba County	January 2020	Map Disclaimer: This product is for informational purposes only and is based on some unverified information provided by others. This product has not been prepared for nor is it suitable for legal, engineering, or surveying purposes. It represents only the approximate relative location of property boundaries. McKim & Creed, Inc. assumes no liability or damages due to inaccuracies, errors or omissions.	1 inch = 1.5 miles	McKIM&CREED 8020 TOWER POINT DRIVE CHARLOTTE, NC 28227 Ph: (704) 841-2588

2.1.2 WASTEWATER SYSTEM

All the wastewater collected within the SECC system is conveyed through a network of pump stations and force mains and delivered to the Hickory-Catawba wastewater treatment facility (WWTF) near the Town of Catawba. The County has a 50% interest in treatment capacity at that facility. The facility has a capacity of 1.5 MGD, of which the County owns 0.75 MGD. The plant's existing National Pollutant Discharge Elimination System (NPDES) permit allows for phased construction to expand to 3.0 MGD, and the interlocal agreement with Hickory allows either party to finance and be vested in all or a part of that expanded capacity. Currently, the sewer collected and delivered to the plant has averaged 36,000 gpd (FY 2017/18), so there is ample treatment capacity available to the County.

Analogous to the water system, the sewer system is completely linear. It originates in the western portion of the service area, in the vicinity of NC-16 and NC-150, and collects and conveys sewer along NC-150 and then north along Sherrills Ford Rd.

Figure 2.2 illustrates the existing sewer system, including the location of the WWTF, pump stations, and the collections system layout.

A total of 9 pump stations collect flow locally, and then pump further east or north (and repump previously conveyed flow from the west or south, respectively) until reaching the Hickory-Catawba WWTF. All gravity sewers, pump stations, and force mains currently are operating at very low percentages of ultimate design capacity, with significant excess available capacity. **The current sewer system model development, calibration, and analysis are discussed in detail in Appendix A.**

2.1.3 PARTNERSHIPS

The SECC system has been implemented and is operated through a number of various interlocal agreements with municipalities within the County. These include agreements with the cities of Hickory, Newton, Conover, Claremont, Maiden and Catawba. These agreements have been instrumental in the successful creation and continued development of the SECC, and provide a platform for regional collaboration and continued growth.

Some of these agreements define service area delineations and practices, whereas others provided technical and financial collaboration for capital facilities or the operation thereof. Among the most significant:

- Agreement with Hickory provides for the supply and expansion of potable water.
- Agreement with Hickory related to the Hickory-Catawba WWTF provides the right to treat to capacity the SECC system, as well as expand capacity.
- Agreement with Hickory provides for operation of the water distribution and wastewater collection systems, customer billing and revenue collection, and revenue sharing with the County.
- Agreement with Conover provides for transport of potable water from Hickory through Conover's system and delivery to the northeast connection point of the SECC system.
- Agreements with the municipalities of Newton and Hickory provide for delineation of service area boundaries.

It is expected that the growth within the SECC will be supported by the continued implementation of these agreements and may include prospective modifications when warranted.

2.1.4 FINANCES

The SECC presently serves a variety of customers within its defined service area boundary. It largely serves commercial and recently developed properties along major transportation corridors in concert with previously implemented focused area plans. System growth has been quite modest in recent years, but with a significant increase in development activity since 2017. **At the closing of FY 2018/19 (30 June 2019,) there were 1,057 water customer accounts but only 178 sewer customers, as shown in Table 2.2.**

Table 2.2 – Residential and Commercial Customers

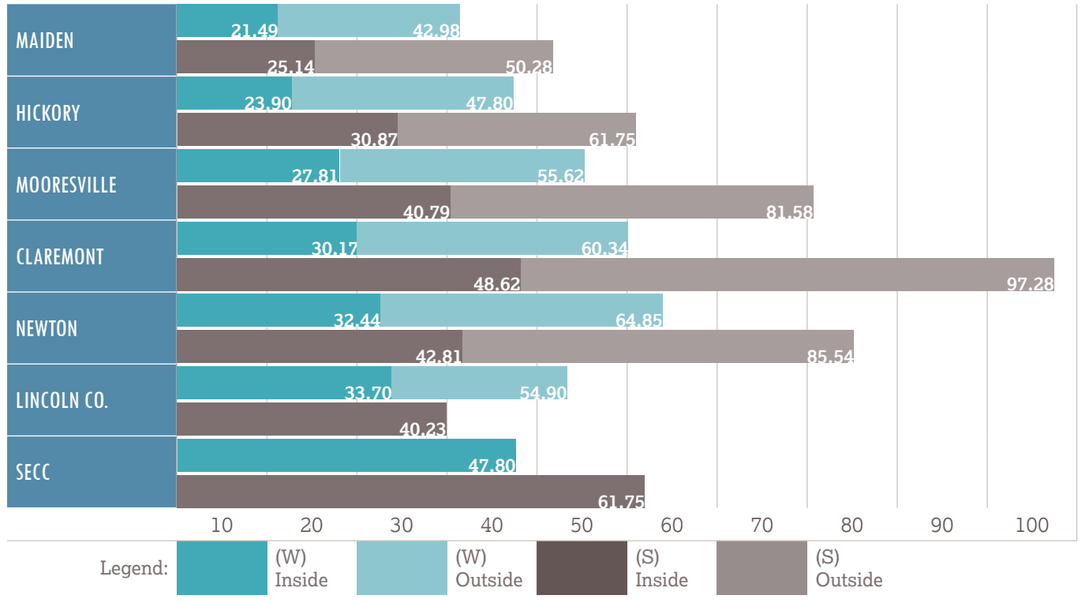
FISCAL YEAR CONNECTIONS AS OF:	2015 6/30/2015	2016 6/30/2016	2017 6/30/2017	2018 6/30/2018	2019 6/30/2019
WATER					
RESIDENTIAL WATER	643	662	686	839	981
COMMERCIAL WATER	35	37	42	64	76
WASTEWATER					
RESIDENTIAL SEWER	0	2	14	74	164
COMMERCIAL SEWER	1	3	6	9	14

Source: City of Hickory

By agreement with Hickory, SECC customers are charged Hickory's usual out-of-City rates (double the in-City rates) and half of those revenues collected are returned to the County to fund system expenses. Other various fees are assessed and returned by Hickory, or directly by the County, depending on the fee in question. Most significant are fees collected from new development, now termed System Development Fees (SDF) – essentially what may have been titled with many terms (capacity development fees, capital fees, etc.) – which are the result of state Legislature's attempt to implement a more uniform method and system to derive and apply these fees. After performing the requisite fee analysis prescribed by the statutes, the County has elected to maintain the SDF for the time being at the current level assessed for that purpose (less than what is otherwise allowed under the statute). Nonetheless, SDF fees are expected to grow dramatically as new development occurs, and become a significant element for funding of required system expansions.

With this new but emerging customer base, revenue collected is not sufficient to fully support and offset system expenses. Historically, the County has supplemented the water/sewer fund with transfers from the General Fund in order to meet all its obligations. **It is a goal for the SECC service area to progress toward and ultimately be a self-sufficient and sustainable enterprise fund able to continue indefinitely without the benefit of General Fund transfers.** The feasibility of achieving this will be demonstrated in the following sections that discuss future conditions and alternative support measures.

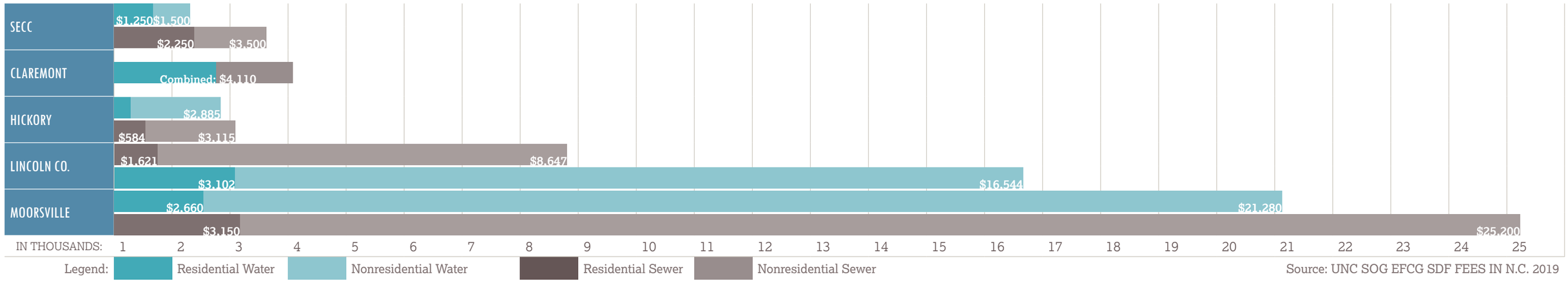
Table 2.3 – Rates ($5{,}000_{GAL}$)



Source: UNC SOG EFCG 2019 water/wastewater rate tables

It is a goal for the SECC service area to progress toward and ultimately be a self-sufficient and sustainable enterprise fund able to continue indefinitely without the benefit of General Fund transfers.

Table 2.4 – System Development Fees



Source: UNC SOG EFCG SDF FEES IN N.C. 2019

In table 2.4, system development fees were unavailable for the Town of Maiden and the City of Newton.

catawba county

SECTION 3.0
PREDICTED FUTURES

3.1 OPERATIONS

Forecasting is always an inexact science at best. The nature of this study area makes it particularly challenging. This area exhibits a relatively small established population and development pattern, sparse in density given the study area size, and yet with potential – poised even – for rapid growth. These conditions make traditional tools for population projections that rely heavily on past trends and empirical data misleading and, often, all but irrelevant.
To have some basis for projecting future growth and, therefore, water and sewer demands, the key questions to be answered were:

- What is expected to be developed based on the Unified Development Ordinance?
- What is the demand exerted by that type of development?
- Where is the development expected to occur?
- How fast (or at what pace) is the development expected to occur?

These are both independent AND interdependent variables, and each can vary significantly as the future unfolds; therefore, there are a multitude of potential combinations and resultant forecasts.

With virtually a clean slate for additional future development, answering these questions began with a decision to anchor to the zoning and land use projections in existing County code and planning documents. This approach capitalized on the reasonable conclusions of previously performed analysis and evaluations. In addition to leveraging the County's previous analysis, forecasting the impact of future development on utility demands began with an examination of near-term development projects already in the planning process. **Figure 3.1 illustrates the County's current, approved development projects,** most of which are in very early stages of completion – less than 5% of the permitted new residential units had actually been built. The list was further vetted for each project's likelihood of proceeding within the timeline covered by this report; providing further insight as to the character and magnitude of prospective projects, and validating insights gathered from previous planning efforts.

The forecasting segregated total demands by land use categorization, and aligned them with bases found in the utility planning references utilized by the cities of Charlotte and Raleigh that plan for large capital facilities to support future demands in their service areas based upon empirical evidence of sewer generation for various classes of land use or occupancies. It is expected that the intrinsic nature of development in Catawba County will not vary significantly from other jurisdictions with comparable land use categories and, therefore, their reference data appears reasonable to utilize.

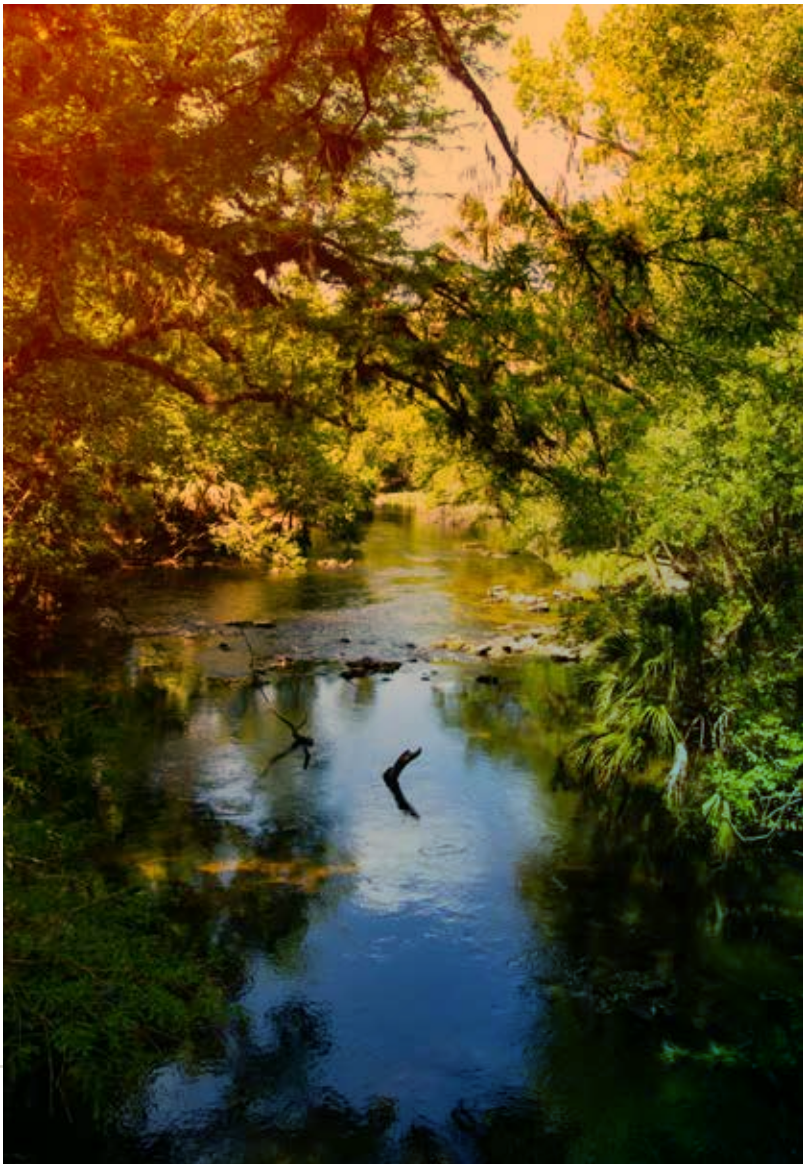


Figure 3.1 illustrates the County's current, approved development projects, most of which are in very early stages of completion.

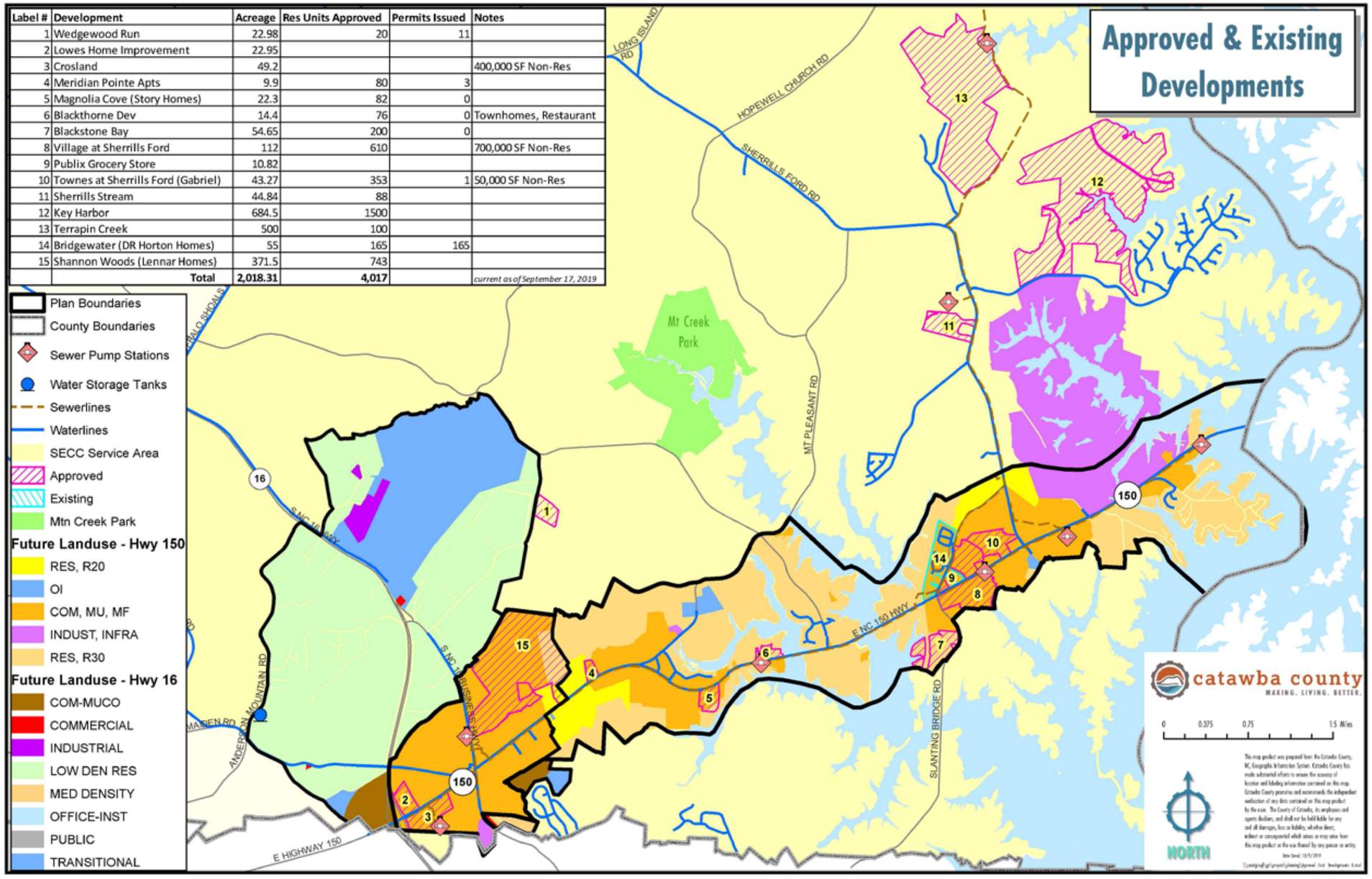
This results in development of a reference demand generation table stratified by land use classes and presented in Table 3.1.

Table 3.1 – Zone Categories

CATAWBA CO. GEN ZONING DISTRICTS	WW (GPD/AC)	WATER (GPD/AC)
Residential (R-80)	100	120
Residential (R-40)	200	240
Residential (R-30)	300	360
Residential (R-20)	400	480
Residential (R-15)	600	720
Residential (R-12)	720	864
Residential (R-10)	880	1056
Residential (R-7)	1240	1488
Rural Conservation (RCon)	40	48
Rural Commercial (RC)	871	1045
Highway Commercial (HC)	1452	1742
Office-Institutional (O-I)	871	1045
Light Industrial (LI)	1452	1742
General Industrial (GI)	1742	2091

Figure 3.1 – Approved and Existing Developments Map

Label #	Development	Acreage	Res Units Approved	Permits Issued	Notes
1	Wedgewood Run	22.98	20	11	
2	Lowes Home Improvement	22.95			
3	Crosland	49.2			400,000 SF Non-Res
4	Meridian Pointe Apts	9.9	80	3	
5	Magnolia Cove (Story Homes)	22.3	82	0	
6	Blackthorne Dev	14.4	76	0	Townhomes, Restaurant
7	Blackstone Bay	54.65	200	0	
8	Village at Sherrills Ford	112	610		700,000 SF Non-Res
9	Publix Grocery Store	10.82			
10	Townes at Sherrills Ford (Gabriel)	43.27	353	1	50,000 SF Non-Res
11	Sherrills Stream	44.84	88		
12	Key Harbor	684.5	1500		
13	Terrapin Creek	500	100		
14	Bridgewater (DR Horton Homes)	55	165	165	
15	Shannon Woods (Lennar Homes)	371.5	743		
	Total	2,018.31	4,017		*current as of September 17, 2019*

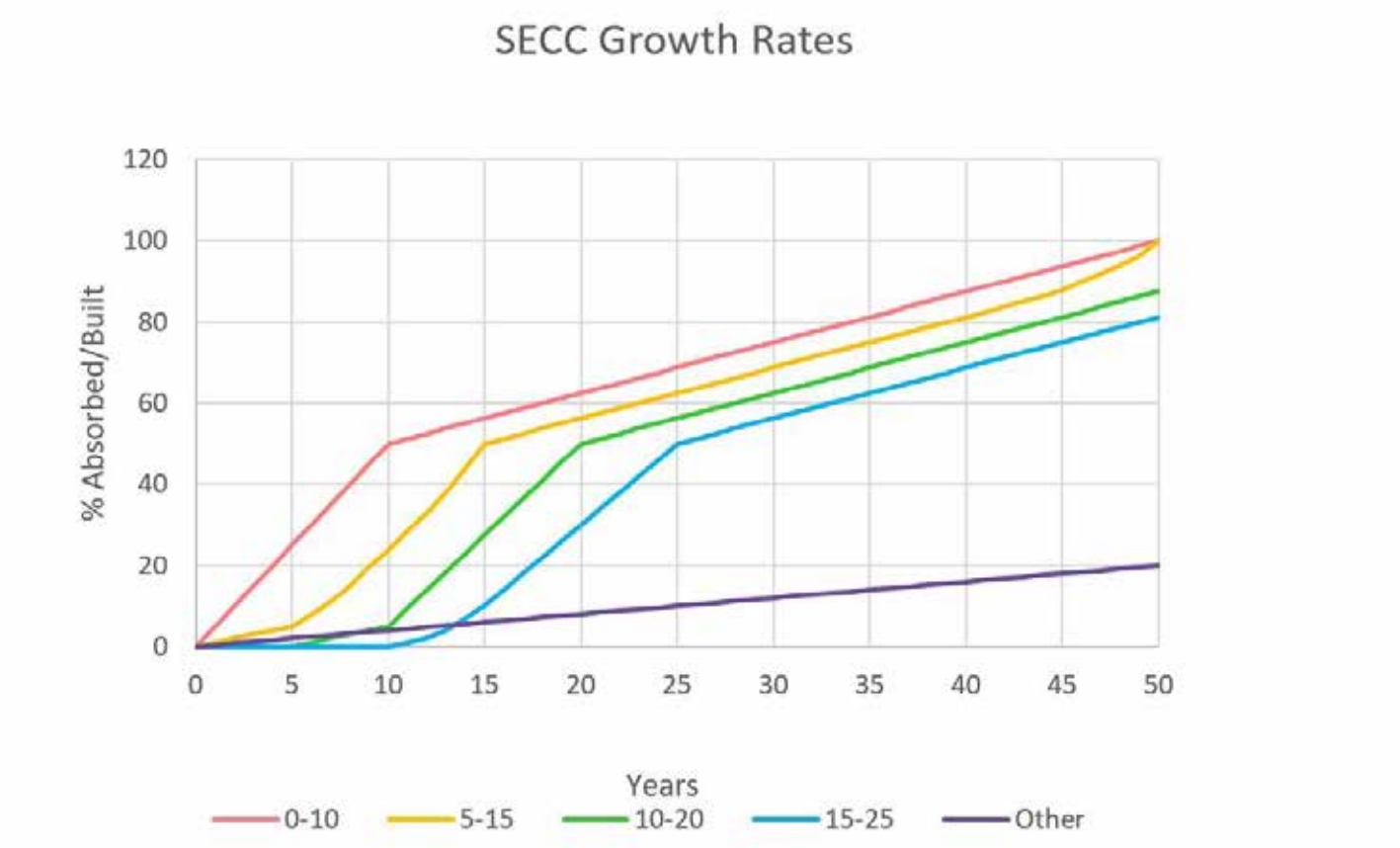


3.1 OPERATIONS CONT.

Ultimate (build-out) demands were established based on the area of each individual parcel and its categorization into a zone. Each zoning classification was assigned an expected sewer volume generated per acre based on generally comparable categories and empirical data within the cities of Raleigh and Charlotte. The sewer loading rates were multiplied by a factor of 1.2 to estimate the water demand rates. See Appendix A for further details on the water and sewer flow distribution/collection.

Finally, most developing areas have generally exhibited some form of an 'S-curve' – a slower beginning period while the growth gets started and gains traction, then a more rapid pace for a period of time, then a flattening of the pace as the area approaches ultimate build-out. However, there is always variance in when this ramping may begin, how long the runway is, how fast and for how long and to what extent does the rapid phase occur, how long the flattening period lasts, and if the area even reaches full build-out, let alone within a reasonable study projection period. Several sets of curves were developed (utilizing independent S-curves for each type of development or time-step) for utilization in scenario development. Ultimately, **Figure 3.2 is the set of S-curves utilized for the pace of growth to be assigned to various land uses and geographical locations.**

Figure 3.2 – Growth Pace



3.1 OPERATIONS CONT.

Multiple scenarios, essentially "alternative futures", were developed by modifying each of these variables (growth pace, time steps, land uses, geographical locations) in multiple combinations. Those combinations were then narrowed to five scenarios considered to be a reasonable range from most optimistic to most conservative. These iterations were a succession of refinements based on collaborative evaluations, and in light of recent changes in conditions associated with near-term development expectations. The scenario selected to be evaluated further will now be referred to as the modeling scenario and is the final iteration of the scenario selected as the most reasonable basis for future demand projections and modeling for support requirements.

Table 3.2 presents the water demand and sewer flows generation at each significant modeling time step, along with an estimate of the number of equivalent residential units supported by each incremental increase. Current water supply capacity of 1.7 MGD and current wastewater treatment capacity of 0.75 MGD is sufficient to support over 3,000 new equivalent residential units. These flow projections have formed the basis for determining the likely infrastructure improvements necessary to support this growth and were used to model the infrastructure improvements necessary to support adequate services; this is presented in detail in Appendix A.

Table 3.2 Modeling Scenario - Future Flow Projections

MODELING YEAR	WATER	WASTEWATER	INCREMENTAL EQUIVALENT RESIDENTIAL UNITS	TOTAL EQUIVALENT RESIDENTIAL UNITS
	ADF (MGD)		ERUs (1)	
EXISTING	0.236	0.036	-	1,000
5	1.00	0.67	3,000	4,000
10	2.20	1.67	5,000	9,000
15	3.75	2.97	6,000	15,000
20	4.97	3.98	5,000	20,000
ULTIMATE	18.96	15.64	75,000	76,000

Figure 3.3– Growth Pacing Map (modeling scenario)

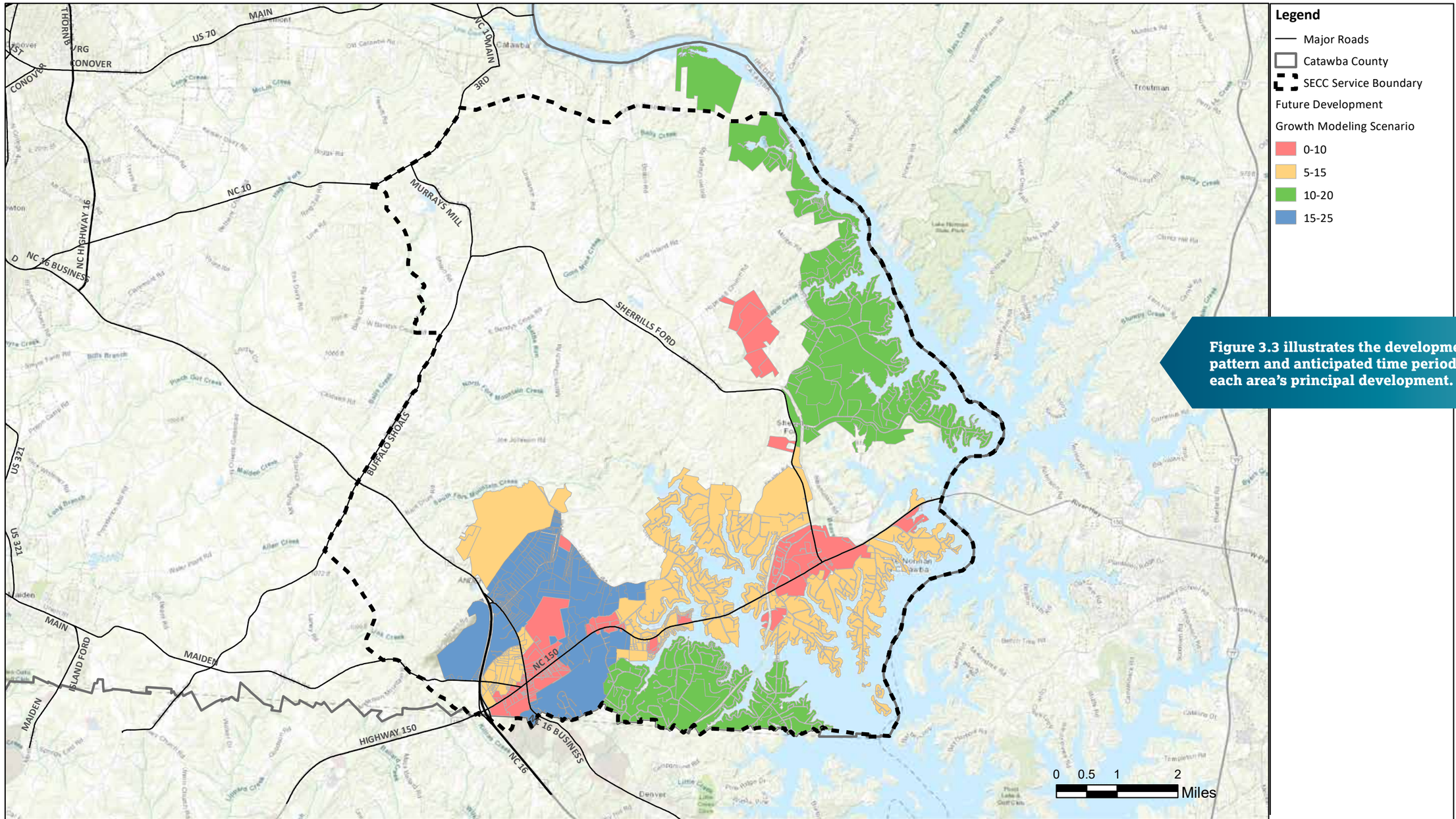
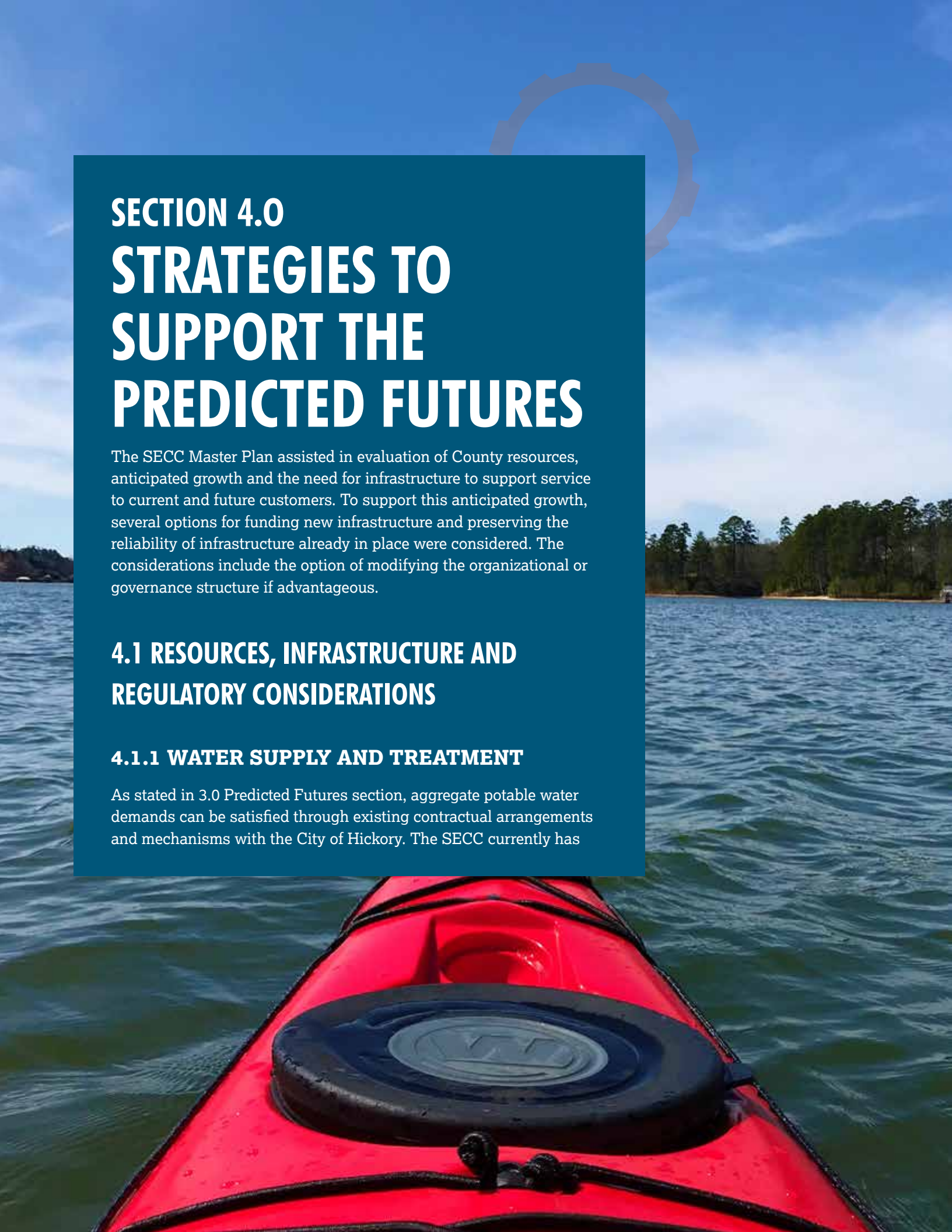


Figure 3.3 illustrates the development pattern and anticipated time period of each area's principal development.

Southeast Catawba County Growth Pacing Map			
Prepared For: Catawba County	October 2019	**Map Disclaimer: This product is for informational purposes only and is based on some unverified information provided by others. This product has not been prepared for nor is it suitable for legal, engineering, or surveying purposes. It represents only the approximate relative location of property boundaries. McKim & Creed, Inc. assumes no liability or damages due to inaccuracies, errors or omissions.**	1 inch = 1.5 miles

McKIM&CREED
8020 TOWER POINT DRIVE
CHARLOTTE, NC 28227
PH: (704) 841-2588



SECTION 4.0
STRATEGIES TO SUPPORT THE PREDICTED FUTURES

The SECC Master Plan assisted in evaluation of County resources, anticipated growth and the need for infrastructure to support service to current and future customers. To support this anticipated growth, several options for funding new infrastructure and preserving the reliability of infrastructure already in place were considered. The considerations include the option of modifying the organizational or governance structure if advantageous.

4.1 RESOURCES, INFRASTRUCTURE AND REGULATORY CONSIDERATIONS

4.1.1 WATER SUPPLY AND TREATMENT

As stated in 3.0 Predicted Futures section, aggregate potable water demands can be satisfied through existing contractual arrangements and mechanisms with the City of Hickory. The SECC currently has

1.7 MGD committed, with an option for an additional 3.3 MGD, bringing total supply to 5 MGD. This closely matches the forecast demand in 20 years. Further, studies performed for the Catawba-Wateree Management Group indicate that the raw water supplies utilized by the City of Hickory exhibit a safe yield lifespan in excess of 100 years, so further expansion of those supplies to meet demands in the future appears reasonable. Worth noting is that the SECC is fortunate to have adequate water resources that can be made available to current and future customers.

4.1.2 WASTEWATER TREATMENT

Treatment service for the SECC service area is currently provided by the Hickory-Catawba WWTP up to 0.75 MGD. This is 50 percent of the total 1.5 MGD currently-constructed capacity. The WWTP's NPDES permit allows for phased/staged construction to expand the plant discharge to 3.0 MGD. Contractually, this capacity expansion is available to the SECC subject to cost determination and contribution. The plant construction was configured to facilitate this expansion; this alternative is the most cost-effective option given the lack of other external or regulatory drivers.

4.1.3 REGULATORY CONSIDERATIONS

For wastewater treatment, in many parts of the state, much more restrictive limitations have been or are in the process of being applied – particularly for nutrients. The recent High Rock Lake pilot study has been completed and is expected to inform future regulations to be applied at other lakes, reservoirs, and impoundments. However, it may be as much as 10 years in the future to develop and apply state-wide rules. In addition, future regulations are expected to be applied on a site-specific basis (conditioned upon a site-specific analysis to be performed to demonstrate conditions which warrant more aggressive pollutant management strategies). Given the current relatively relaxed permit limitations and health of the receiving waters, it is at least uncertain, if not unlikely, that more restrictive permit limits will be on the regulatory horizon within the next 10 to 15 years.

4.1.4 WATER RECLAMATION

With assurance of a reliable and economical water supply, there is little incentive for implementing a significant water reuse program as an alternative to increased discharge capacity. From a high-level perspective, water reuse is already being accomplished given the wastewater plant returns flow to the same water body from which it is withdrawn, and prior to other water users in that basin. The Catawba-Wateree Management Group is concerned about consumptive uses in the basin impacting safe yields available to downstream users, which further deters implementing certain forms of water reuse.

It is expected that further expansion of the Hickory-Catawba WWTP will remain the most reasonable course of action to provide additional capacity for the foreseeable future.

4.1.5 WATER DISTRIBUTION & WASTEWATER CONVEYANCE SYSTEMS

In the case of both the water distribution and wastewater collection systems, both are configured in an extremely linear fashion. Generally, water is supplied at "point A" and moved linearly across the SECC service area to consumptive uses at "point B". Ideally a water distribution system may consist of multiple feed or entry points and multiple cases of looped distribution lines and very limited 'dead ended' distribution lines. However, the SECC population and projected growth is configured in a linear fashion along major thoroughfares, dictating a similar linear system of distribution pipelines. Similarly, wastewater is collected at the extremity of the service area and moved linearly across the area to its destination at the treatment plant at the opposite extreme of the service area. There are no feasible additions of multiple water supply points at interspersed locales within the service area, nor any incentive nor reasonable opportunity to create decentralized wastewater treatment and disposal facilities in multiple locales. Therefore, there are no 'alternatives' per se in the form of alternate means of distributing water or conveying wastewater beyond the progressive reinforcement and expansion of the linear distribution and conveyance infrastructure. This systematic reinforcement and expansion is detailed in "Appendix A Hydraulic Modeling" and referenced/ incorporated in the Revenue Sufficiency Analysis (RSA) in Appendix B.

4.2 FINANCIAL STRATEGIES

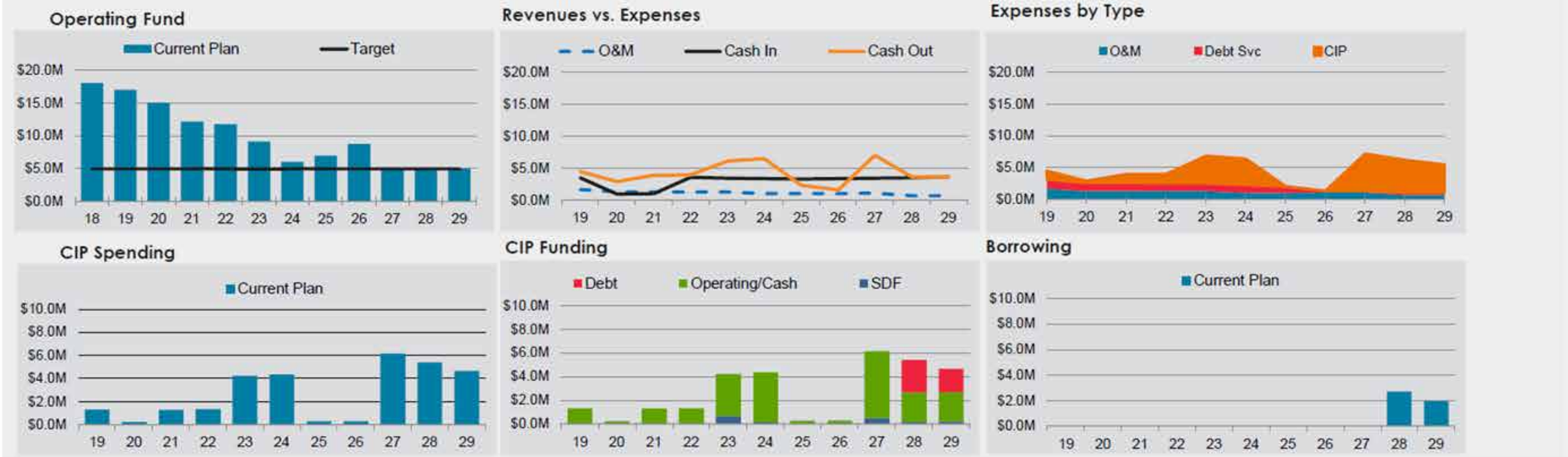
The approach to evaluation of financial resources to support infrastructure needs is presented in the Appendix B. This strategy to validate revenue sufficiency conservatively estimates the revenue generated, and anticipates the need to initiate investments to complete infrastructure projects ahead of the official target date needed. It should be noted that the itemization and timing of infrastructure improvements in Appendix A's Water and Wastewater Master Plan-Hydraulics and Improvements does not exactly match the capital improvement planning expenditures forecast in the Revenue Sufficiency Analysis (RSA). The actual need for these improvements will be driven entirely by the actual growth pace and locations over the planning period. While the document does anchor to one particular 'predicted or alternative future', these two appendices utilize slightly different infrastructure investments timing - yet both are conservative. Improvements presented in the "Hydraulic Modeling" appendix reflect a possibly quicker response to growth. The "Revenue" appendix (Appendix B) utilizes a modestly slower implementation of certain improvements. As the reasoning and impacts are more closely related to financial conservatism, it will be more fully discussed in the following Finance section.

A principal objective of this study is to place the SECC service area on a path to operating as a self-sufficient enterprise, with a reduction in reliance on transfers from the General Fund. Concurrent with that, the intent is to more closely align the costs of service and operating with the revenue generated or to be generated by the actual direct beneficiaries of that service. In concert with the recently adopted System Development Fee structure, the Revenue Sufficiency Analysis incorporates current financial status and practice, and predicted future conditions; and demonstrates progress toward and achievement of those goals by the end of the first 10-year forecast period. This was done without any non-inflationary increases in user charges, and without any increase in System Development Fees. It also incorporated a very conservative moderating of the growth projections presented in the 3.0 Predicted Futures section, while keeping with a fairly aggressive implementation of capital improvements within a 10-year CIP planning horizon. Certain water and wastewater improvements on the cusp of the 10-year window were left outside that window with respect to the CIP built into the Revenue Sufficiency Analysis (as projections and CIP implementation are already aggressive.) Further capital expenditures are warranted only in the service of that actual growth materializing.

> **The Revenue Sufficiency Analysis demonstrates sufficiency with an aggressive CIP, coupled with very conservative growth/customer, increased strong financial solvency, and validation that growth will only enhance and bolster the revenue sufficiency of the SECC service area.**

Figure 4.1 Financial Analysis Dashboard

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2023	FY 2028
Override ▶	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	Cumulative	
Water Rate Plan	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	10.38%	21.85%
Override ▶	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%		
Sewer Rate Plan	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	10.46%	21.93%
Total Residential W&S Bill	$109.56	$111.72	$113.95	$116.27	$118.61	$120.99	$123.44	$125.90	$128.40	$130.92	$133.53		



4.3 GOVERNANCE

Historically, Catawba County has been implementing infrastructure investments and improvements in all areas of the county under the auspices of the current County government structure. With the breadth and depth of current investments in the SECC and the anticipated magnitude of growth in that area, an alternative organization and governance structure unique to the SECC was evaluated to facilitate a more efficient and equitable structure for continued growth and operation. North Carolina general statutes authorize multiple organizational options to govern and manage water and sewer systems. Summarily, these options are:

- City/Municipal
- County
- Interlocal Contract
- Joint Management Agency
- County Service District
- Sanitary District
- Water and Sewer Authority
- Metropolitan Water District
- Metropolitan Sewerage Authority
- County Water and Sewer District
- Private Nonprofit Associations

Figure 4.2 illustrates the distribution of NC organizational structures currently (2018) in place.

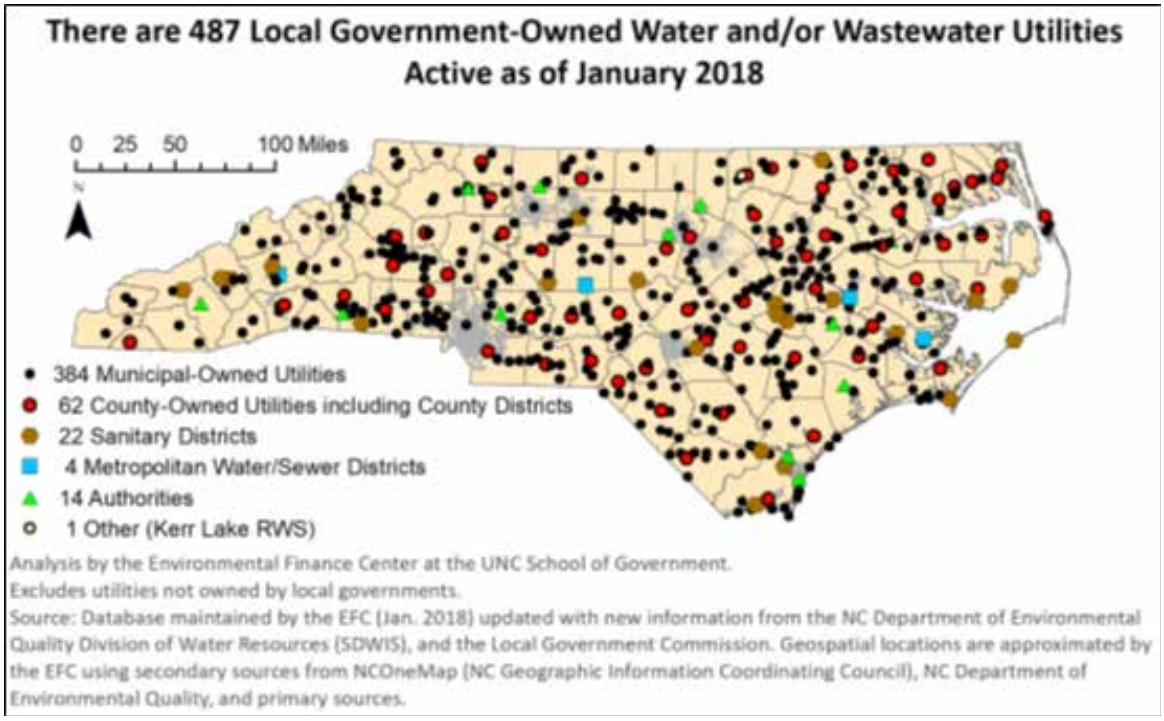
Each of these organizational structures is endowed with a wide array of powers and authorities, and subject to certain restrictions and constraints. While there is commonality among these powers and the nature of these restrictions, there are also exceptions and cases of unique applicability. Some of the more important and relevant of these are:

- Governing Body
- Access to Funding Sources
- Facilitate Boundary Modifications
- Special Assessment Authority
- Condemnation Power
- Mandatory Connections
- Taxation

Over the years the statutes have been modified and amended, largely normalizing and removing certain powers (mandatory connection capability among the most significant.) Table 4.1 illustrates a comparison of each structure and certain powers granted or withheld.

After a collaborative review, examination, and discussion, it has been determined that **the formation of a County Water & Sewer District is the most advantageous structure to implement in this situation**. Rules and regulations governing this organizational structure are set forth in NCGS 162A (included herein as

Figure 4.2 North Carolina Water and/or Wastewater Utilities



Appendix D,) which also establishes the procedure and activities required in order to develop and implement this governance structure.

In deciding whether to adopt an alternative governance structure for the SECC service area, there are various factors to consider that include eligibility differences with respect to reimbursement for costs to relocate utilities within an NCDOT highway project, and the ability to effect changes to rate-setting policies within the SECC different from those implemented throughout other parts of the County.

With the NCDOT Highway 150 expansion (and attendant significant utility relocation requirements) imminent, the advantage of an alternative structure is attractive; but recent developments may have diminished the urgency attractiveness of implementing this option. First, the Highway 150 project timeline was delayed; and second, in the wake of recent legislation modifying the basis for utility relocation cost-sharing on NCDOT projects, these utility relocations appear to be considered more critically and conservatively, and may reduce the frequency and magnitude of required relocations and their attendant cost. That said, the Hwy 150 project will proceed eventually, and broader relief from relocation costs appears unlikely in the near term. Nonetheless, it will be important to monitor if and how there may be any change in the policies or implementation of utility relocations.

While the County currently has no urgent financial deficiencies or incentives that may drive a short-term action to create significantly different rate-setting or fee-setting structures within the SECC apart from the remainder of the County. While the County currently has no urgent financial deficiencies or incentives that may drive a short-term action to create significantly different rate-setting or fee-setting structures with the SECC apart form the remainder of the County, this flexibility may be desired as future development partners unfold further. an alternative structure speaks to over-arching goals of establishing greater equity and alignment of costs with beneficiaries.

> **While each of the foregoing situations may diminish or defer the immediate value of an alternative structure, there is still substantial value in serving internal goals and objectives, even in the current absence of any greater external drivers, and it is recommended to proceed with District formation.**

Over the years the statutes have been modified and amended, largely normalizing and removing certain powers (mandatory connection capability among the most significant.) Table 4.1 illustrates a comparison of each structure and certain powers granted or withheld.

Table 4.1 Summary of Powers Available To Different Organizational Arrangements Used In Providing Water And Sewerage Services In NC

SUMMARY OF POWERS AVAILABLE TO DIFFERENT ORGANIZATIONAL ARRANGEMENTS USED IN PROVIDING WATER AND SEWERAGE SERVICES IN NC										
	CITY / COUNTY	INTERLOCAL CONTRACT	JOINT MANAGEMENT AGENCY	COUNTY SERVICE DISTRICT	SANITARY DISTRICT	WATER & SEWER AUTHORITY	METROPOLITAN WATER DISTRICT	METROPOLITAN SEWER DISTRICT	COUNTY WATER AND SEWER DISTRICT	PRIVATE NONPROFIT ASSOCIATIONS
General corporate powers: own property, sue, be sued, etc.	YES	YES; can hold legal title	YES; cannot hold legal title	NO	YES subject to approval	YES	YES	YES	YES	YES
Own, extend, operate W/S systems	YES	By units	YES; cannot hold legal title	County	YES	YES	Not sewers in MSD	Sewers Only	YES	YES
Acquire W/S systems by purchase, lease, gift, etc.	YES	By units	YES; cannot hold legal title	County	YES	YES	Not sewers in MSD	Sewers Only	YES	YES
Construct W/S systems	YES	Under contract	YES	County	YES	YES	Not sewers in MSD	Sewers Only	YES	YES
Require installation of W/S in new subdivisions	YES	YES	NO	County	NO	NO	NO	NO	NO	NO
Contract with local governments	YES	YES	YES	County	YES	YES	YES	YES	YES	YES
Eligible for state and federal grants	YES	To units	YES	County	YES	YES	YES	YES	YES	Some
Issue revenue bonds	YES	By units	NO	County	YES	YES	YES	YES	YES	YES
Establish rates and charges	YES	By units	NO	County	YES	YES	YES	YES	YES	YES
Exempt from NCDOT Utility Relocation Cost	Conditional/Partial	Conditional/Partial	Conditional/Partial	Conditional/Partial	YES	YES	YES	YES	YES	YES
Rates regulated by Utilities Commission	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Levy property taxes	YES	Most units	NO	County	YES	NO	YES	YES	YES	NO
Issue general obligation bonds	YES	Most units	NO	County	YES	NO	YES	YES	YES	NO
Impose special assessments for extensions of lines	YES	Most units	NO	County	If pop >15,000	YES	NO	NO	YES	NO
Power of condemnation	YES	Most units	NO	County	YES	Sometimes need approval	YES	YES	YES	YES
Regulate land subdivision	YES	City or county	NO	County	NO	NO	NO	NO	NO	NO
Zoning power	YES	City or county	NO	County	Conditional	NO	NO	NO	NO	NO
General police powers	YES	YES	Dependent on agreement	Specific	NO	NO	NO	NO	NO	NO
Provide other public services	YES	YES	Dependent on agreement	Specific	Specific	NO	NO	Specific	NO	YES
Require connections	YES	City or county	City or county	County	Conditional	NO	NO	YES	NO	NO

4.4 POLICY STRATEGIES

Regardless of the consideration to change the government structure, the need to maintain financial health leads to the need to evaluate current policy and develop new policies that will support economic growth and maintain utility service reliability.

Currently the County has a broad set of ordinances and policies that address various aspects of new development projects. To the extent practical, the County has expressed a desire to develop or modify policies and ordinances which provide a more uniform basis for government actions with respect to development requests, while also providing developers and the public at large with a clearer understanding of roles and responsibilities that help to guide their own actions.

The Board of Commissioners broad policy objectives include:

1 | Policy Framework: Rooted in fairness and shared risk. Those who benefit from the infrastructure, pay for that infrastructure.

2 | Financial Solvency: Move the Water and Sewer Fund to self-sufficiency and away from General Fund transfers.

3 | Framework Supporting Shared Participation:

- **Developers: Performance-and-incentive-based reimbursement mechanisms**
- **Citizens: Petition-driven pathway to funding**

As projects can vary widely in nature and scope, it is not possible to develop static guidelines that are fully applicable nor sufficient in their entirety for all projects. Policies can address many common, if not universal, aspects while also providing for sufficient flexibility and adaptability to address unique aspects on an individual basis.

(1) CONNECTIONS:

Current policy requires a new development to connect to water and/or sewer utilities when the property is located within a specified proximity to existing utility facilities, which is scaled (shorter or longer distances) based on ultimate allowable density of users based on current zoning of the property. Proximity is an almost universally applied criteria in most jurisdictions and utilities. Often they are predicated on a single fixed distance, and the County's scalability is a significant improvement from that baseline. The County may wish to consider two modifications:

- Provision for the County to require connection even at a distance beyond the prescribed/calculated distance when circumstances may warrant. This could occur when a development otherwise exempt from connection requirement is of a nature or at a location where further future development and extensions would be practical and desired, and this advanced extension would facilitate it. In other cases, this requirement may be warranted to increase system efficiency, reliability, or resiliency.
- The County's sewer system is largely a linear daisy-chained series of pump stations and force mains, and the connection policy doesn't distinguish sufficiently in terms of what infrastructure type the development may connect, nor exactly how. Generally, it is recommended to discourage manifolded pump stations and connection to force mains (especially small and/or privately-owned connecting facilities) as that introduces both operational and liability issues. Rather, the policy should apply the proximity criteria (or a modified version) to gravity segments or pump stations themselves; and provide for creation of publicly-owned and managed strategically-located pump stations and gravity segments.

(2) INFRASTRUCTURE AND COST RESPONSIBILITY:

Current County policy makes any utility infrastructure within the development itself to be the sole responsibility of the developer, as well as any required new or expanded infrastructure off-site (sized for what is necessary for service to this development.) The County has the right to mandate an increase in sizing of the off-site infrastructure when it may be necessary to provide service to additional development in that area, and the County will reimburse the developer that marginal cost of over-sizing. This is a common practice and should be retained. The County may consider amending the policy to address:

- Provisions to require utility line extension to continue along the entire road frontage of the development's property rather than only requiring it to the nearest convenient point of connection.
- Provisions to oversize specific utility infrastructure within the development, usually to extend service

beyond that development's furthest boundary.
- Development proposals may occur at locations or at times that require system improvements that are not present within the then-current CIP, or present but at a much later date than needed. Policy modifications should provide for the opportunity to execute these projects, but remain consistent with policies for allocating and recovering capital costs.

(3) CURRENT POLICY

Current policy provides for reimbursement to the developer of eligible cost-sharing proceeds (marginal over-sizing) at the time of construction completion. Generally, this is more developer-friendly than many other jurisdictions have implemented. It is more common to reimburse on a performance basis by passing through fees collected from other new development using those oversized facilities, and only as they are collected. They also often incorporate a sunset date at which point no further reimbursement occurs—even if the full amount has not yet been generated and disbursed.

Reasonable modifications may include:
- Reimburse planned CIP projects on performance basis using line-specific revenue, with final payment to developer occurring on original CIP funding schedule.
- Offer performance-based reimbursement for non-planned CIP projects using line-specific revenue for specified time period.

While not as generous as current policy, these policy changes further the goal of self-sufficiency, and are typical of many other jurisdictions.

(4) SERVICE TO EXISTING DEVELOPMENT

At present the County has no official policy which would dictate how existing development may be provided utility service. Generally, the drivers for this initiative are impaired or inadequate potable water wells, failing on-site septic systems, or degraded surface water or groundwater quality. There are prescriptive provisions in the North Carolina General Statutes for the governing body to implement corrective measures in the case of significant public health or environmental health concerns. In the event interest in service is expressed by residents, but in the absence of these health concerns, there must be provisions for voluntary connection of a magnitude sufficient to assure revenue generation will support the capital and operating expense of that newly serviced area.

> **One long-established methodology is through creation of a Special Assessment District (SAD), and there are alternative protocols which have been used to ensure viability in setting up rural water districts that could be adapted for either water or sewer service.**

SECTION 5.0

CONCLUSIONS & RECOMMENDATIONS

5.1 OPERATIONS & INFRASTRUCTURE

The prior investments and current systems and infrastructure will support projected growth for several years. Further actions and investments will be required as growth continues, or circumstances change. Those investments are only necessary to support actual growth, and they can be funded adequately while moving to a self-sufficient service area or district.

5.1 OPERATIONS & INFRASTRUCTURE

5.1.1 WATER SUPPLY

As aggregate water demand within the SECC approaches its current allocation of 1.7 MGD, the County should exercise its option with the City of Hickory to commit the additional 3.3 MGD, bringing total commitment to 5.0 MGD, and begin discussions regarding long-term increase beyond that amount. Rather than budgeted as a lump sum project but with an inexact date, initiate an annual budgeted amount directed toward the eventual exercising of this option (analogous to current practice with respect to the eventual expansion of the Hickory-Catawba WWTP.)

5.1.2 WASTEWATER TREATMENT

As actual wastewater originated within the SECC approaches 80% of its current allocation (0.60 MGD) confirm the SECC's ability to utilize additional excess unused capacity in the Hickory-Catawba WWTP. This potential excess unused capacity has been diminished with the recent Hickory-Claremont agreement to transfer Claremont's waste load to the Hickory-Catawba WWTP for treatment. If or when that excess capacity has been utilized or committed, initiate expansion of the plant under its current NPDES permit to 3.0 MGD. Additionally, at that time pursue an increase in permitted capacity beyond 3.0 MGD, perhaps to 6.0 MGD (time of implementation will depend on the proportion of the 3.0 MGD expanded capacity that can be obligated to the SECC Service area). Continue the current practice of an annual budgeted amount directed toward the eventual expansion of this capacity.

5.1.3 WATER & WASTEWATER CONVEYANCE

Monitor actual development and growth, and update the hydraulic model (at least annually, more frequently in the event of rapid or high-demand growth) to recast the locations and timing of requisite improvements. Begin implementation of requisite system expansions and reinforcements as actual growth magnitudes and locations dictate. Consider proactive design and permitting of likely nearer term improvements so that construction can be timed to more closely align with actual need without risk of delay due to potential regulatory changes or delays.

As a result of this master plan effort a series of improvements and recommendations need to be implemented in order to assist the County with continuing to provide reliable and resilient services. These recommendations are presented in time intervals that may vary depending on the actual quantity and distribution of the growth.

WATER DISTRIBUTION SERVICE RECOMMENDATIONS PER PLANNING PERIOD

Infrastructure improvements are listed below and grouped by planning periods. For each, the improvements would need to begin within the planning period and be completed near or just after the end of that period. Projects have been assigned to one or two fiscal years dependent upon magnitude; but the potentially unique design, permitting, and construction timeline needs for each project should be considered in the capital improvements planning – perhaps warranting earlier efforts in longer lead activities such as land acquisition or permitting. This would enable the bulk of the expenditure (for construction) to be more closely timed and aligned to support actual growth, and less reliant on projections.

Note that when capital project costs were incorporated in the Revenue Sufficiency Analysis, a uniform additional contingency of 20% has been applied. Also, expenditures for larger projects are expected to be executed over successive fiscal years, and may straddle the end of period cutoff year (e.g. a project may be shown to begin in FY 2023 and extend into FY 2024, and again in years 2028/2029).

PRESENT TO YEAR 2023:

- Complete a water main connection along Old Hwy 16 (approximately 8,000 linear feet (LF) of 12-inch) to extend the current NCDOT portion already under construction and connect the loop with the main on Hwy 150
- Install altitude valves at the Anderson Mountain GST and the Bandy EST for the SW and NE pressure zones (respectively)
- Install four (4) pressure reducing valves (PRVs) at a setting of 80 psi in the following locations:
    - Molly's Backbone Road near Sherrills Ford Road
    - Island Point Road near Sherrills Ford Road
    - Beatty Road near Sherrills Ford Road
    - Highway 150 east of Sherrills Ford Road
- Continue to utilize the four (4) automatic flushing stations (no additional cost) located at:
    - 8693 E Hwy 150
    - Marshall Steam Plant at E Hwy 150
    - Shorelaunch Drive and Anchors Aweigh Lane
    - Gregory Road
- Open the valve that separates the pressure zones (no additional cost)

YEAR 2023 TO YEAR 2028:

- 8,200 LF of 24-inch and 4,500 LF of 16-inch (replacing 12-inch) along Sherrills Ford Road
- Complete a water main connection along Buffalo Shoals Road (approximately 15,000 LF of new 16-inch) to interconnect the SWPZ and NEPZ.
- 1.0 MG of elevated storage tank (EST) near Sherrills Ford Road and NC 150 E
- New booster pump station (5,500 GPM @ 150 ft capacity) for the new EST

YEAR 2028 TO YEAR 2038:

- Upgrade the SWPZ BPS to 6,200 GPM
- Design and construct the replacement of the existing 16-inch water main to 20-inch at E. Maiden Rd.
- Design and construct a new 4.0 MG of storage tank (EST or GST) near Sherrills Ford Rd and Hwy 150 E

Table 5.1 - List of capital improvements and their anticipated cost based on present value (2019).

PRESENT TO YEAR 2023:

DESCRIPTION:	COST:	PAGE :
S NC 16 Water Main - 8,000 LF of 12-inch new water main	$2,500,000	
Anderson Mountain GST and Bandy's EST – Install altitude valves and appurtenance	$70,000	
Sherrills Ford Road - Install PRV stations	$200,000	
(2019) PRESENT VALUE:	**$2,770,000**	

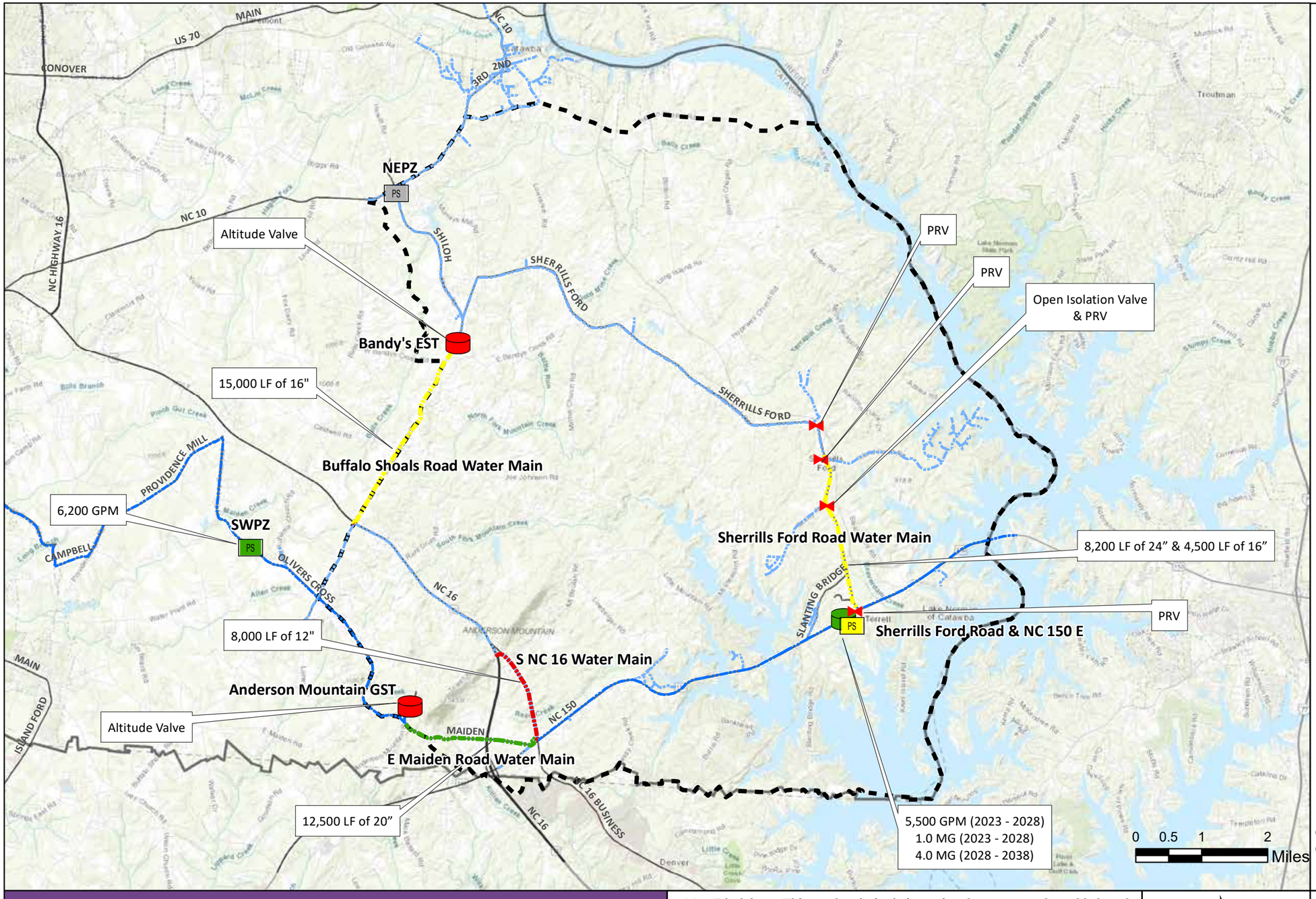
YEAR 2023 TO 2028:

DESCRIPTION:	COST:	PAGE:
Buffalo Shoals Road Water Main – 15,000 LF of 16-inch new water main	$5,100,000	
Sherrills Ford Road and NC 150 E EST – 1.0 MG of elevated storage	$2,900,000	
Sherrills Ford Road and NC 150 E BPS – New booster pump station	$1,580,000	
Sherrills Ford Road Water Main Replacement – Upsize existing 12-inch water main to 8,200 LF of 24-inch and 4,500 LF of 16-inch	$3,780,000	
(2019) PRESENT VALUE:	**$13,360,000**	

YEAR 2028 TO 2038:

DESCRIPTION:	COST:	PAGE:
SWPZ BPS – Upgrade booster station with larger pumps	$1,800,000	
E Maiden Road Water Main – Upsize 12,000 LF of existing piping to 20-inch	$5,040,000	
Sherrills Ford Road and NC 150 E EST/GST – 4.0 MG of additional tank storage	$5,760,000	
(2019) PRESENT VALUE:	**$12,600,000**	

Figure 5.1 – Recommended infrastructure improvements for the water system by planning period.



Legend

Other System Improvements

- Present - 2023

Storage Tank Improvements

- Present - 2023
- 2023 - 2038

Pump Station Improvements

- PS 2023 - 2028
- PS 2028 - 2038
- PS Existing - No Improvements Planned
- Major Roads

Pipe Improvements

- Present - 2023
- 2023 - 2028
- 2028 - 2038

Pipe - No Improvements Planned

- 6" - 12" Diameter Pipe
- 12" - 24" Diameter Pipe
- 24" - 36" Diameter Pipe
- Catawba County
- SECC Service Boundary

Notes:
EST = elevated storage tank
GPM = gallon per minute
GST = ground storage tank
LF = linear feet
PRV = pressure reducing valve

Southeast Catawba County Water Improvements

Prepared For:
Catawba County

January 2020

Map Disclaimer: This product is for informational purposes only and is based on some unverified information provided by others. This product has not been prepared for nor is it suitable for legal, engineering, or surveying purposes. It represents only the approximate relative location of property boundaries. McKim & Creed, Inc. assumes no liability or damages due to inaccuracies, errors or omissions.

N
1 inch = 1.5 miles

McKIM&CREED
1730 Varsity Drive, Suite 500
Raleigh, NC 27606
Ph: (919) 233-8091

WASTEWATER COLLECTION SYSTEM RECOMMENDATIONS PER PLANNING PERIOD

PRESENT TO YEAR 2023:

- Village Center Station Upgrade
- Village Center Force Main Upgrade
- Sherrills Ford Pump Station Upgrade

PRESENT TO YEAR 2023:

DESCRIPTION:	COST:	PAGE :
Village Center Pump Station Upgrade - Upsized pumps, electrical, and wet well	$2,709,000	
Village Center Force Main Upgrade - 19,500 LF of 12-inch force main	$3,330,000	
Sherrills Ford Pump Station Upgrade - Add third pump and associated valves & electrical	$265,000	
(2019) PRESENT VALUE:	**$6,304,000**	

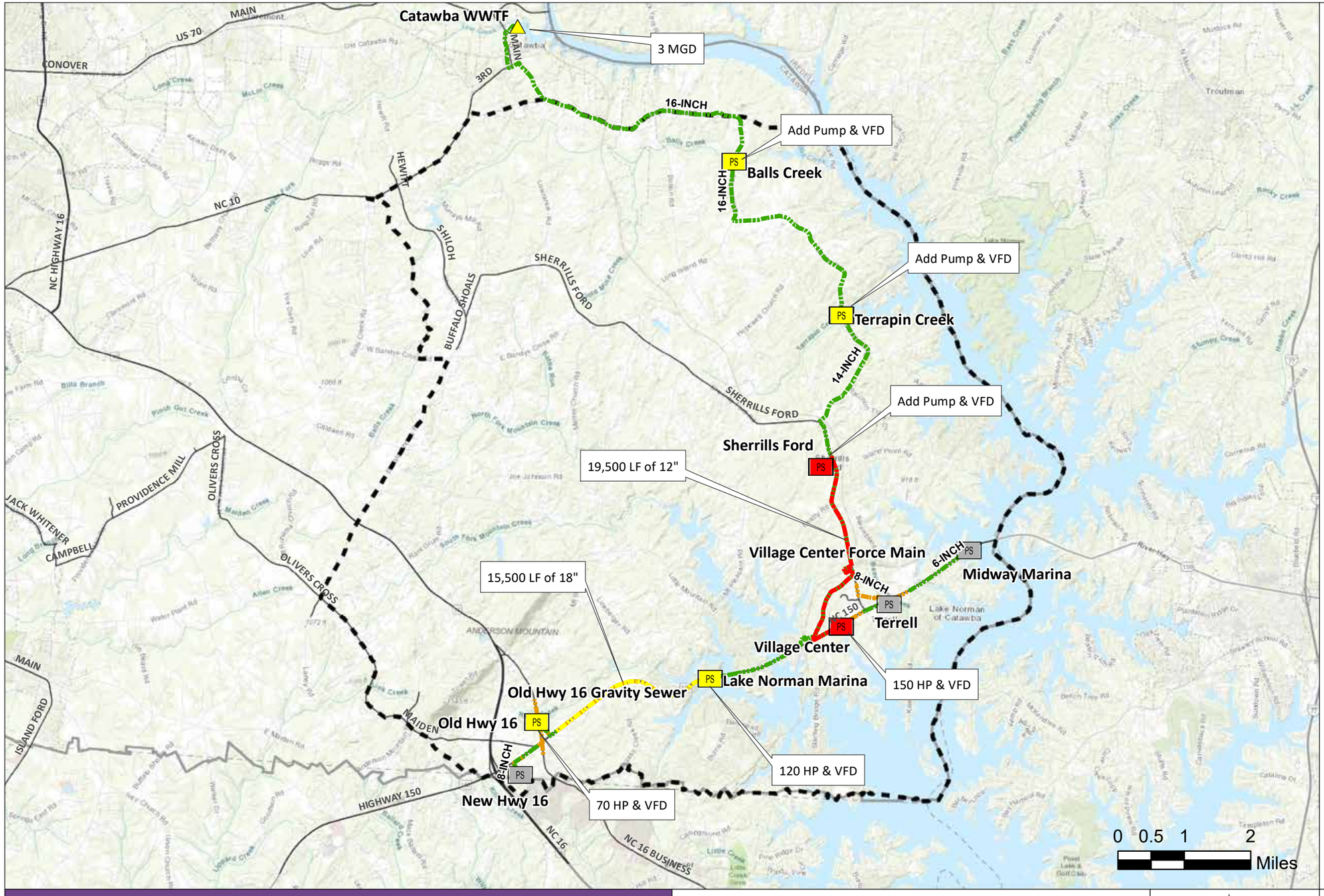
YEAR 2023 TO YEAR 2028:

- Lake Norman Marina Pump Station Upgrade
- Old Highway 16 Pump Station Upgrade
- Old Highway 16 Gravity Sewer Upgrade
- Terrapin Creek Pump Station Upgrade
- Balls Creek Old Pump Station Upgrade

YEAR 2023 TO YEAR 2028:

DESCRIPTION:	COST:	PAGE :
Lake Norman Marina Pump Station Upgrade - Upsized pumps and electrical	$609,000	
Old Highway 16 Pump Station Upgrade - Upsized pumps and electrical	$520,000	
Old Highway 16 Gravity Sewer Upgrade	$3,447,000	
Terrapin Creek Pump Station Upgrade - Add third pump and associated valves & electrical	$315,000	
Balls Creek Pump Station Upgrade - Add third pump and associated valves & electrical	$315,000	
(2019) PRESENT VALUE:	**$5,206,000**	

Figure 5.2 –Recommended infrastructure improvements for the wastewater collection system by planning period



Legend

Pump Station Improvements

- PS Existing - No Improvements Planned
- PS Present - 2023
- PS 2023 - 2028

Catawba WWTF Improvements

- 2023 - 2028

Pipe Improvements

- Present - 2023
- 2023 - 2028

Pipe - No Improvements Planned

- Sewer
- Force Main
- Major Roads
- Catawba County
- SECC Service Boundary

Notes:
HP = horsepower
LF = linear feet
VFD = variable frequency drives

Southeast Catawba County Wastewater Improvements

Prepared For:
Catawba County

October 2019

Map Disclaimer: This product is for informational purposes only and is based on some unverified information provided by others. This product has not been prepared for nor is it suitable for legal, engineering, or surveying purposes. It represents only the approximate relative location of property boundaries. McKim & Creed, Inc. assumes no liability or damages due to inaccuracies, errors or omissions.

N

1 inch = 1.5 miles

McKIM&CREED
8020 TOWER POINT DRIVE
CHARLOTTE, NC 28227
Ph: (704) 841-2588

5.2 FINANCE

The current rates and System Development Fees (SDF) adopted are sufficient to begin a path toward self-sufficiency and reduced or eliminated dependency on general fund transfers. It is recommended to monitor actual growth and operational revenue and expenses, and update the revenue sufficiency model annually. Consider adjustments to System Development Fees within the current calculated approved maximum fees for either more rapid decreasing of general fund transfer, or to fund additional new system reinforcements or expansions to support new growth, or a combination thereof. Consider transitioning to a hybrid method of SDF calculation as major capital expenditures begin to appear warranted within the next approximate five-year period to allow for accumulation of funds for those expenditures.

5.2.1 GOVERNANCE

Forming an alternate governance structure for the SECC service area provides benefits beyond continuing to operate as an extension of County government. A County Water & Sewer District appears to be the most advantageous. While the current financial analyses performed, legislative review studies in progress, and recent legislation and responses have combined to lessen any previously perceived urgency in regard to alternative governance restructure, each of these situations should be monitored in the near term as changes can impact decisions with respect to this restructuring. Irrespective of this, **it still will be prudent to proceed toward alternative structure formation in order further equity among all users and constituents, to be in position to better align costs with beneficiaries, and continue toward self-sufficiency.**

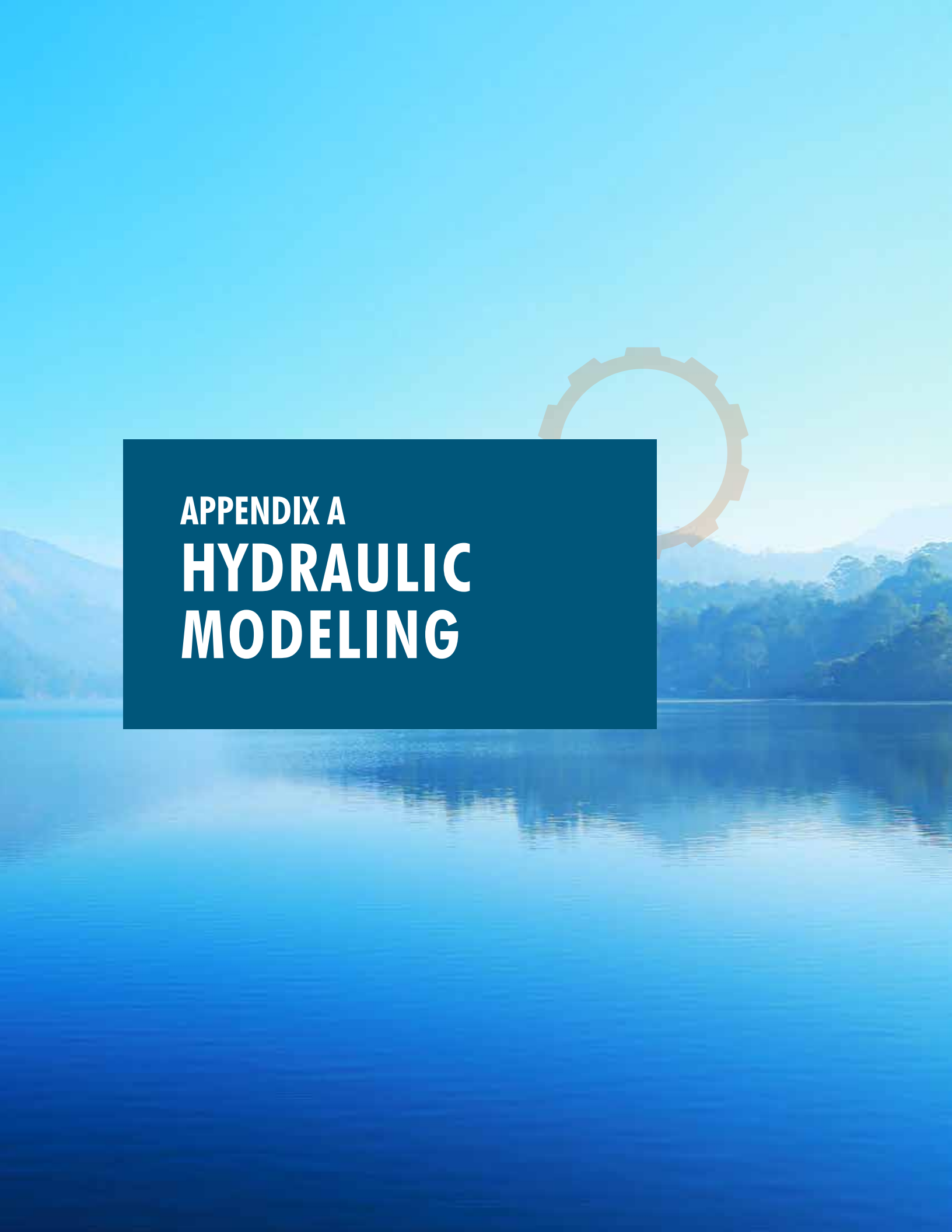
5.2.2 POLICY DEVELOPMENT

It is recommended that policies be amended to better further the adopted policy objectives of:

- Fairness and shared risk
- Financial solvency and self-sufficiency
- Shared participation

This should include:

- Revisions to connection policy to allow for authority to require connection to utility systems at distances beyond current policy when practical to serve future development or required for system efficiency.
- Revisions to extension policy requiring utilities to be installed along the development's entire road frontage (rather than at closest connection point).
- Revisions to reimbursement policy providing for performance-based reimbursement mechanisms for planned CIP projects, and alternate performance-based reimbursement for projects not in the current CIP as may be warranted.
- Creation of a policy providing for a public/citizen-driven mechanism for existing development to acquire utility service(s).



APPENDIX A
HYDRAULIC MODELING

McKIM&CREED
ENGINEERS SURVEYORS PLANNERS

APPENDIX A – HYDRAULIC MODELING

Catawba County

Newton, NC

Date: NOVEMBER 2019

Prepared for:
Catawba County
Government Center
25 Government Drive
Newton, NC 28658

Prepared by:
McKim & Creed, Inc.
8020 Tower Point Drive
Charlotte, NC 28277

McKim & Creed Project # 01215-0003

Table of Contents

TABLES

FIGURES

INTRODUCTION

As part of the SECC (SECC) Master Plan, McKim & Creed developed hydraulic models of the existing water distribution and the wastewater/sewer collection systems within the service area to adequately evaluate the infrastructure needs of the systems. For the water system, the model includes an additional waterline that extends beyond the SECC study area to the Catawba County connection point with the City of Hickory. For the wastewater system, the model also included the force main manifold that extended to the existing wastewater treatment facility (WWTF) located in the Town of Catawba.

The description of how the models were set up, calibrated, and tested for the selected future growth scenarios are described throughout this appendix.

1 WATER DISTRIBUTION SYSTEM HYDRAULIC MODEL

SECC utilizes the southeast portion of the City of Hickory water system. The City of Hickory developed a water model of its entire water system for the West Hickory Elevated Storage Tank Analysis Memo in June 2017. This model was used as the basis for developing a SECC water model. The City of Hickory water system portion of the model was inactivated, and only the SECC system was left active.

Existing pipeline data in the model was verified against available GIS linework. In addition, booster station information including pump curves, tank sizes, and station piping were verified using available record information. The SECC connections to both the City of Hickory and the City of Conover water mains were represented in the model by fixed head reservoirs. The pressures at these reservoirs were set manually based on the range of pressures recorded during hydrant pressure readings taken from November 8, 2017 to November 17, 2017. The results of the hydrant pressure reading are summarized in **Table 1.1**.

Table 1.1 - Summary of Hydrant Pressure Readings

	Pressures near City of Hickory Connection	Pressures near City of Conover Connection	Pressures at NC 150 Hwy. and Sherrills Ford R.
Location	Beverly St.	Shiloh Road	Sherrills Ford Road
Minimum Reading	179.2 psi (1265 ft)	45.6 psi (1082 ft)	131.0 psi (1158 ft)
Average Reading	194.6 psi (1301 ft)	83.0 psi (1169 ft)	161.0 psi (1227 ft)
Maximum Reading	213.6 psi (1344 ft)	102.8 psi (1215 ft)	180.6 psi (1272 ft)

Flow measurements during the time of the pressure readings were not available. However, the City of Hickory provided SCADA data for the water levels in the water storage tanks during that same time period. This information can be used as an indication of the magnitude of water demand over time and

can serve to compare with model results. The changes in water levels are represented in **Figure 1.1** and **Figure 1.2**.

Figure 1.1 - SCADA Data for Bandy's Elevated Water Storage Tank in November

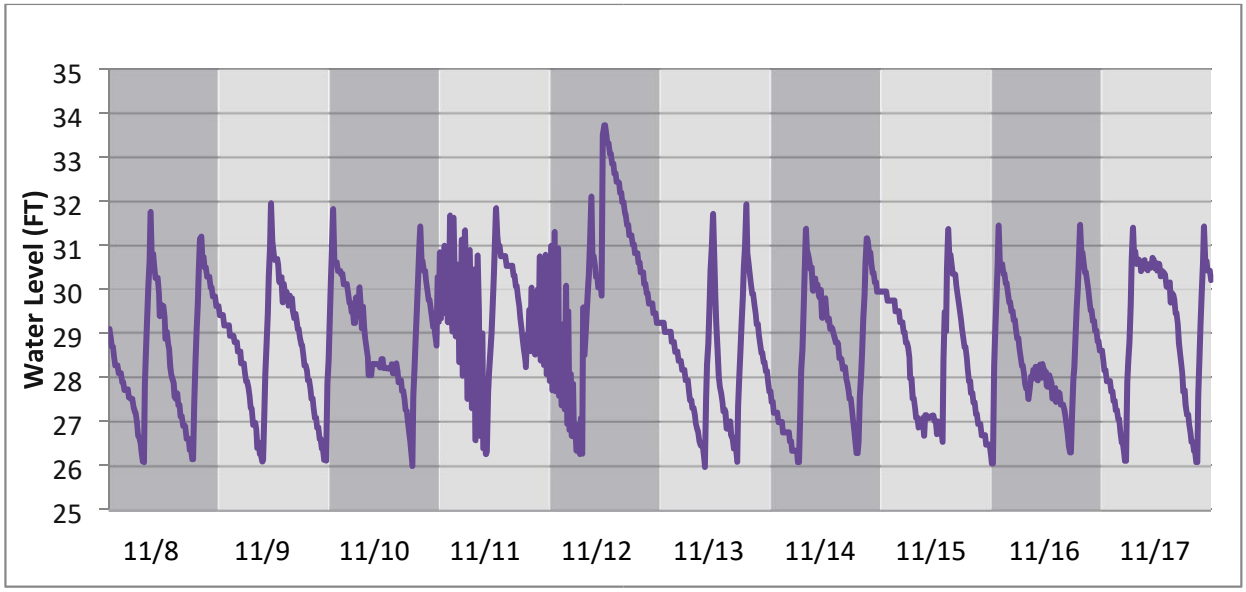
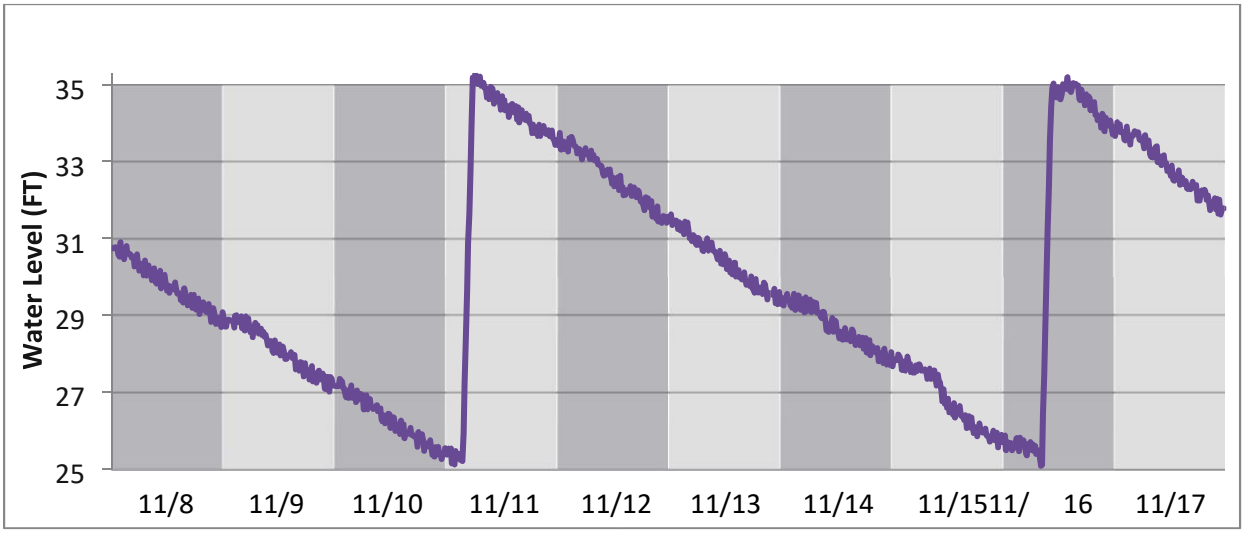


Figure 1.2 - SCADA Data for SWPZ Ground Water Storage Tank in November 2017



The system elements include two booster pump stations, two water storage tanks and pipe. Existing pipe diameters were verified using available GIS linework for the system. The properties of the two booster pumps stations and water storage tanks were modified based on available record drawings and pump

curves provided by the County. The data from the County resources are summarized in **Table 1.2** and **Table 1.3**.

The SECC water system is split into two regions: the South/West pressure zone (SWPZ), serving the western and southern portions of the SECC, and the North/East pressure zone (NEPZ), serving the eastern and northern portions of the SECC. The SWPZ region begins at the connection with the City of Hickory 36-inch water main on Startown Road and Kirsten Street, and then ends at a normally closed isolation valve that splits the SWPZ and NEPZ regions. The isolation valve is located near the intersection of Sherrills Ford Road and Beatty Road. The NEPZ region begins at the connection with the City of Conover 12-inch water main on NC Highway 10 and Shiloh Road, then ends at the isolation valve that separates the SWPZ and NEPZ regions. These features of the SECC existing water system can be seen in **Figure 1.3.**

Table 1.2 – Summary of County Data for Booster Pump Stations

	SWPZ Booster Pump Station	NEPZ Booster Pump Station
Elevation (ft)	1,012	973.5
No. of Duty Pumps	2	1
No. of Standby Pumps	1	1
Design Flow - each (gpm)	1,700[1]	700
Design Flow - each (MGD)	2.45[1]	1
Design Head (ft)	63[1]	195
Rated Capacity - Each (gpm)	2,850	700
Rated Capacity - Each (MGD)	4.11	1
Rated Head (ft)	75	195
HP	75	60
Drive	VFD	Constant Speed
Type	Horizontal Split Case	Horizontal Split Case

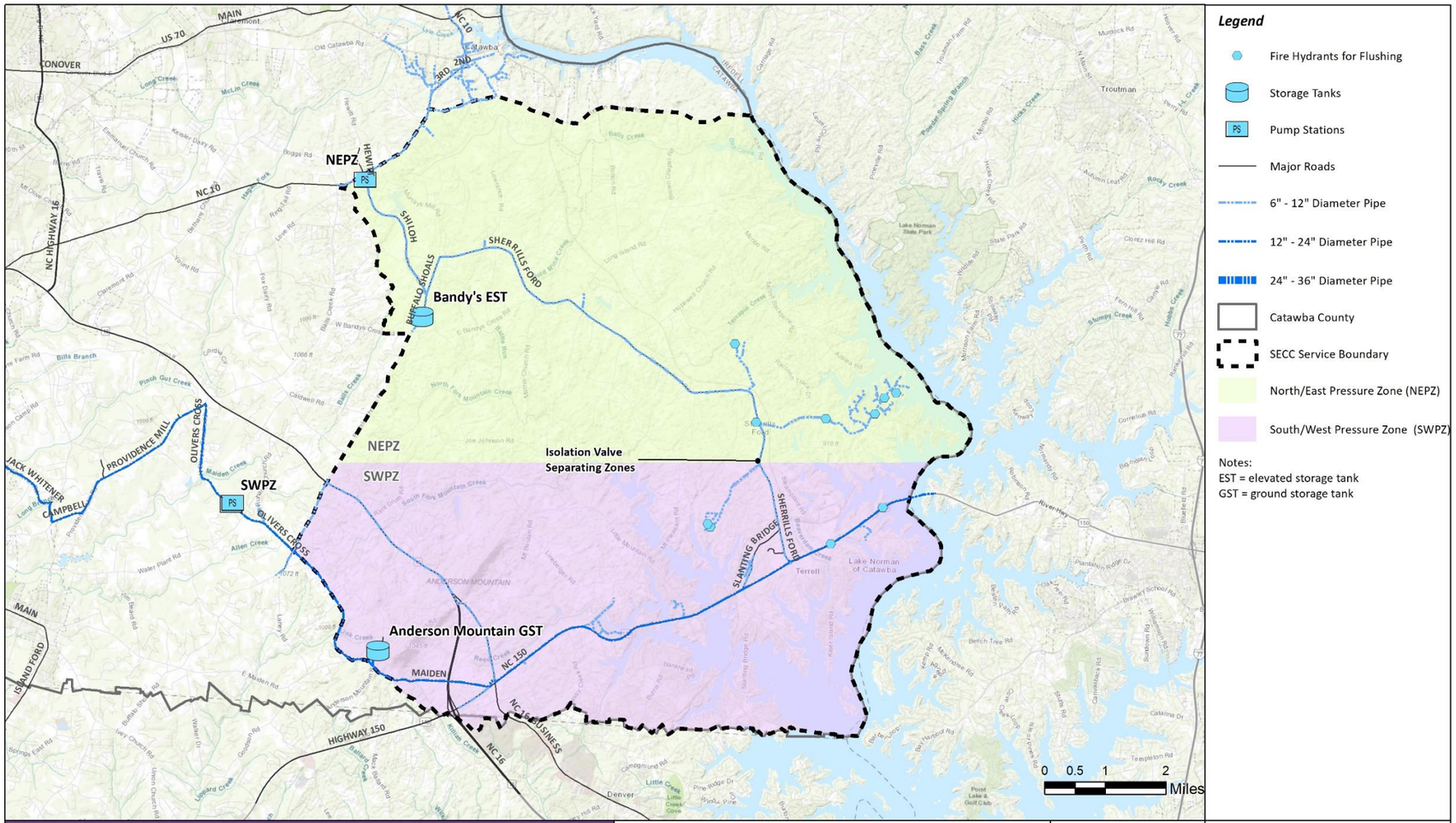
[1]These numbers were inferred from the pump test data provided in the booster station O&M manual.

Table 1.3 – Summary of County Data for Water Storage Tanks

	Anderson Mountain GST	Bandy's EST
Volume (MG)	1	0.5
Diameter (ft)	65	50
Ground Elevation (ft)	1,195	1,030.17
Tank Bottom Elevation (ft)	1,195	1,195
High Water Elevation (ft)	1,235.33	1,232.17

The existing water demands for SECC were estimated from water usage data provided by the City of Hickory for January through December 2017. This data was imported into the water model and the demands were allocated to the nearest junction. The resulting existing water demands by region are summarized in **Table 1.4**. These demands do not include the volume of water the flushes periodically to maintain water quality.

Figure 1.3– SECC Existing Water System



Legend

- Fire Hydrants for Flushing
- Storage Tanks
- Pump Stations
- Major Roads
- 6" - 12" Diameter Pipe
- 12" - 24" Diameter Pipe
- 24" - 36" Diameter Pipe
- Catawba County
- SECC Service Boundary
- North/East Pressure Zone (NEPZ)
- South/West Pressure Zone (SWPZ)

Notes:
EST = elevated storage tank
GST = ground storage tank

Southeast Catawba County Existing Water System

Prepared For:
Catawba County

October 2019

Map Disclaimer: This product is for informational purposes only and is based on some unverified information provided by others. This product has not been prepared for nor is it suitable for legal, engineering, or surveying purposes. It represents only the approximate relative location of property boundaries. McKim & Creed, Inc. assumes no liability or damages due to inaccuracies, errors or omissions.

N
1 inch = 1.5 miles

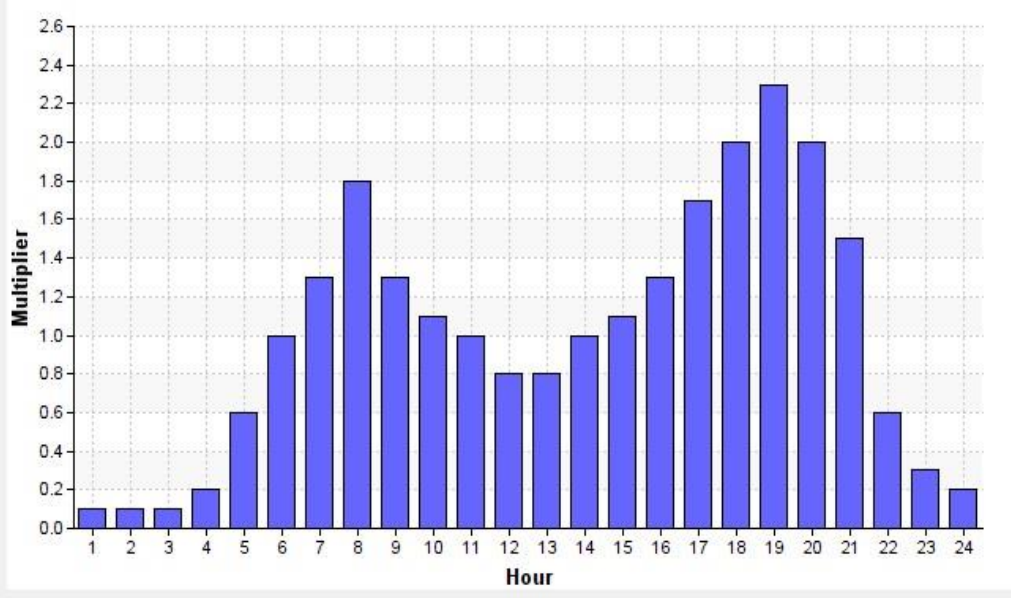
McKIM&CREED
1730 Varsity Drive, Suite 500
Raleigh, NC 27606
Ph: (919) 233-8091

Table 1.4– Existing Water Demands

Average Day Flow (ADF)	Demand
SWPZ Region ADF	65 gpm
NEPZ Region ADF	99 gpm
Total SECC ADF	164 gpm

In order to run extended period simulations, a generic system-wide diurnal demand pattern was assumed based on typical industry patterns and applied to the existing water model. This allows the evaluation of the water system's performance throughout the day's peaks and lows. Only one diurnal pattern has been applied to all consumers at this point and it is shown in **Figure 1.4**. Additional curves will be added to reflect future zoning assumptions. A C-factor of 120 was used to estimate the friction loss in all water mains. This factor represents the possibility of higher friction in older pipes and allows for conservative evaluation of the system pressures.

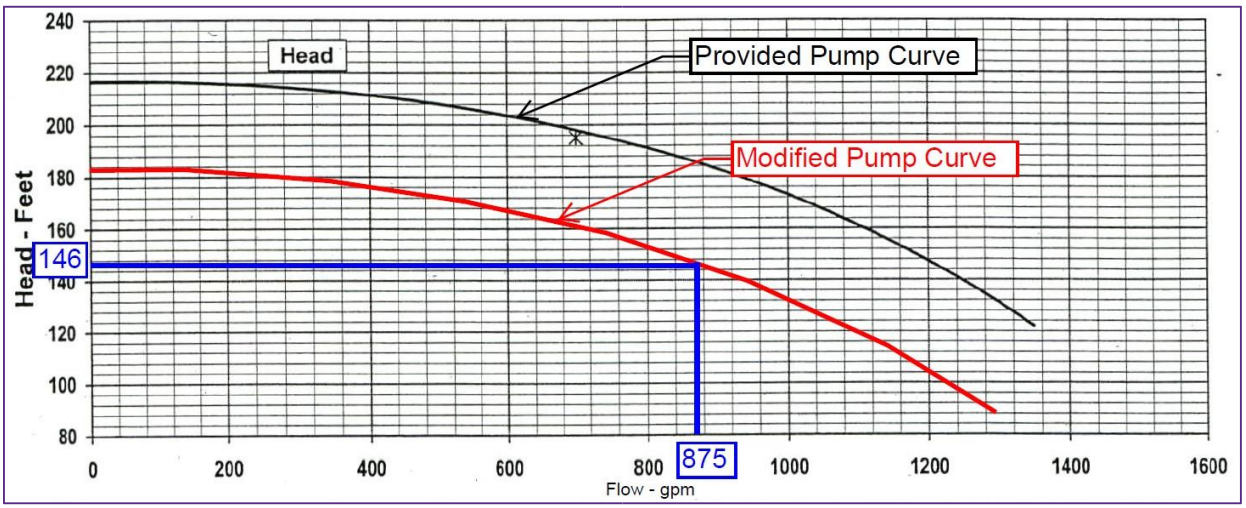
Figure 1.4 – Diurnal Pattern



1.1 SETTING FOR EXISTING SCENARIO

The existing scenario was developed from the original base scenario and updated to include SECC water demands and other existing conditions. Originally, the NEPZ Reservoir pressure was set to the average pressure recorded in the field during the hydrant readings (1,169 ft), but this resulted in the pump running off its curve to the right. A field investigation of the NEPZ Booster Pump Station was conducted on June 5, 2018. During the field investigation, the suction pressure was 62 psi (143 ft.), the discharge pressure was 125 psi (289 ft.) and the flow was 875 gpm when Pump No. 1 was turned on. A new curve was drawn based on the 2018 field investigation data to represent actual existing performance. This modified pump curve for the NEPZ Booster Pump Station was added to the model and is shown in **Figure 1.5**.

Figure 1.5– Modified Pump Curve for the Existing NEPZ Booster Pump Based on Field Data



Since the NEPZ Booster Pump Station pulls water from the City of Conover connection, the suction pressure measured in the field is representative of the City of Conover pressure at that time. In order to set the model to reflect the field data, the elevation of the pump station (973.5 ft.) was added to the observed suction pressure (143 ft.) to determine the pressure needed at the NEPZ Reservoir. The SWPZ reservoir was set to the average pressure that was recorded in the field during the hydrant pressure readings. The settings for both reservoirs are show in **Table 1.5**.

Table 1.5– Reservoir for Existing Scenario

	Head (ft)
SWPZ Reservoir	1,300
NEPZ Reservoir	1,117

As seen in **Figure 1.1,** the Bandy's EST typically begins to fill when the water level reaches 26 feet and then finishes filling when the water level reaches 32 feet. In **Figure 1.2**, the Anderson Mountain ground storage tank (GST) typically begins to fill when the water level reaches 25 feet and finishes filling when the water level reaches 35 feet. These set points were used to control when the pumps turn on and off in the model. The pump control settings are listed in **Table 1.6**. The speed setting for the SWPZ booster pumps was calculated from the pump test data given in the pump station O&M Manual.

Table 1.6– Pump Control Settings for Existing Scenario

Parameter	SWPZ Booster Pumps	NEPZ Pump
Number of Pumps Activated	2	1
Initial Status of Pumps	Closed	Closed
Variable Speed Setting	85%	100% (Constant Speed)
Control Logic	On: If GST water level < 25 ft Off: If GST water level > 35 ft	On: If EST water level < 26ft Off: If EST water level > 32ft

After running the extended period simulation (EPS), system pressures were graphed. The minimum pressure in the SWPZ region is 44 psi. This occurs at the intersection of E Maiden Road and Anderson Mountain Road, near the ground storage tank. The minimum pressure in the NEPZ region is 83 psi at the intersection of Buffalo Shoals Road and W Bandy's Cross Road.

The model successfully produced results within expectations based on the available data records. **Figure 1.6** and **Figure 1.7** show the SWPZ booster pumps operating at 1540 gpm each and 67 ft. head. The time that the pumps turned on correctly corresponds to the time the model shows the Anderson Mountain GST filling. As seen in **Figure 1.8**, the tank only fills up once within the 24-hour period when the tank was initially set at 26 feet reflecting very low demands in the SWPZ.

Figure 1.6 – SWPZ Booster Pump Flow in Existing Scenario

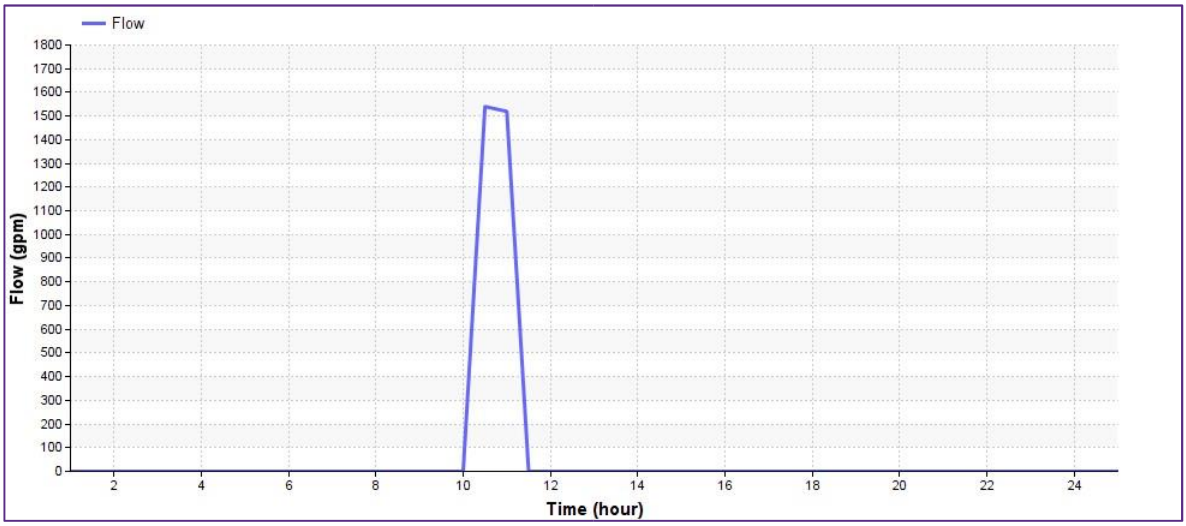


Figure 1.7 – SWPZ Booster Pump Head Gain in Existing Scenario

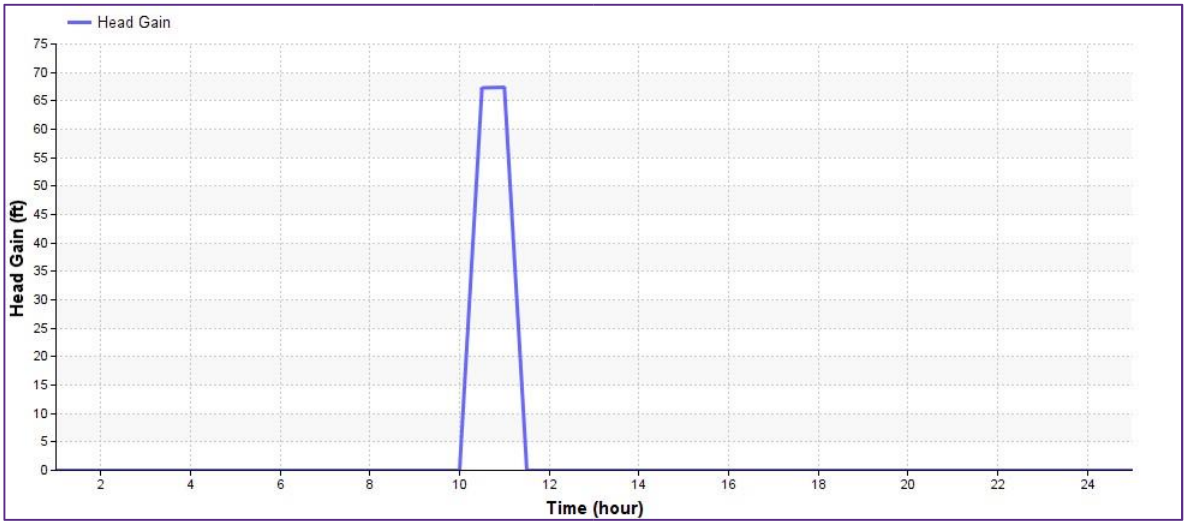
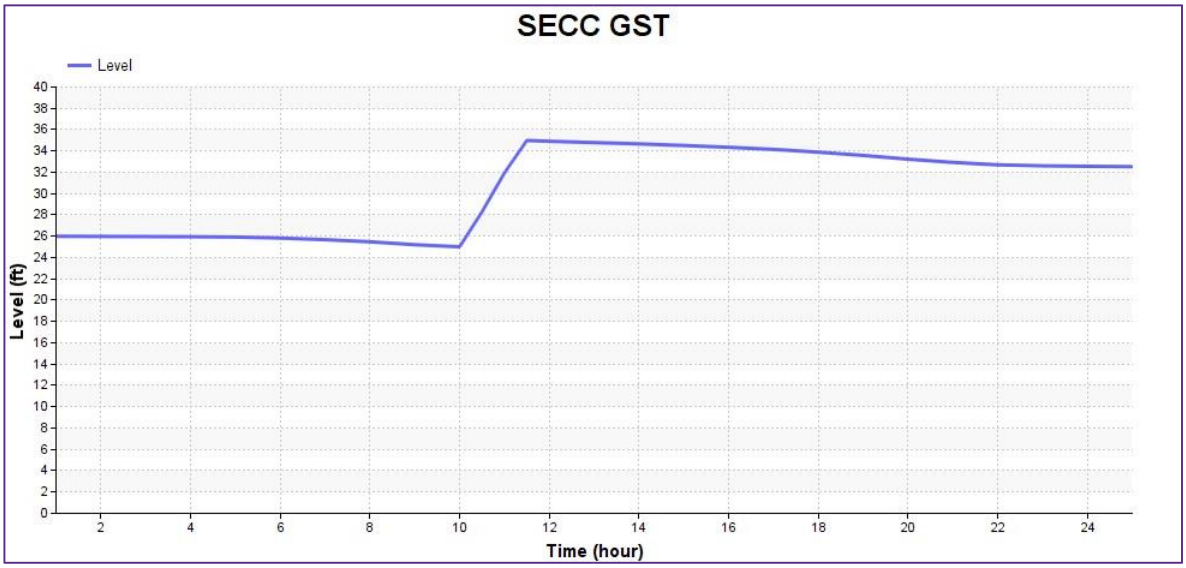


Figure 1.8 – Anderson Mountain GST Water Level in Existing Scenario



The model estimated the NEPZ booster pump performing at 918 gpm and 141 ft. head as shown in **Figure 1.9** and **Figure 1.10**. The time that the pumps turned on correctly corresponds to the time the model shows the Bandy's EST filling. As seen in **Figure 1.11**, the tank only fills once within the 24-hour period when the tank was initially set at 32 feet. This reflects the NEPZ's greater water demand than the SWPZ; however, demands are still well below the capacity of the existing system.

Figure 1.9 – NEPZ Booster Pump Flow in Existing Scenario

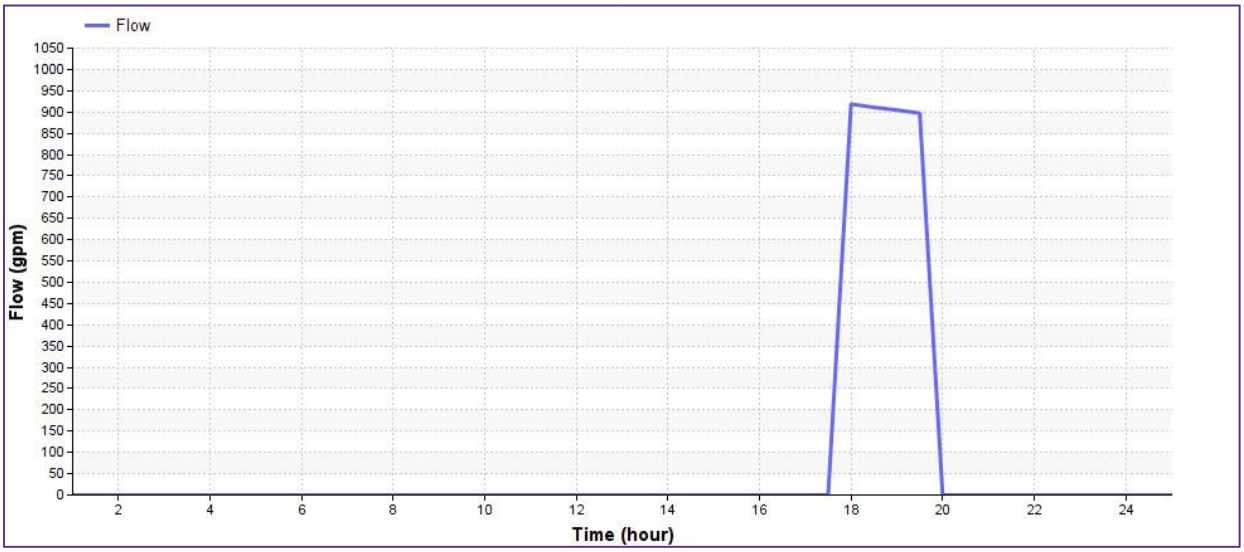


Figure 1.10 – NEPZ Booster Pump Head Gain in Existing Scenario

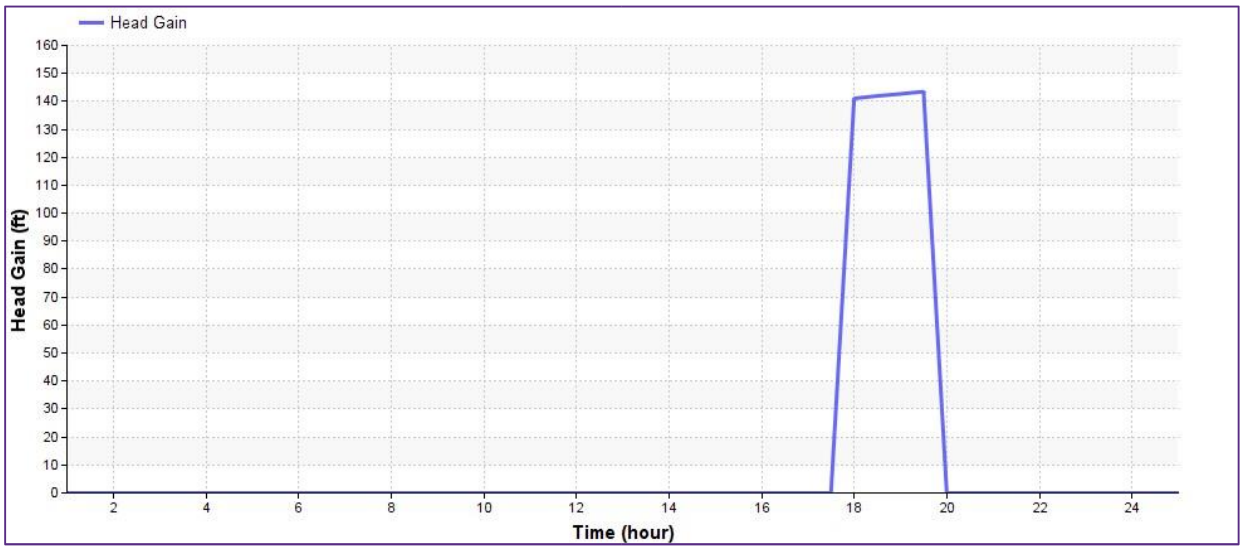
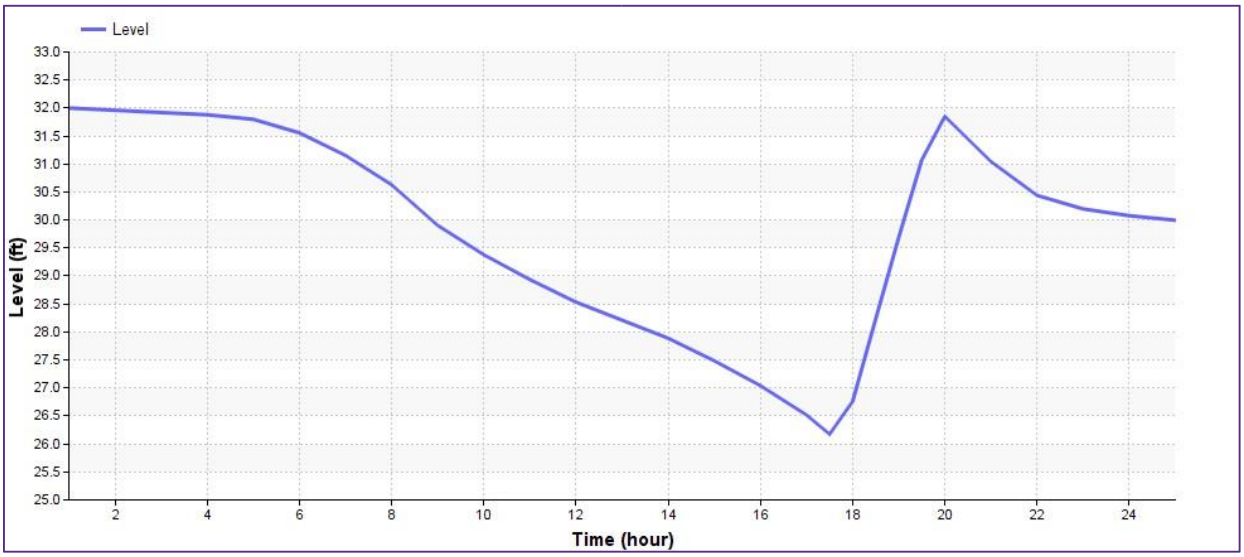


Figure 1.11 – Bandy's EST Water Level in Existing Scenario



1.2 WATER STORAGE

The purpose of finished water storage in elevated or ground storage tanks is to provide volume for:

- Equalization and general operation
- Fire flow
- Emergency supply

Typically, 50-75% of tank volume is allotted for equalization and general operation (i.e. fluctuating between 50% and 100% full over the course of a day), with 25-50% reserved for emergency supply and fire flow purposes (e.g. the volume between 25% and 50% full for fire flow and the remaining bottom 25% for emergency reserves). A lack of tank turnover can result in poor water quality, while a drained tank will be unable to provide sufficient fire flows or emergency reserves, so a balance between these objectives must be maintained. Rather than looking specifically at individual tank turnover, many systems look at water age as a metric of water quality or even explicitly model water quality across the system as a whole.

According to 15A NCAC 18C .0805, the combined elevated and ground storage capacity must be a minimum of one-half of the average annual hourly demand.

1.2.1 Existing Water Storage

The SWPZ portion is served by the Anderson Mountain GST that sits at an elevation higher than most of the surrounding area and therefore acts as elevated storage. The NEPZ portion is served by the Bandy's EST. These facilities are summarized in **Table 1.7**. The existing demand is 0.24 MGD and the existing storage of 1.5 MG is over ten (10) times the required 0.12 MG (50% x 0.24 MGD) for existing demands

Table 1.7– Existing Water Storage Tanks

	Anderson Mountain (SWPZ) GST	Bandy's (NEPZ) EST
Volume (MG)	1.0	0.5
Diameter (ft)	65	50
Ground Elevation (ft)	1,195.00	1,030.17
Tank Bottom Elevation (ft)	1,195.00	1,195.00
High Water Elevation (ft)	1,235.33	1,232.17

1.2.2 Future Water Storage

Based on future demand projections, additional water storage will be required to meet statutory requirements. **Table 1.8** summarizes system demand projections and required storage based on development Modeling Scenario. **The current storage is projected to meet the minimums set by 15A NCAC 18C .0805 until a time period between 10 and 15 years into the future. However, it should be noted that meeting these minimum requirements does not imply efficient or optimal sizing and operational standards.** Location, elevation, and utilization of storage are among the factors that dictate the effectiveness of meeting constraints such as system pressure ranges, tank level fluctuations, tank turnover for water quality, fire flow availability, and emergency reserve capacity. Fire flow requirements (both flow and duration), peak demands, and other system specific factors also influence the amount of storage a system requires to function properly and may require additional storage beyond statutory minimums.

Despite selecting a scenario that represents the most likely future development there will be variances in how this region actually develops. The location, magnitude and pace of development will significantly affect operational characteristics and dictate the most effective support strategies. **Presently, plans can be made at an aggregate level for supplemental storage to meet regulatory requirements. Plans can incorporate more specific improvement elements once system demands reach levels closer to the limits of existing storage, and empirical observations and data with respect to operational conditions are known.**

Table 1.8 – Future Water Storage Needs

	Average Day Demand (MGD)	Required Storage (MG)
Existing	0.24	0.12
Year 5	1.00	0.50
Year 10	2.20	1.10
Year 15	3.75	1.88[1]
Year 20	4.97	2.49
Ultimate	18.96	9.48

[1]Existing combined ground and elevated storage capacity will have been exceeded.

1.3 WATER HYDRAULIC MODELING CRITERIA

The design of model scenarios and analysis of results focused on several parameters, including system pressures, pipe velocities and headlosses, fire flow availability, and water age. System pressures, fire flow availability, and pipe velocities were used to identify deficiencies and size improvements. Additional parameters such as headloss gradients provided further insight into system operations. The model results were compared to generally accepted ranges of performance, including those in the *American Water Works Association's Manual of Water Supply Practices M32 - Computer Modeling of Water Distribution Systems, Fourth Edition* (AWWA 2017). The recommended sizing of pipeline improvements is typically initially governed by fire flow availability before other deficiencies are addressed.

1.3.1 Storage Tank Levels

As discussed previously, a typical operational target is a daily fluctuation in tank volume between 50% and 100% full levels to provide turnover while reserving 25% of tank volume for fire flow and an additional 25% of tank volume for emergency supply.

Storage tanks were evaluated with a target range of 50-100% full, recovery at the end of 24-hours to initial settings, and an absolute minimum of 25% full at all times.

1.3.2 System Pressures

Typical guidelines for distribution system pressures under normal operating conditions are 35 psi to 90 psi. Operating in this range typically delivers qualitatively satisfactory pressure for customers while minimizing system leakage and pipeline breaks associated with high pressures.

Recommended Standards for Water Works (Water Supply Committee of the Great Lakes, 2012), or so-called "Ten State Standards," states that normal operating pressures should be 60-80 psi with a 35-psi minimum and no lower than 20 psi under any conditions. Additionally, pressure reducing devices should be placed on mains or at metering devices where pressures exceed 100 psi.

Maximum pressure limits are often in the range of 90-110 psi, but in areas with varied topography, higher pressures are not uncommon. Pressures are typically driven by a combination of topography, proximity to pump stations, elevated storage tank levels, and water system operations. High pressures can increase rates of leakage and breakage. In conjunction with the highly linear nature of this system (e.g. primarily transmission mains with very little looping), booster pumping starts on-and-off can generate transients which increase the risk of breakage and/or shorten the life cycle of piping.

Minimum pressures are established as 20 psi under fire flow conditions and are necessarily higher in the absence of a fire flow event.

For this report, pressures were evaluated under the following guidelines:

- Minimum pressure of 40 psi at demand nodes during normal operations
- Minimum residual pressure of 20 psi under fire flow conditions
  Maximum pressure target as close to 100 psi as realistically possible with flexibility to allow higher (but generally no higher than existing system pressures)

1.3.3 Watermain Velocities

Under normal operating conditions, 5 fps is a typical guideline for maximum velocity in a waterline. However, velocities up to 10 fps are often acceptable under fire flow conditions, and slightly higher velocities are often seen in the vicinity of pump stations. When velocities higher than 10 fps are

experienced, there is an increased potential for hydraulic transients ("water hammer") in a distribution system. This results in high velocity pressure waves travelling up and down pipelines that can reduce the remaining useful life of pipes or even cause an immediate break.

For the purposes of this study, a maximum of 7 fps under ADD and MDD conditions was used for evaluation. There is no explicit water system operational requirement for minimum velocity, although low velocities contribute to water quality problems by increasing water age and possibly allowing for the deposition of solids.

1.3.4 Watermain Headloss Gradients

The headloss gradient along a pipe is a measure of how much energy is lost per unit length of pipe. Such lost energy can result in poor operating efficiency within a system, higher operating costs, lower pressures, and diminished fire flow availability. Excessive headloss is a result of either constriction from a pipe that is undersized or a pipe that has become too "rough" (e.g. tuberculation) for the operating conditions.

Design guidelines commonly used for pipe headloss gradients under normal operating conditions are as follows:

- Headloss gradient of 5-7 feet per 1,000 feet of pipeline (0.005 to 0.007) and no more than 10 feet per 1,000 feet (0.010) for pipes less than 16 inch in diameter.
- Headloss gradient of 2-3 feet per 1,000 feet of pipeline (0.002 to 0.003) and no more than 5 feet per 1,000 feet (0.005) for pipes larger than 16 inch in diameter.
  Higher headloss gradient values are allowed in the immediate vicinity of pump stations over short distances.

There is no strict water system operational requirement for headloss gradients. It should be noted that the hydraulic gradients identified in the model are based on the Hazen-Williams C-values assigned. These may not accurately reflect field conditions for individual segments of pipe.

Headloss gradients were presented as part of this report for informational purposes, to support other findings, and to identify bottlenecks.

1.3.5 Fire Flow Availability

The North Carolina State Fire Prevention Code is based off the most current International Fire Code. Appendix B, Section B105.1 of the 2018 International Fire Code (International Code Council, 2017) states that the minimum fire flow for residential dwellings with no automatic sprinkler system is 1,000-gpm for a duration of one (1) hour.

A fire flow of 1,000-gpm during MDD with a minimum residual pressure in the system of 20 psi was considered the target standard. Higher targets were used on transmission mains to account for diminished fire flow availability in future developments where distribution mains will be some distance from the transmission main. Higher targets were also used for commercial and industrial areas. Additionally, a 2-hour fire event was used rather than the minimum 1-hour fire event.

1.3.6 Water Age

There is no specific engineering standard for water age in distribution systems. It is common practice for many water system operators to target 4-6 days for maximum water age as a surrogate for water quality. However, in addition to water age, water quality depends on, but not limited to, the following factors: the type of disinfectant used, the condition and material of piping systems, potential contamination, residual

organic matter from source water, temperature, tank mixing, and turbidity. Therefore, the age at which water quality has deteriorated to undesirable levels varies from system to system and even between portions of the same distribution system.

Pipe-sizing for water distribution systems is typically dictated by fire flow requirements. This can lead to pipes that are relatively oversized relative to normal operations and demands. This can lead to long travel times between water source and consumption, compounded with excessive storage volumes and potentially inadequate turnover characteristics. In turn, water age in the system can result in various forms of water quality degradation. These typically can include reducing residual disinfectant concentrations to inadequate levels, increased concentrations of unacceptable and/or regulated contaminants (e.g. trihalomethanes), or objectionable but harmless taste and odor issues

1.4 WATER MODEL SCENARIOS

Four (4) different base scenarios were used to analyze the current and future system:

- 24-hour EPS under average day demand (ADD) for hydraulic analysis
- 240-hour EPS under ADD for water age analysis
- 24-hour EPS under maximum day demand (MDD) for hydraulic analysis, using a demand factor for MDD = 2 x ADD
- A 2-hour EPS under MDD with a 2-hour fire flow from 1pm to 3pm

The results from these scenarios yielded system pressures, pipe velocities and headlosses, fire flow availability, and water age. System pressures, fire flow availability, and pipe velocities were then used to identify deficiencies and size improvements.

1.4.1 Existing System

Customer demands from January through December of 2017 were also added to the model. A generic system-wide diurnal demand pattern based on typical industry standards with hourly demand factors was applied. This was discussed in Section 2.

1.4.1.1 Existing System Average Day Demand 24-hr EPS

The pressures in the model show little variation between minimum and maximum levels throughout the 24-hour EPS, ranging as low as around 44 psi near the Anderson Mountain GST (lower immediately adjacent to the GST due to elevation) to as high as 200 psi in areas such as Northview Harbor Dr and along Hwy 150 near the eastern end of the service area (see **Figure 1.12**). Most of the system registers above 100 psi in the model.

These high pressures appear to be substantiated by pressure recordings taken at system hydrants, such as the following three (3) examples:

- Pressure readings from 11/08/2017 through 11/17/2017 along Sherrill's Ford Rd south of Hwy 150 (see **Table 1.1**) ranged from 131-187 psi with an average of 161 psi. Model results predict an ADD range of 158-163 with an average of 161. Field measurements show greater variation because they were taken at 5-minute intervals and are not limited to demands across periods of an hour. When averaged across hourly periods of the day for the duration of the field measurement period, the field measurements ranged from 160 psi (3-4pm) to 162 psi (5-6am).
- Pressure readings from 11/29/2017 through 12/11/2017 near the intersection of Hwy 150 and Grassy Creek Rd (**Figure 1.13**) ranged from 137-156 psi with an average of 148 psi. When the nearest model junction is adjusted for the elevation difference, the resulting ADD pressure range

is 143-146 psi with an average of 145. When the field readings were averaged over hourly periods of the day, they ranged from 147 psi (8-9am) to 148 psi (12-1pm).
Pressure readings from 11/29/2017 through 12/11/2017 along Sherrills Ford Rd between Island Point Rd and Molly's Backbone Rd (**Figure 1.15**) ranged from 112-152 psi with an average of 144 psi. When the nearest model junction is adjusted for the elevation difference, the resulting ADD pressure range is 146-150 psi with an average of 148. When the field readings were averaged over hourly periods of the day, they ranged from 142 psi (8-9am) to 145 psi (12-1am).

Based on these model pressure comparisons to field data in three (3) locations, along with other comparative data of the existing system discussed in Section 2, the model appears to accurately replicate existing conditions.

Figure 1.12– High maximum pressures during 2018 ADD around the area of Northview Harbor Drive

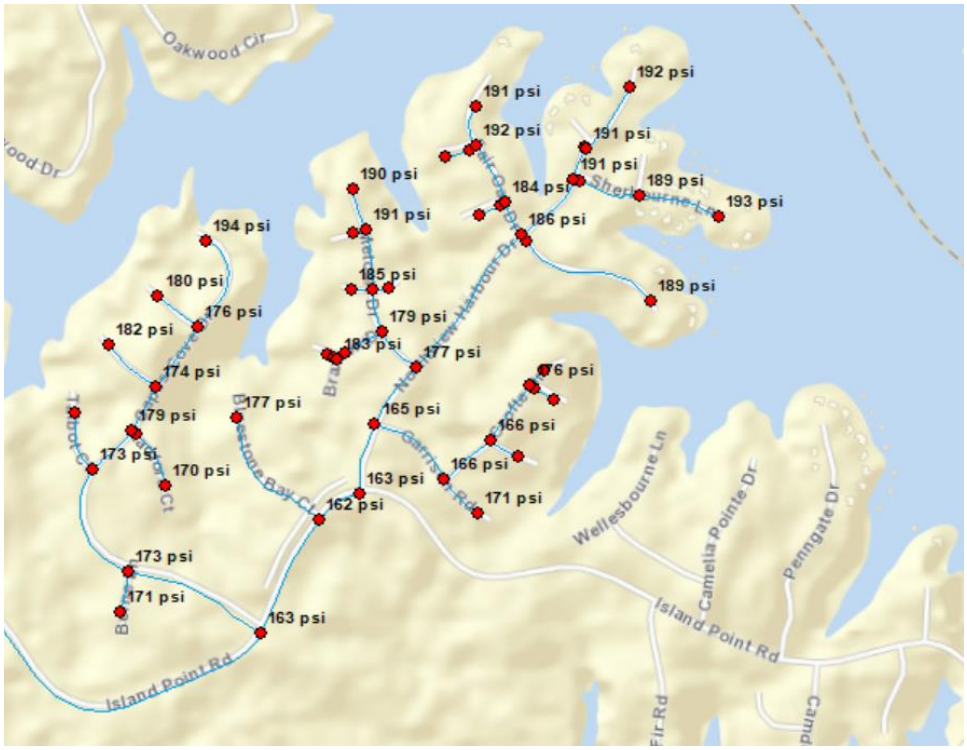


Figure 1.14 – Location of Sherrills Ford Rd and Hwy 150 pressure recordings

Figure 1.13 – Location of Hwy 150 pressure recordings near Grassy Creek Rd

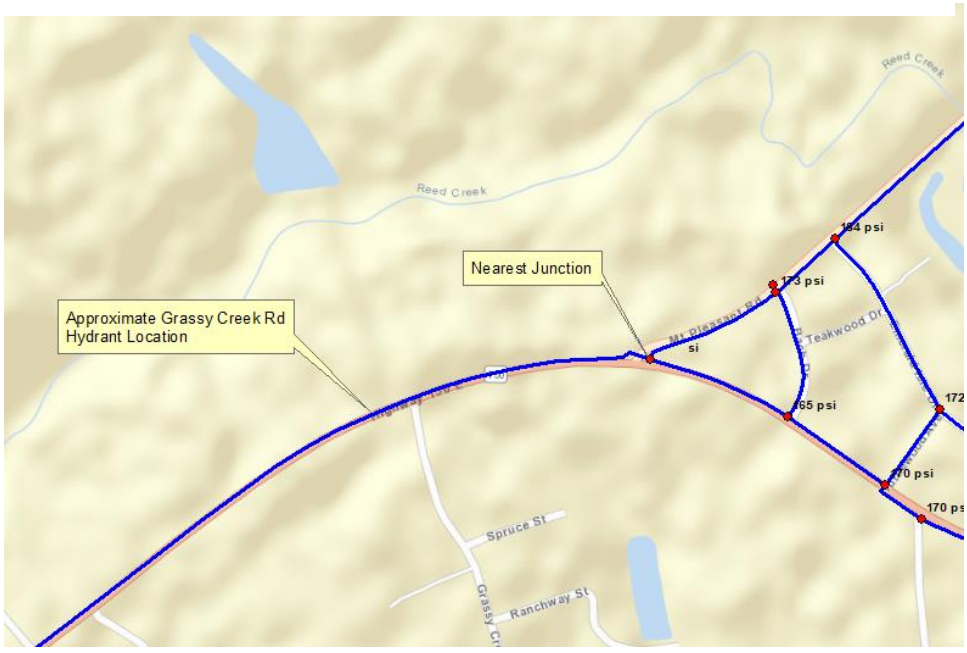
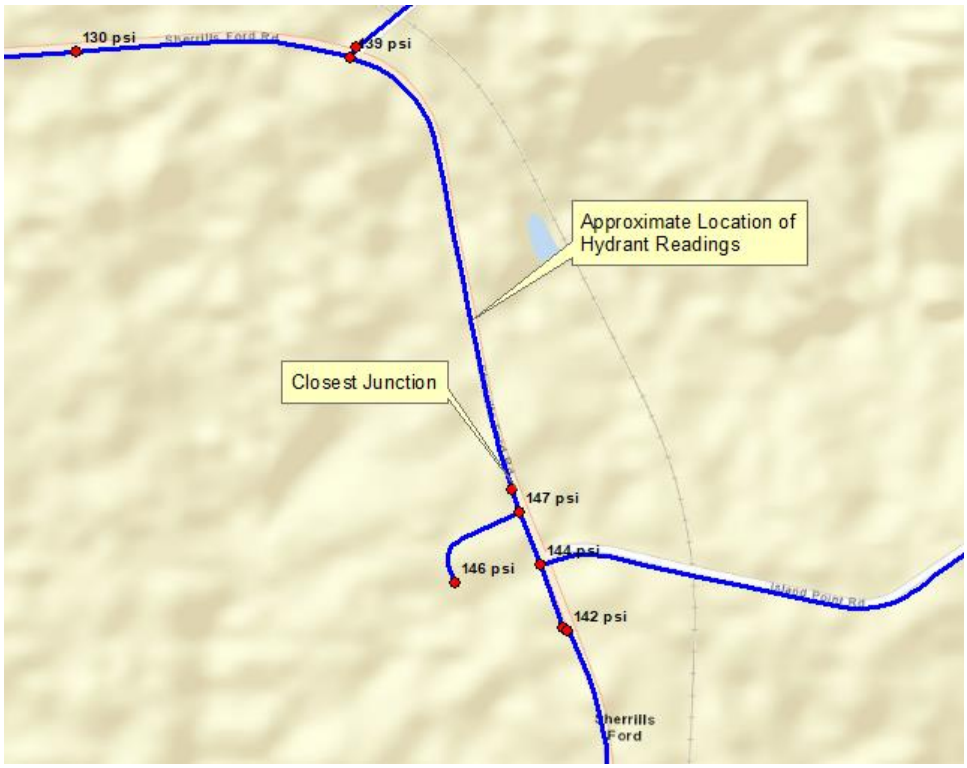


Figure 1.15 – Location of Sherrill's Ford Rd pressure recordings



1.4.1.2 Existing System Average Day Demand 480-hr EPS for Water Age

A 480-hr EPS was analyzed using only the base ADD consumption and controls, i.e. no allowance for any performance of manual or automated flushing. The results of this model run suggests that water age will be a substantial issue until system demands increase and create faster tank turnover and movement of water through the piping system. Existing water age issues are discussed further in Section 3.C.2.a.vi.

1.4.1.3 Existing System Maximum Day Demand 24-hr EPS

A 24-hr EPS was analyzed using the estimated MDD consumption. Pressures are relatively high but almost the same as under ADD conditions.

The maximum day demand in the NEPZ section of the system remains under 0.3 MG (the maximum day supply allowed under the current Conover contract) using the projected MDD, so the SWPZ and NEPZ systems can remain isolated for the time being.

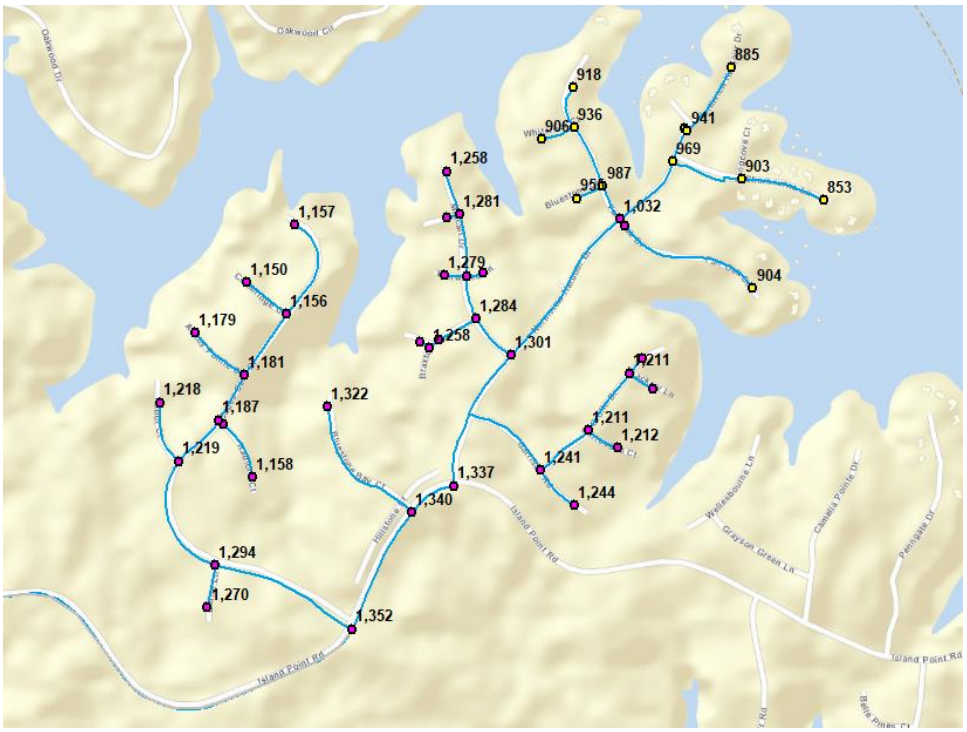
1.4.1.4 Existing System Maximum Day Demand Plus Fire Flow 2-hr EPS

A 2-hr EPS was analyzed using the estimated MDD consumption and simulating a fire flow event from 1-3pm. A base requirement of 1,000 gpm was used at demand nodes (i.e., locations of customers) along with a 20 psi minimum residual pressure at all other demand nodes.

The majority of the system is capable of supplying far more than 1,000 gpm of fire flow under these conditions. The only area that consistently falls below this level of service is in the vicinity of Island Point Road as shown on **Figure 1.16**, with a low of 885 gpm. It should be noted that the model nodes do not necessarily represent hydrant locations and that nodes at the end of lines represent a worst-case condition.

These conditions should be field-verified by flow-tests at actual hydrant locations. It is not atypical for dead-end lines at system extremities to be just below the minimum target.

Figure 1.16 – Location of marginal fire flow service near Island Point Road.



Note: Yellow nodes indicate those with customer demands and which project to be under 1,000 gpm of available fire flow under maximum day demand conditions.

1.4.1.5 Existing System Water Quality

The actual water age entering the SWPZ system is unknown. Based on a preliminary analysis using a City of Hickory model that was not designed to analyze fire flow, it was estimated that the water age is typically 3-5 days from treatment plant to interconnects. No investigation was made as to identify any sources of water "freshening" to address water quality upstream of the interconnects. For these reasons, water age was zeroed at the time the water entered the SWPZ system in the model.

SWPZ currently employs four (4) automatic flushing stations:

- 8693 E Hwy 150 (unmetered), 3 hrs/day at roughly 156 gpm
- Marshall Steam Plant at E Hwy 150 (unmetered), 3 hrs/day at roughly 156 gpm
- Shorelaunch Drive and Anchors Aweigh Lane (metered), 3 hrs/day at roughly 50 gpm
- Gregory Road (new and not included in the 2018 analysis)

The influence of the two (2) E Hwy 150 automatic flushers is apparent in the SWPZ portion of the system. As shown on **Figure 1.17** and **Figure 1.18**, flows entering the SWPZ system reach the SWPZ BPS at a maximum age of 260 hours using the flushing devices instead of 413 hours. Water age reductions along E Hwy 150 also range from one to several days.

Figure 1.17 – 2018 Maximum water age (hours) in the SWPZ portion of the system under ADD conditions without existing automatic flushers operational

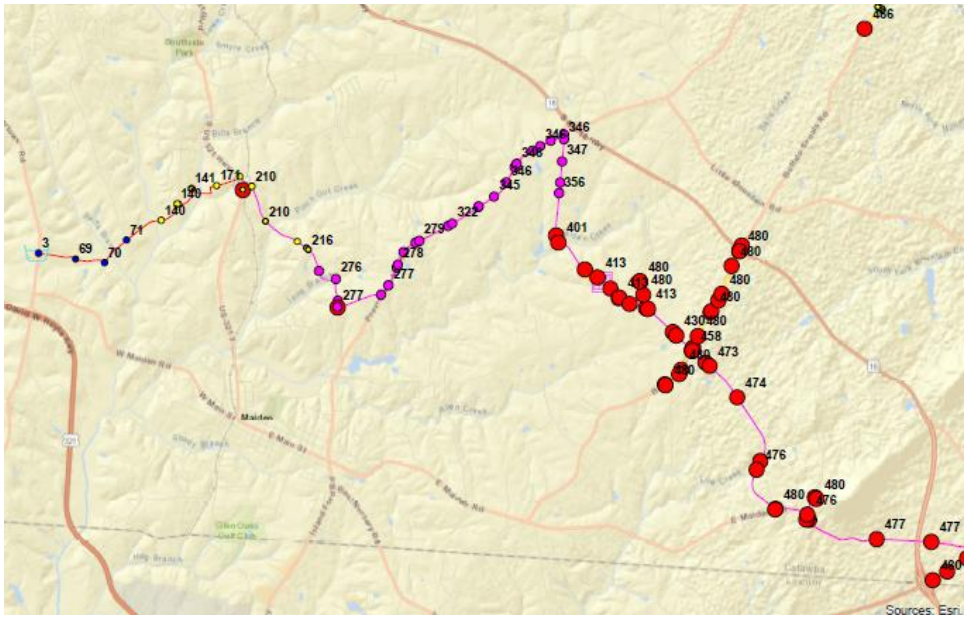
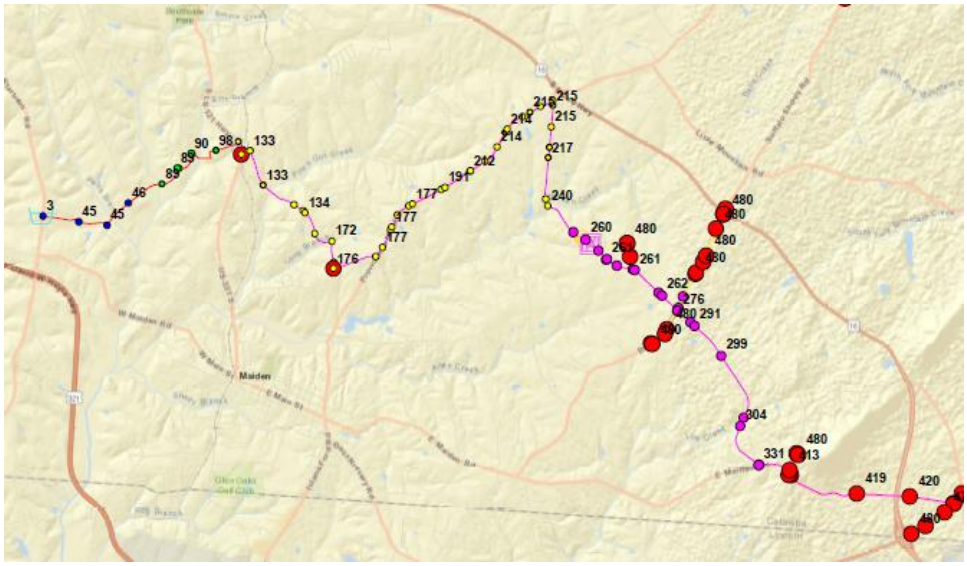


Figure 1.18 – 2018 Maximum water age (hours) in the SWPZ portion of the system under ADD conditions with existing automatic flushers operational



The flusher on Shorelaunch Drive reduced maximum water age locally but had a minimal effect on the NEPZ side of the system. Modeling was performed to see if operational changes could be made to further reduce water age. The opportunity exists to operate the elevated storage tanks in a narrower range in the near-term due to excess storage volume compared to existing demands.

Maintaining the Anderson Mountain GST capacity at 50%, while adjusting the SWPZ BPS controls and narrowing the Anderson Mountain GST operating range resulted in minimal water age reduction and would increase low-pressure complaints and issues. However, cycling the Bandy's EST between 50% and 70% full typically reduced the maximum water age by about 1 day (depending on location) on the NEPZ portion of the system.

For water quality purposes, it is recommended that automatic flushing continues to be implemented in the SWPZ portion of the system and that consideration be given to operating the Bandy's

EST between 50% and 70% full.

1.4.2 Future Scenarios

Of critical importance is the fact that the feed to the NEPZ side through the City of Conover is currently contractually limited to 300,000 gallons per day. The maximum day demand for the NEPZ section is projected to exceed this quantity by 2023.

Either the valve isolating the SWPZ and NEPZ sections will need to be opened to allow the SWPZ side to help meet demands on the NEPZ side (and/or a connection needs to be made elsewhere between the SWPZ and NEPZ sections), or the contract with Conover needs to be changed to allow for an increase in water supply to allow the SWPZ and NEPZ sections to operate separately. However, s single-system may operate more efficiently and provide more flexibility.

The base 20-year analysis and recommended improvements are based on the assumption that the Conover contract remains in place, which necessitates operating the SWPZ and NEPZ sections as a single system with the isolation valve open. It is assumed that all piping will be cement-lined ductile iron.

1.4.2.1 Five-Year Growth Projections or Present - 2023 Improvements

Model simulation for the five-year scenario utilized the existing system model with the addition of the four (4) PRVs.

1.4.2.1.1 2023 Average Day Demand 24-hr EPS

The projected 2023 pressures in the model are comparable to those in existing model (with the addition of recommended PRVs added to the existing system). Tanks are capable of turnover to 50% and re-filling as shown in **Figure 1.19** and **Figure 1.20** without the proposed operational improvements, and **Figure 1.21** and **Figure 1.22** post-improvement.

Figure 1.19 – Modeled 2023 Anderson Mountain GST level fluctuations under ADD

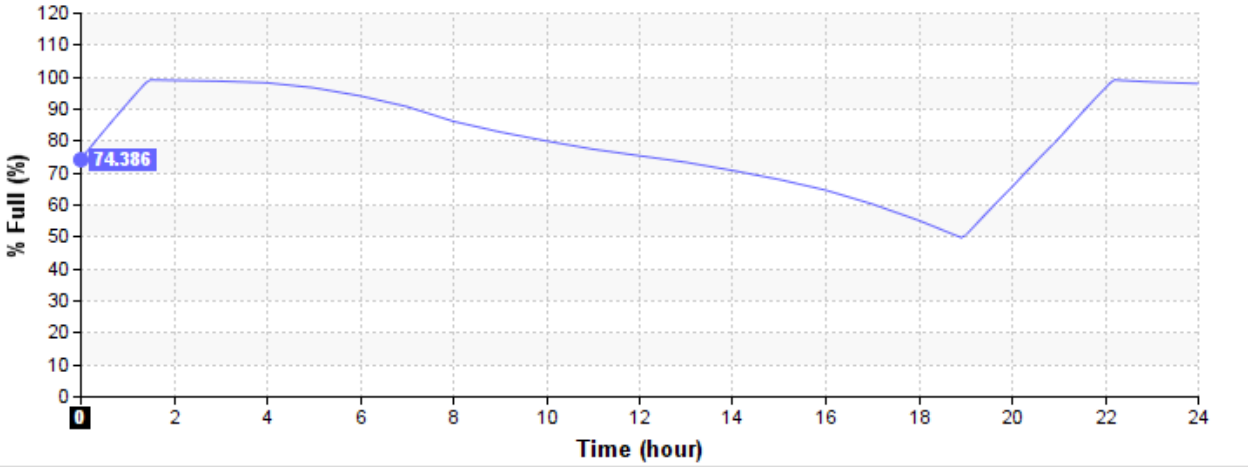


Figure 1.20 – Modeled 2023 Bandy's EST level fluctuations under ADD

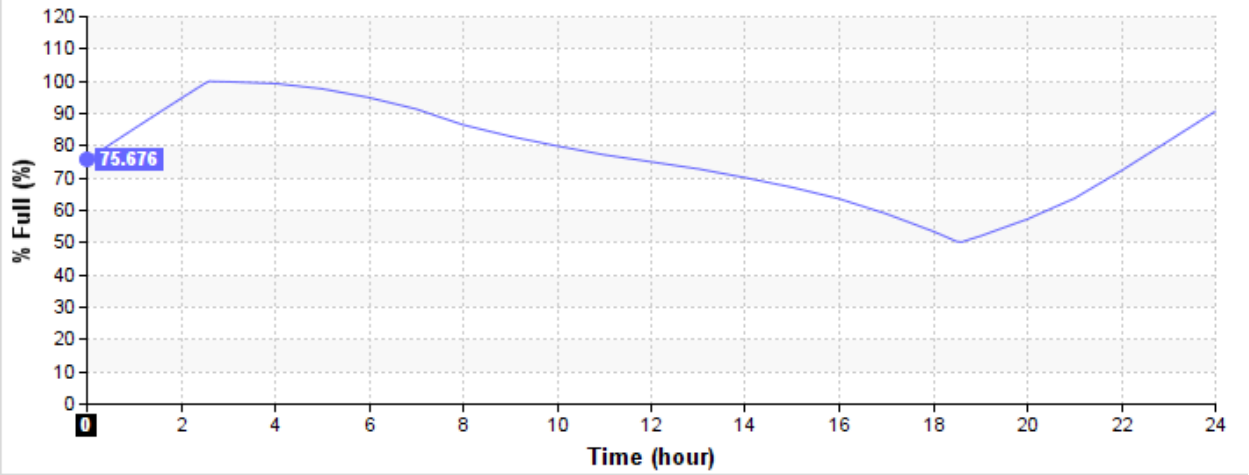


Figure 1.21 – Modeled 2023 Anderson Mountain GST level fluctuations under ADD after operational modifications

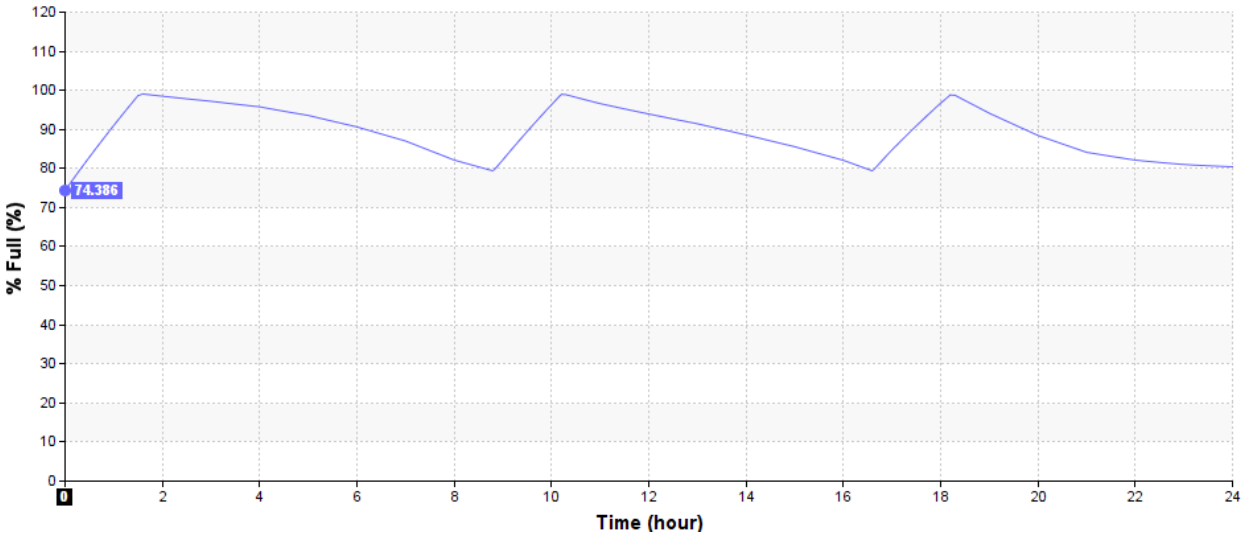
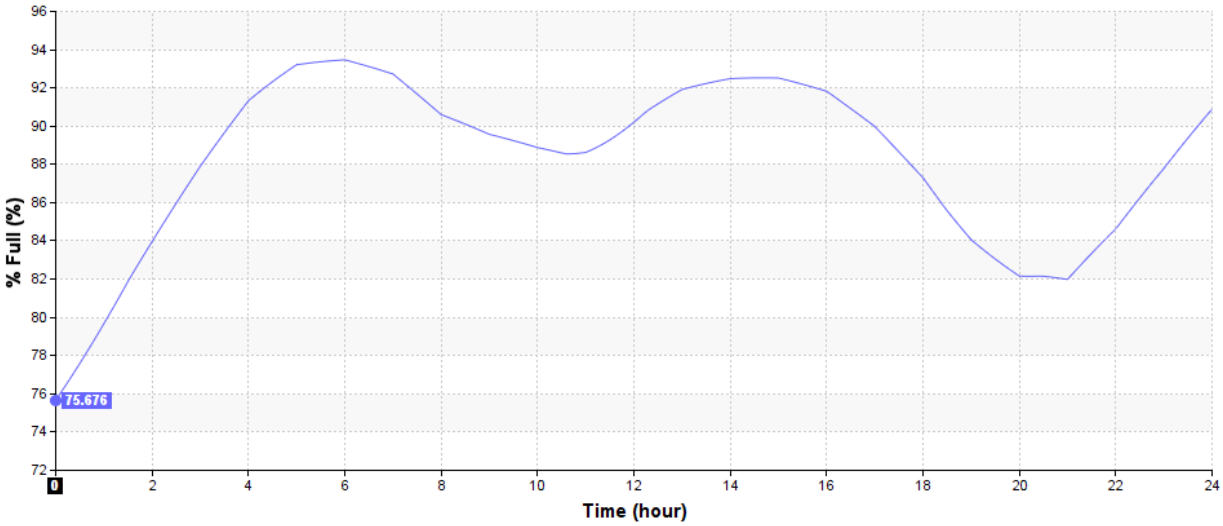


Figure 1.22 – Modeled 2023 Bandy's EST level fluctuations under ADD after operational modifications



1.4.2.1.2 2023 Maximum Day Demand 24-hr EPS

A 24-hr EPS was analyzed using the estimated MDD consumption. The Anderson Mountain GST appears capable of 50% turnover and recovery during the period as shown in **Figure 1.23** and **Figure 1.24**. Note that with the recommended operational improvements, the Anderson Mountain GST will remain full for much of the day under MDD. This can be adjusted as desired to allow the Anderson Mountain GST to turnover as long as the Bandy's EST stays above 50% full.

Figure 1.23 – Modeled 2023 Anderson Mountain GST level fluctuations under MDD

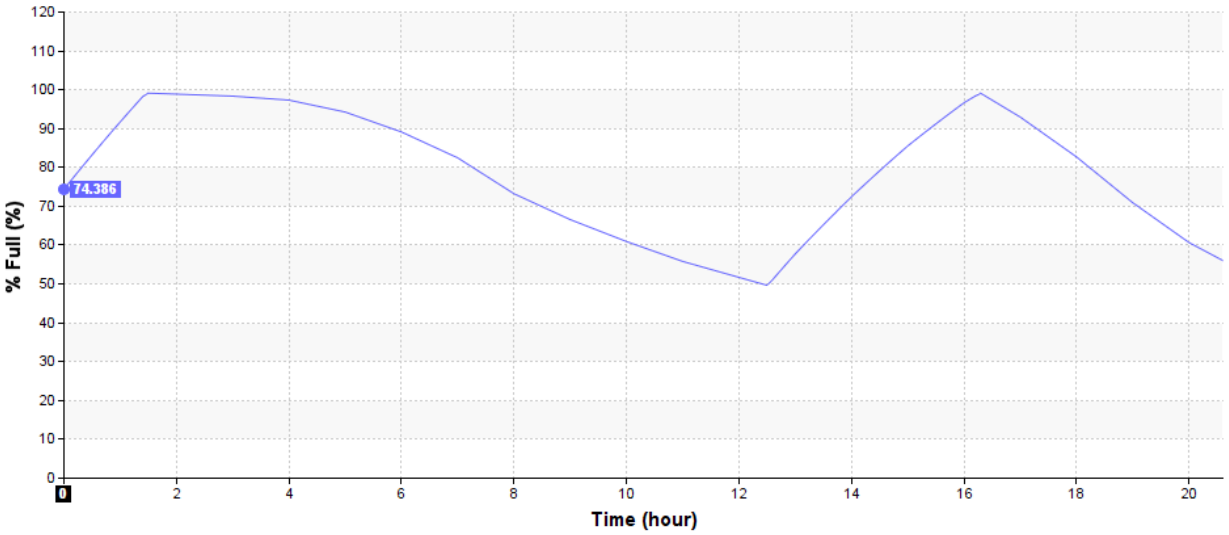
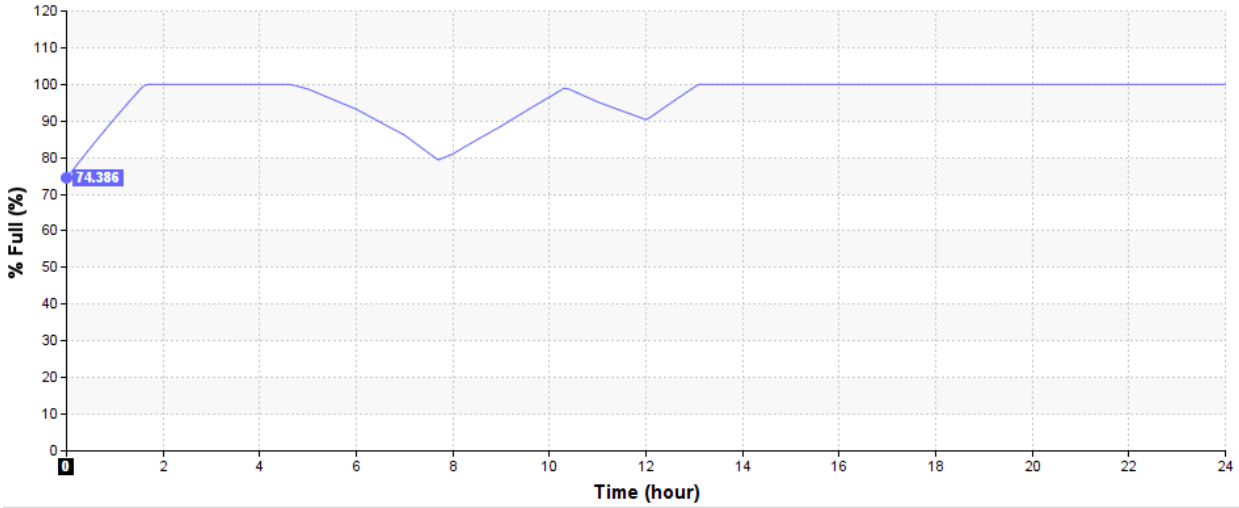


Figure 1.24 – Modeled 2023 Anderson Mountain GST level fluctuations under MDD after operational modifications



The Bandy's EST completely drains within the day as shown in **Figure 1.25** without the implementation of the recommended operational modifications. Once these are implemented, the Bandy's EST is capable of filling, remaining above 100% full under MDD, and recovering at the end of the day to initial levels as shown in **Figure 1.26**.

Figure 1.25 – Modeled 2023 Bandy's EST level fluctuations under MDD

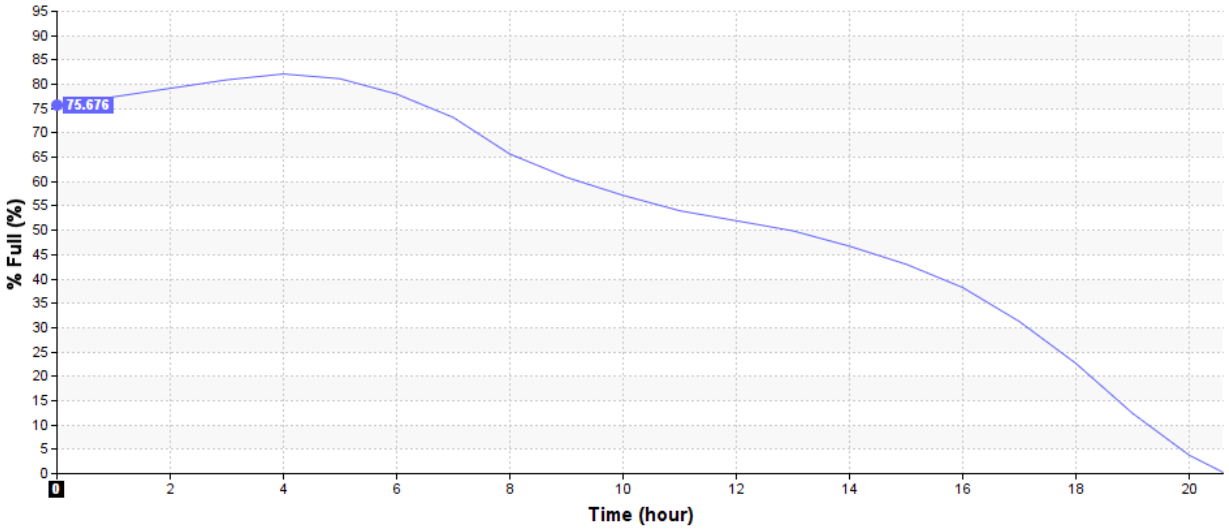
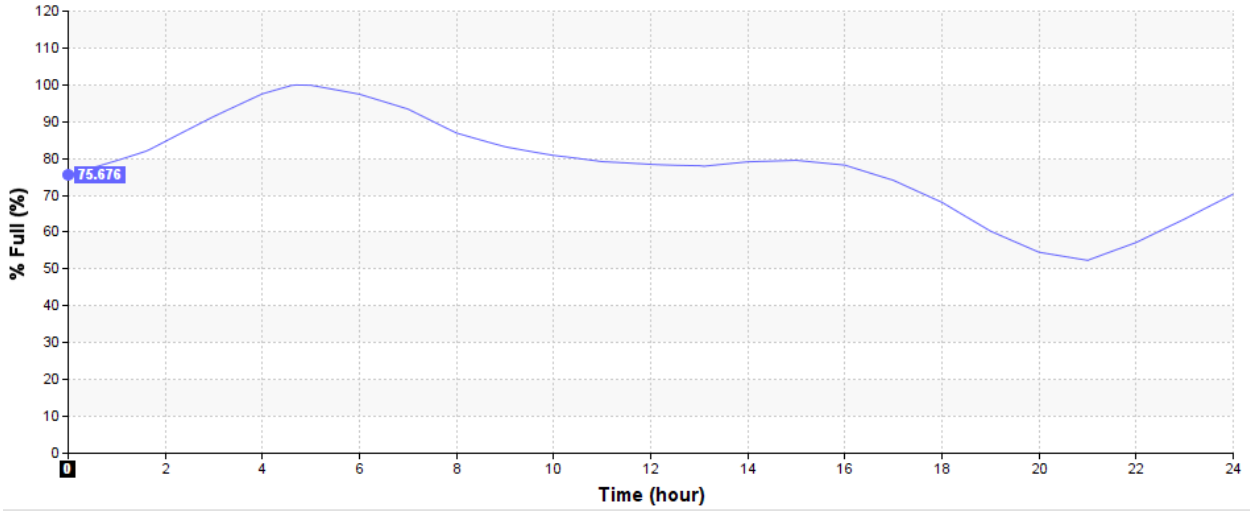


Figure 1.26 – Modeled 2023 Bandy's EST level fluctuations under MDD after operational modifications



1.4.2.1.3 2023 Maximum Day Demand Plus Fire Flow 2-hr EPS

The majority of the system is capable of supplying far more than 1,000 gpm of fire flow after these operational modifications are implemented. The only area that consistently falls below this level of service is in the vicinity of Island Point Road as shown on **Figure 1.27**, with a low of 814 gpm.

Figure 1.27– Location of marginal fire flow service near Island Point Road under 2023 MDD conditions after operational modifications.

Note: Yellow nodes indicate those with customer demands and which project to be under 1,000 gpm of available fire flow

1.4.2.1.4 Summary of Present - 2023 Recommended Improvements

The recommended 5-year improvements are as follows:

- 8,000 LF of 16-inch water main along S NC 16
- Altitude valves and appurtenances for the Anderson Mountain (SWPZ) GST and Bandy's (NEPZ) EST (identified as part of 2018 recommendations)
- Four (4) PRVs along Sherrills Ford Road at Molly's Backbone Road, Island Point Road, Beatty Road, and Highway 150 E
  Opening the system valve separating the SWPZ and NEPZ sections

1.4.2.2 Ten-Year Growth Projections or 2023 to 2028 Improvements

Model simulations for the ten-year scenario utilized the 2023 model with changes in pump controls to overcome any projected system deficiencies due to the increase in demands from 2023 to 2028.

1.4.2.2.1 2028 Average Day Demand 24-hr EPS

The pressures in the model show little variation between minimum and maximum levels throughout the 24-hour EPS, ranging as low as around 44 psi near the Anderson Mountain GST (but slightly lower immediately adjacent to the GST due to elevation). The Anderson Mountain GST is capable of relatively normal operation without the recommended improvements as shown in **Figure 1.28**. It will cycle twice daily after the implementation of recommended improvements as shown in **Figure 1.29.**

Figure 1.28 – Modeled 2028 Anderson Mountain GST level fluctuations under ADD

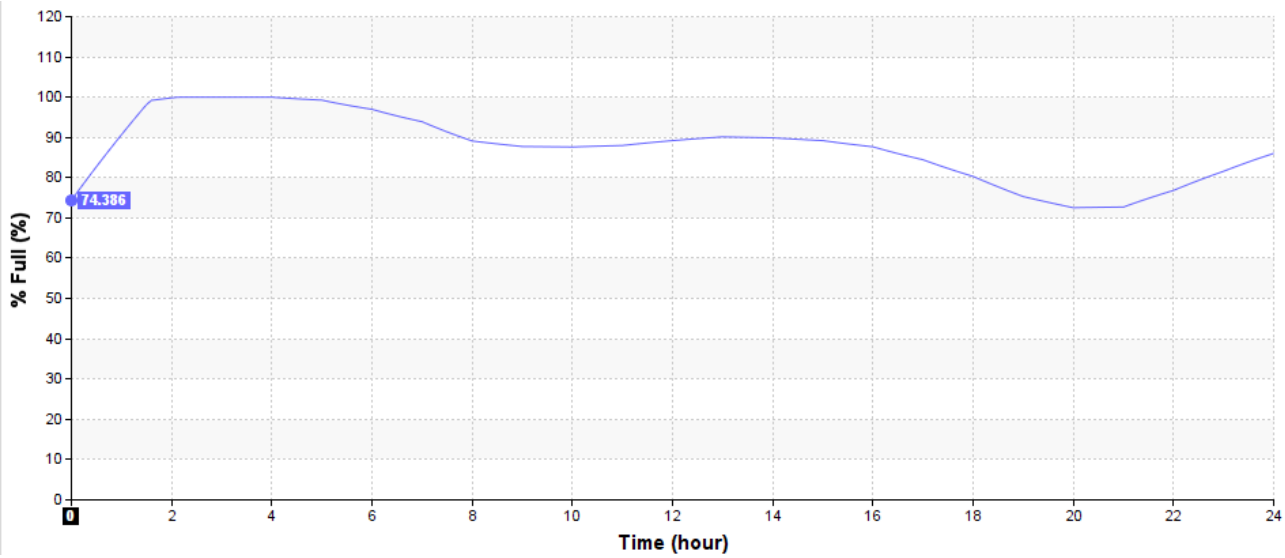
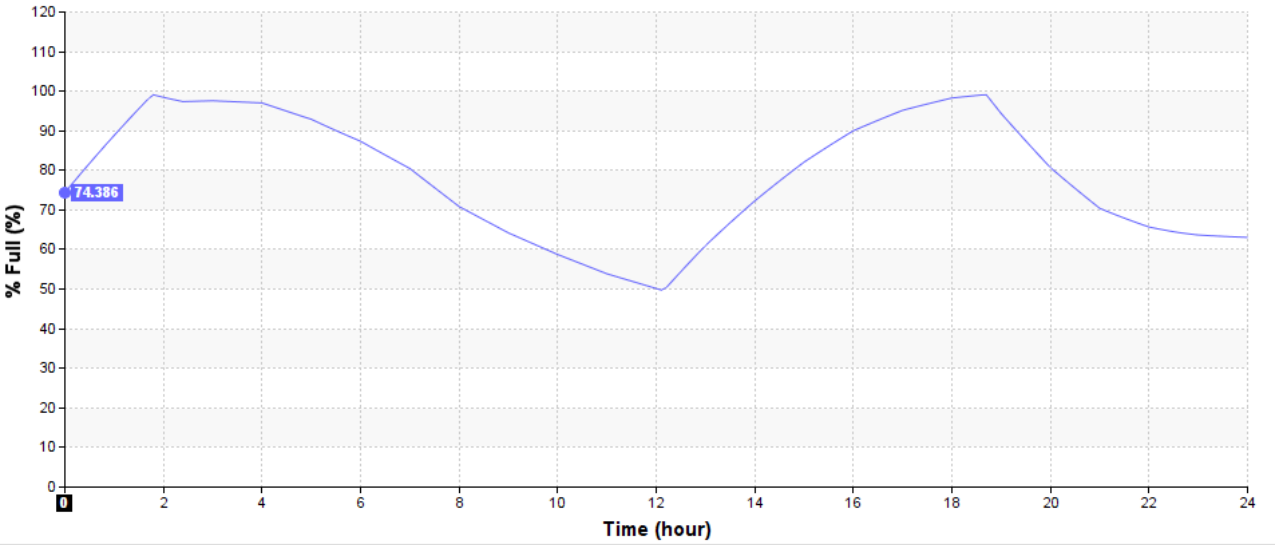


Figure 1.29 – Modeled 2028 Anderson Mountain GST level fluctuations under ADD after implementation of recommended improvements



Even with the SWPZ BPS keeping the Anderson Mountain GST above 70% full, the Bandy's EST is not able to stay at an acceptable level nor recover at the end of the day as shown in **Figure 1.30.** After the implementation of recommended improvements, it is capable of filling, remaining above 50%, and recovering at the end of the day as show in **Figure 1.31**.

Figure 1.30 – Modeled 2028 Bandy's EST level fluctuations under ADD

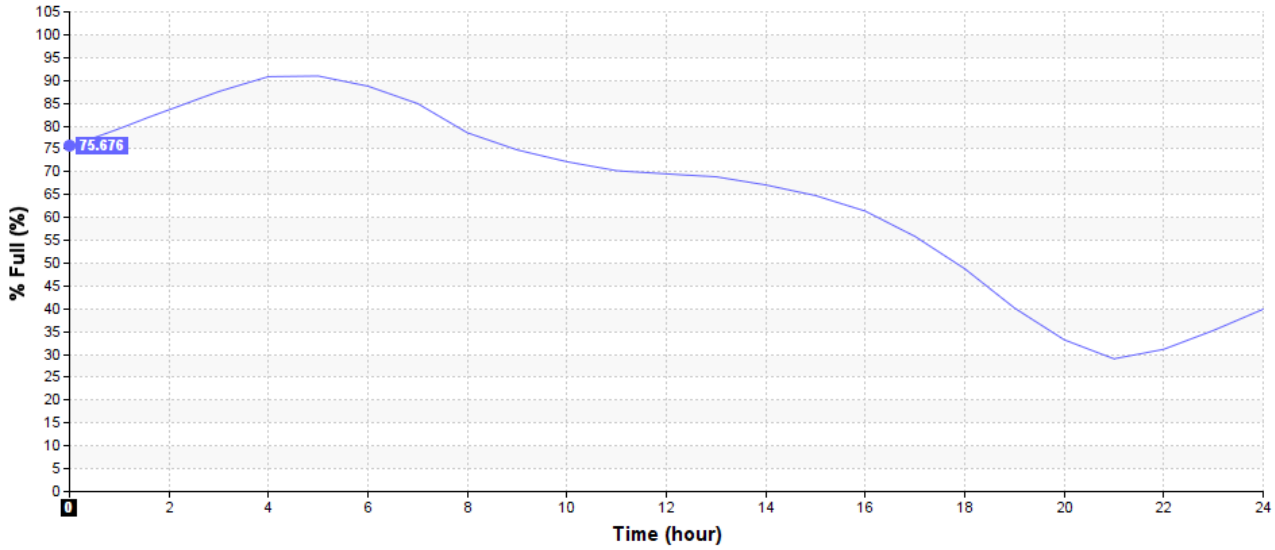
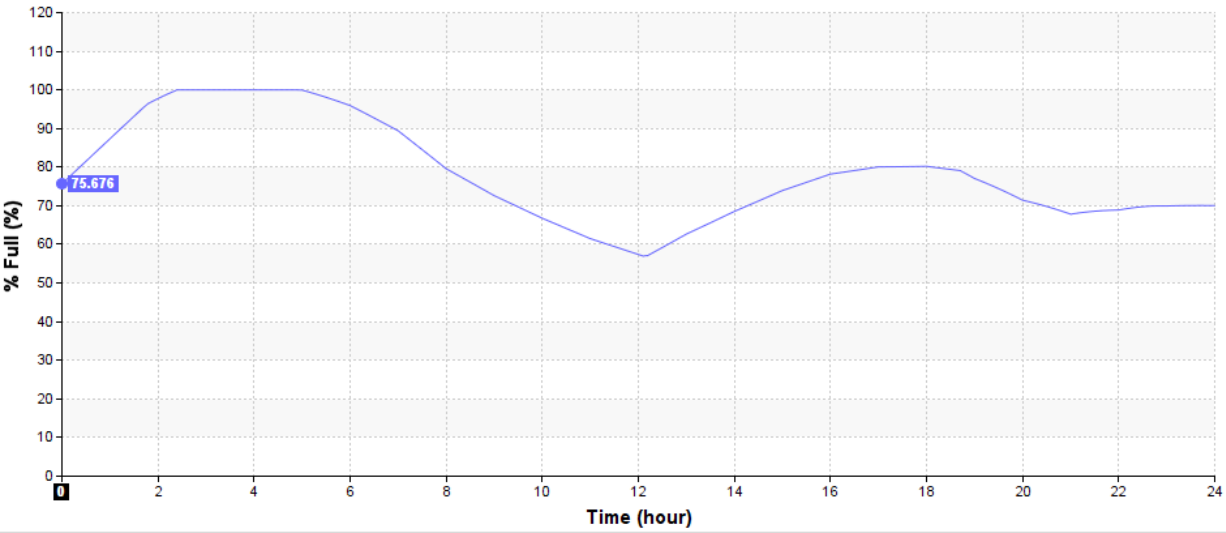


Figure 1.31 – Modeled 2028 Bandy's EST level fluctuations under ADD after implementation of recommended improvements



1.4.2.2.2 2028 Maximum Day Demand 24-hr EPS

A 24-hr EPS was analyzed using the estimated MDD consumption. The Anderson Mountain GST appears capable of near 50% turnover (down to 45%) and recovery during the period as shown in **Figure 1.32** before the implementation of the recommended improvements. As shown in **Figure 1.33**, results are similar after the recommended improvements are incorporated. Provided that the Bandy's EST is maintained at acceptable levels, operations can be adjusted to increase the turnover in the Anderson Mountain GST.

Figure 1.32 – Modeled 2028 SWPZ EST level fluctuations under MDD

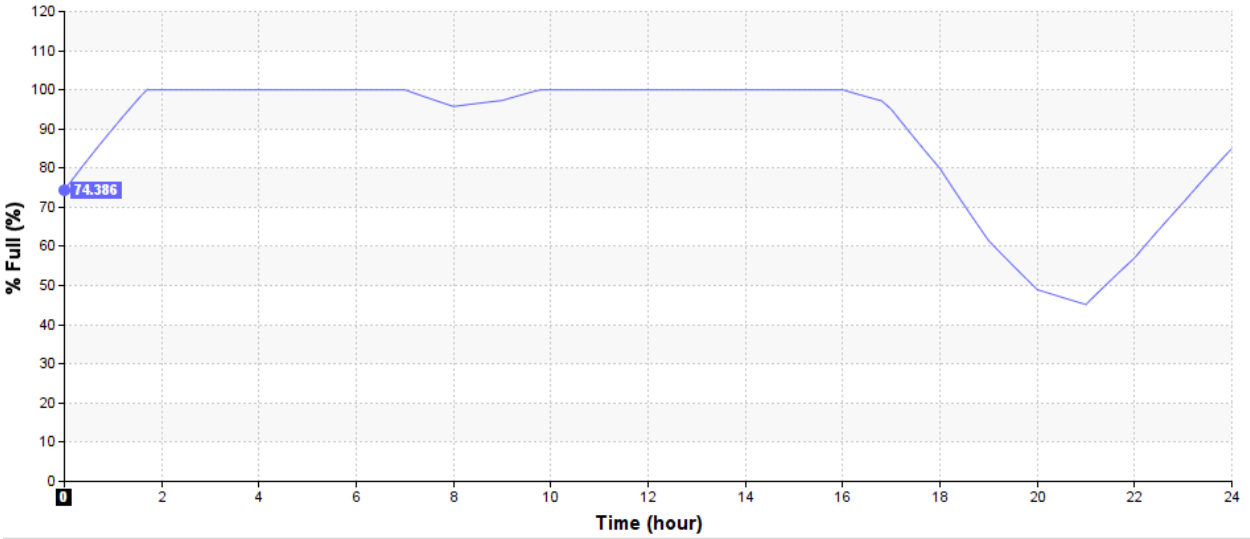
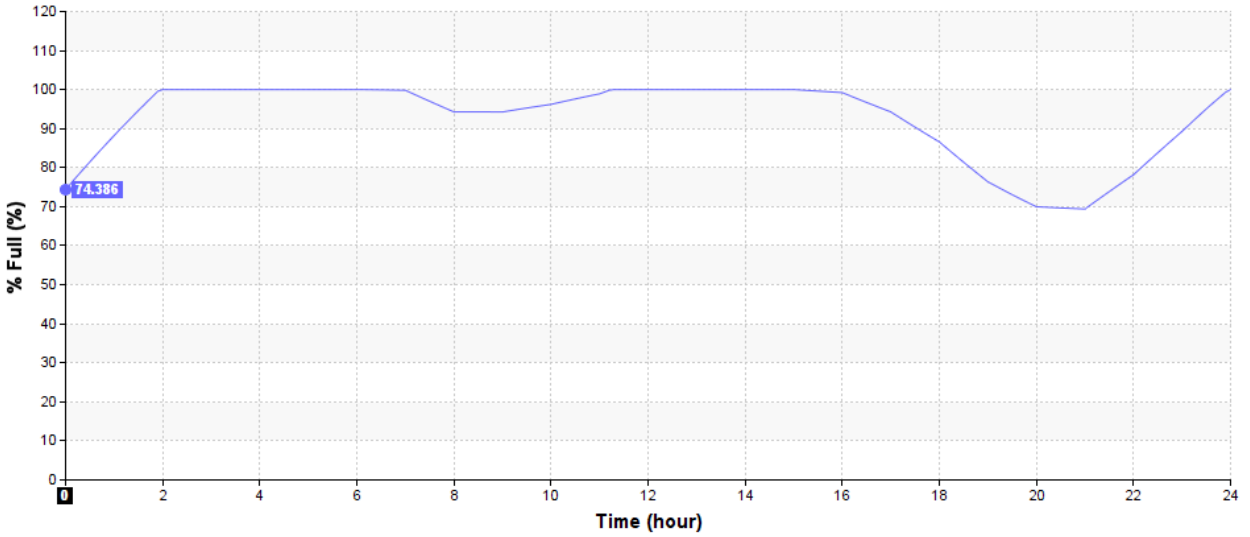


Figure 1.33 – Modeled 2028 Anderson Mountain GST level fluctuations under MDD after implementation of recommended improvements and operational modifications



The Bandy's EST completely drains within the day under these conditions as shown in **Figure 1.34** without the implementation of the recommended improvements. Once the recommended improvements are included, the Bandy's EST is capable of filling, remaining above 25%, and recovering to its starting level as shown in **Figure 1.35**. This is a marginal level of service as 25% is typically reserved for emergency storage rather than usable for fire flow.

Figure 1.34 – Modeled 2028 Bandy's EST level fluctuations under MDD

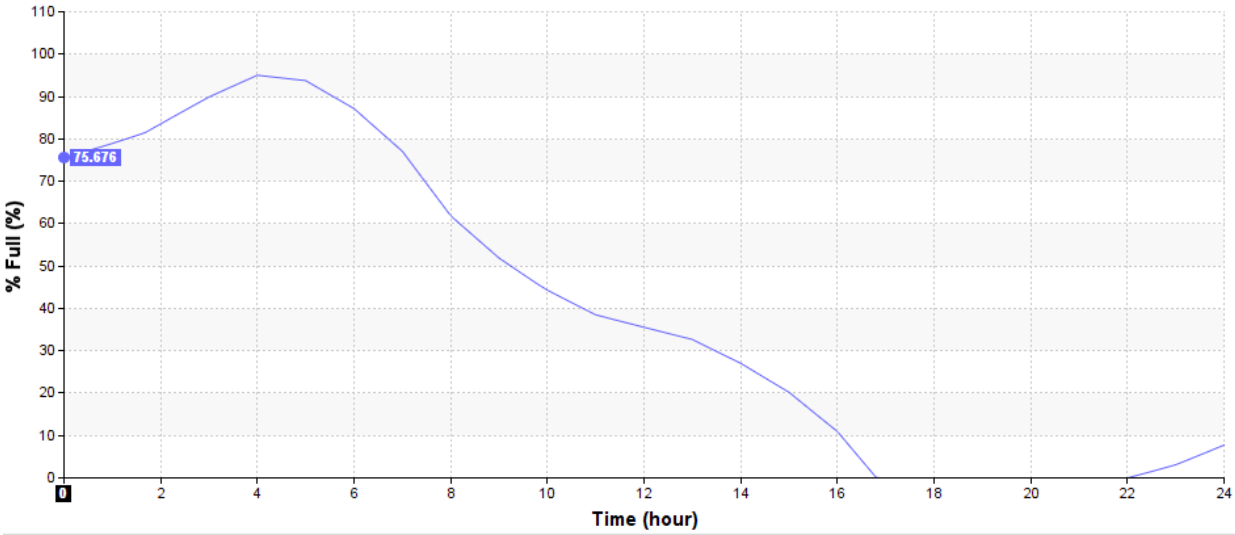
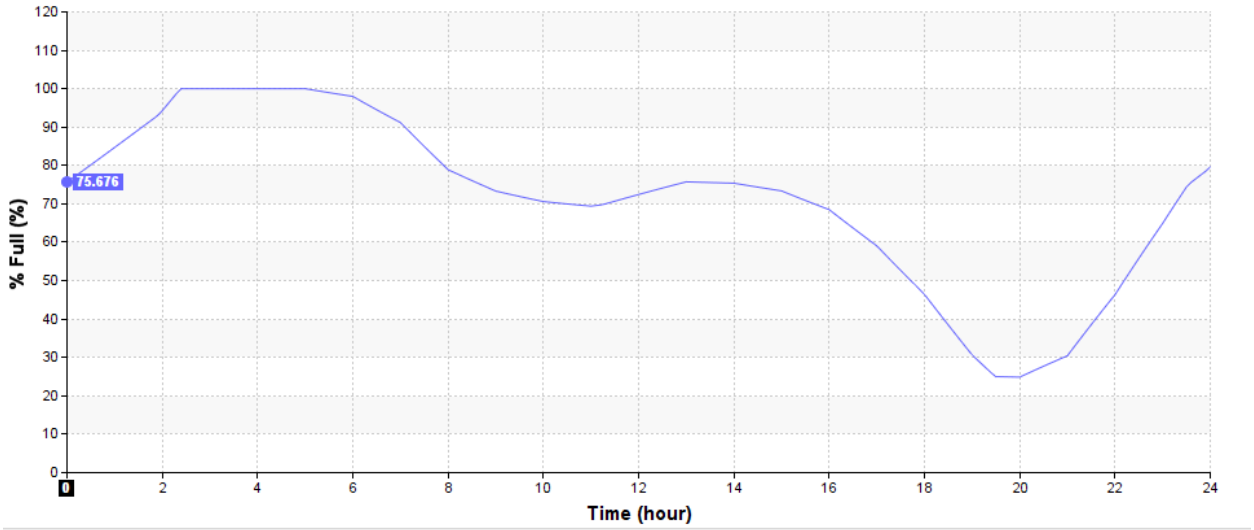


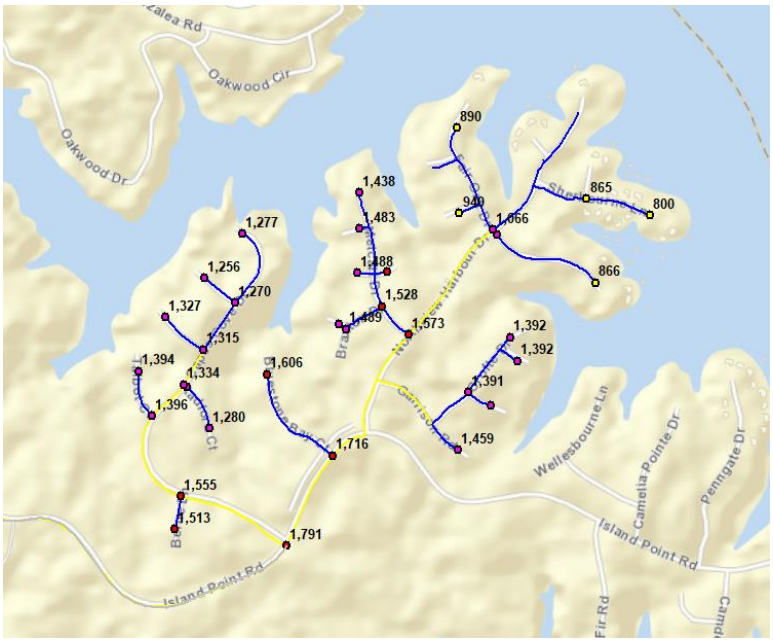
Figure 1.35– Modeled 2028 Bandy's EST level fluctuations under MDD after implementation of recommended improvements and operational modifications



1.4.2.2.3 2028 Maximum Day Demand Plus Fire Flow 2-hr EPS

The vast majority of the system is capable of supplying far more than 1,000 gpm under the revised operating conditions. The only area that consistently falls below this level of service is in the vicinity of Island Point Road as shown on **Figure 1.36**, with a low of 800 gpm.

Figure 1.36 – Location of marginal fire flow service near Island Point Road under 2028 MDD conditions after recommended infrastructure and operational modifications. maximum day demand conditions.



Note: Yellow nodes are those with a customer demand and a fire flow availability under 1,000 gpm during

1.4.2.2.4 Summary of 2028 Recommended Improvements

As described earlier, the recommended 10-year improvements are as follows:

- The 12-inch line along S NC 16 Hwy from Buffalo Shoals Rd to S NC 16 Hwy Business that were recommended previously and are assumed to be installed by this time period. S NC 16 Hwy Business to Hwy 150 E as shown in **Figure 1.46**. It is assumed that this 12-inch line will be fully constructed by 2023 to serve future growth customers along the route.
- A new 1.0 MG of elevated storage tank near Sherrills Ford Road and NC 150 E
- A new booster pump station (5,500 GPM @ 150 ft capacity) near Sherrills Ford Road and NC 150 E
- 8,200 LF of 24" and 4,500 LF of 16" (replacing 12") along Sherrills Ford Road

These locations are shown on **Figure 1.46.** The total estimated construction cost is $8,260,000. These two projects are collocated; however, timing for design and construction will depend on funding.

1.4.2.3 Twenty-Year Growth Projections or 2028 to 2038 Improvements

Model simulations for the twenty-year scenario utilized the 2028 model with changes in pump controls to overcome any projected system deficiencies due to increase in demands from 2028 to 2038.

1.4.2.3.1 2038 Average Day Demand 24-hr EPS

As shown in **Figure 1.37**, the Anderson Mountain GST is projected to reach levels below 50% full under ADD. As shown in **Figure 1.38**, the incorporation of the recommended improvements keeps the level above 50% full. While the Anderson Mountain GST does not completely fill, it remains above minimally-acceptable levels at all times. It could be filled while operating at higher pressures if desired (as later demonstrated under MDD conditions).

Figure 1.37 – Modeled 2038 Anderson Mountain GST level fluctuations under ADD

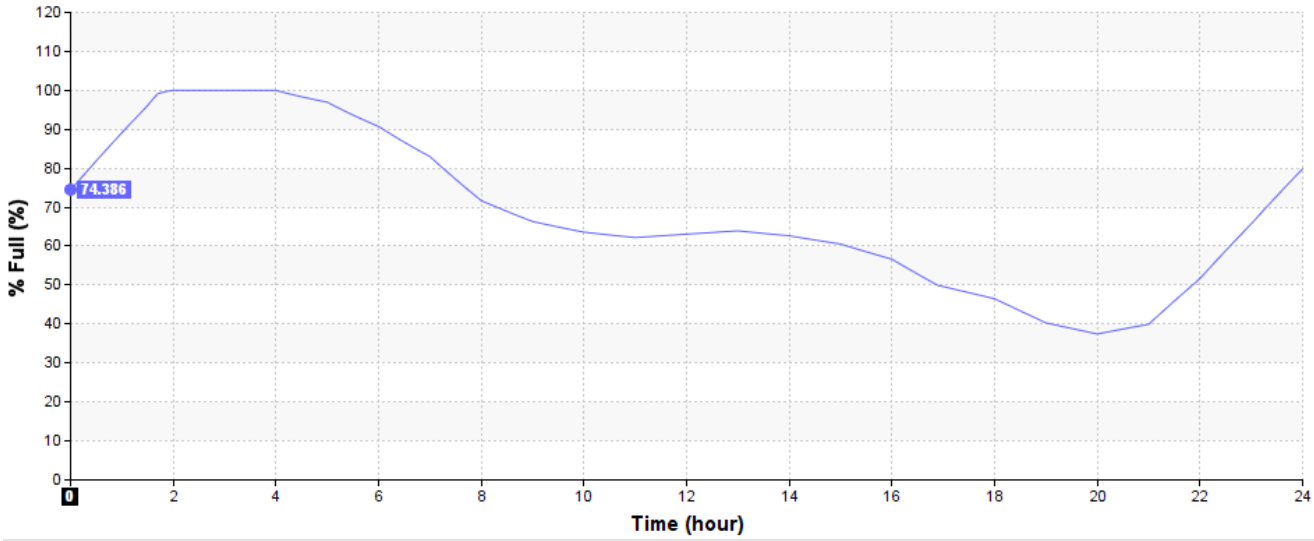
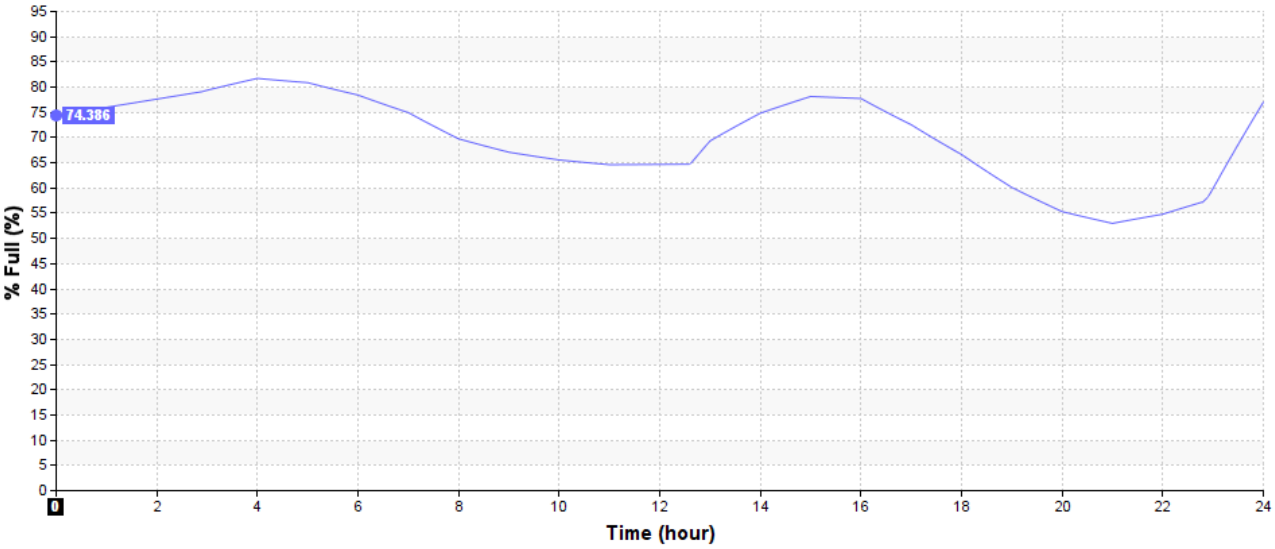


Figure 1.38– Modeled 2038 Anderson Mountain GST level fluctuations under ADD conditions after recommended improvements



The Bandy's EST drops to nearly 20% full during ADD conditions as shown in **Figure 1.39**. Following the implementation of recommended improvements, the Bandy's EST is able to fill, recover, and remain above 60% full.

Figure 1.39 – Modeled 2038 Bandy's EST level fluctuations under ADD

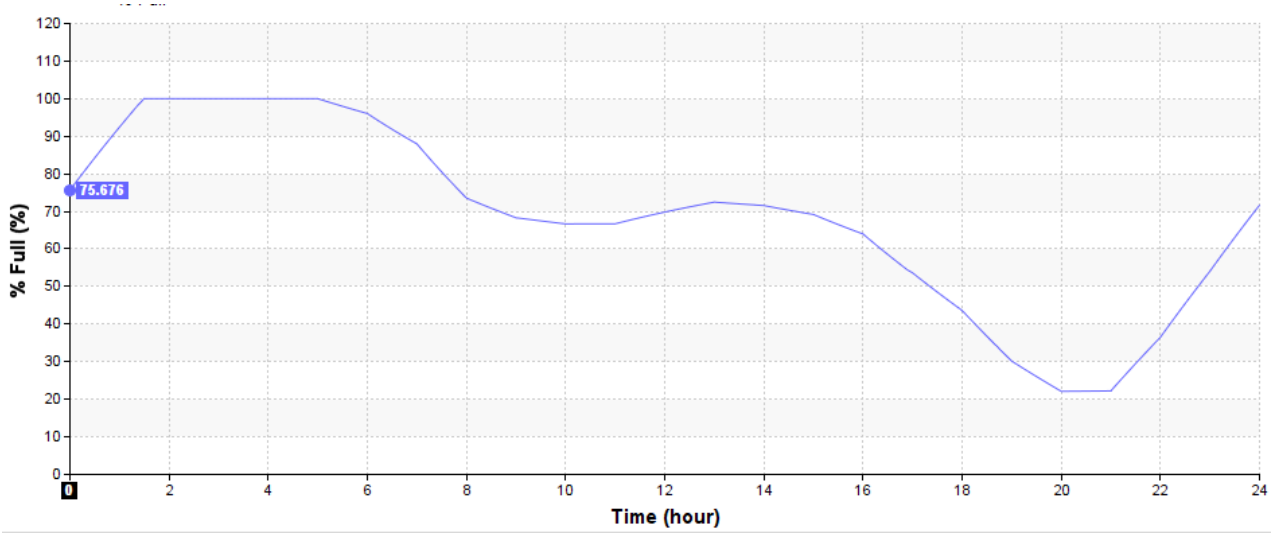
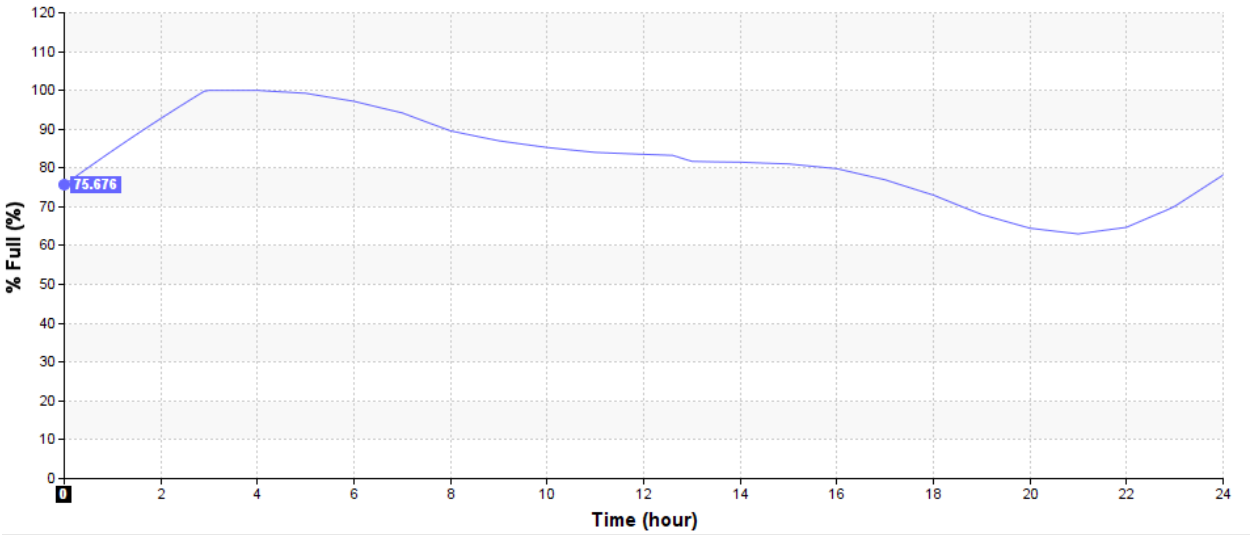


Figure 1.40 – Modeled 2038 Bandy's EST level fluctuations under ADD conditions after recommended improvements



1.4.2.3.2 2038 Maximum Day Demand 24-hr EPS

A 24-hr EPS was analyzed using the estimated MDD consumption. The Anderson Mountain GST is projected to drain within the day as shown on **Figure 1.41**. However, as shown in **Figure 1.42**, the implementation of the recommended improvements allows the Anderson Mountain GST to operate within an acceptable range.

Figure 1.41 – Modeled 2038 Anderson Mountain GST level fluctuations under MDD

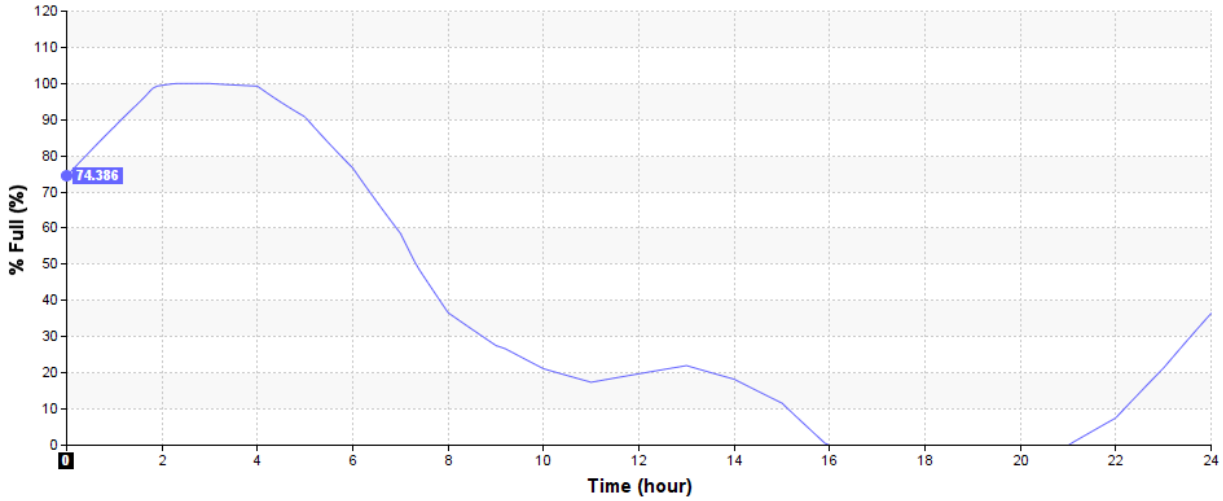
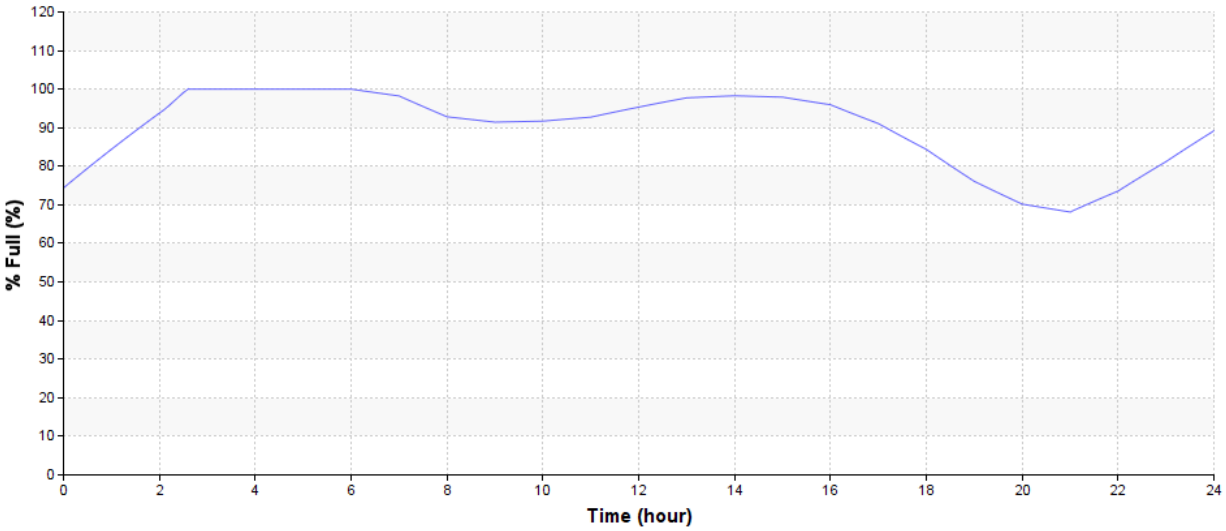


Figure 1.42 – Modeled 2038 Anderson Mountain GST level fluctuations under MDD conditions after recommended improvements



As shown in **Figure 1.43**, The Bandy's EST drains rapidly under MDD conditions without the implementation of the recommended improvements. Following the incorporation of these improvements, the Bandy's EST is able to fill, recover, and maintain a minimum level of 60% full.

Figure 1.43 – Modeled 2038 Bandy's EST level fluctuations under MDD

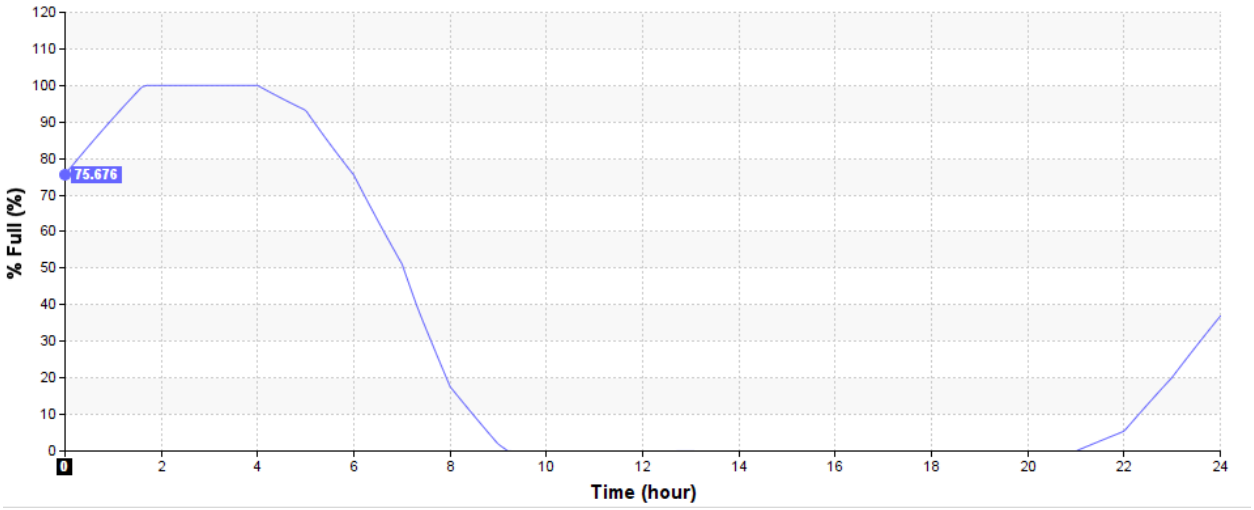
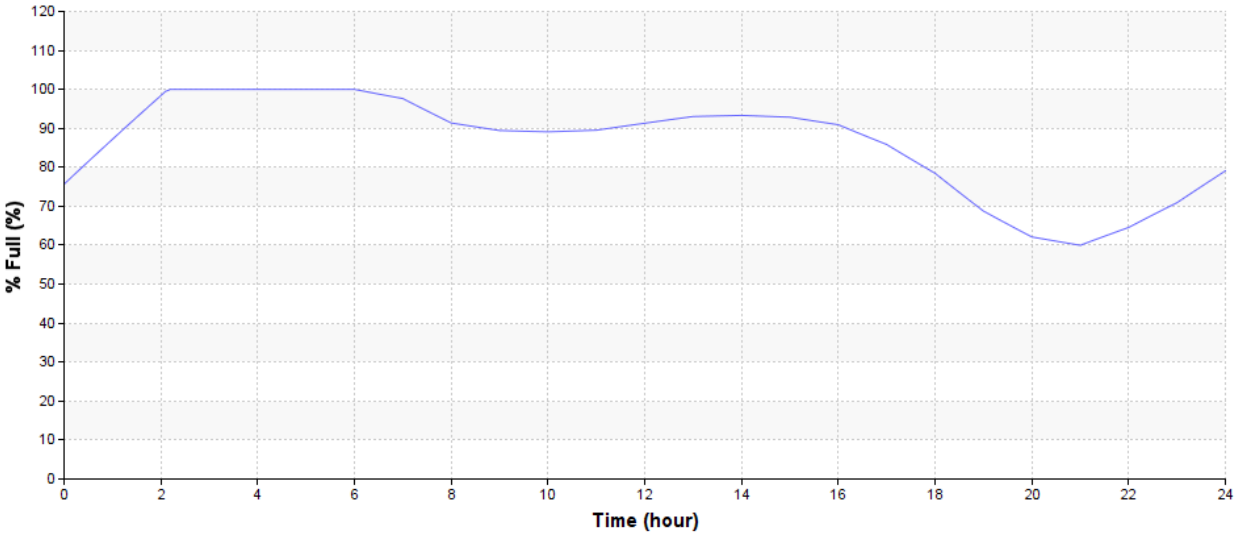


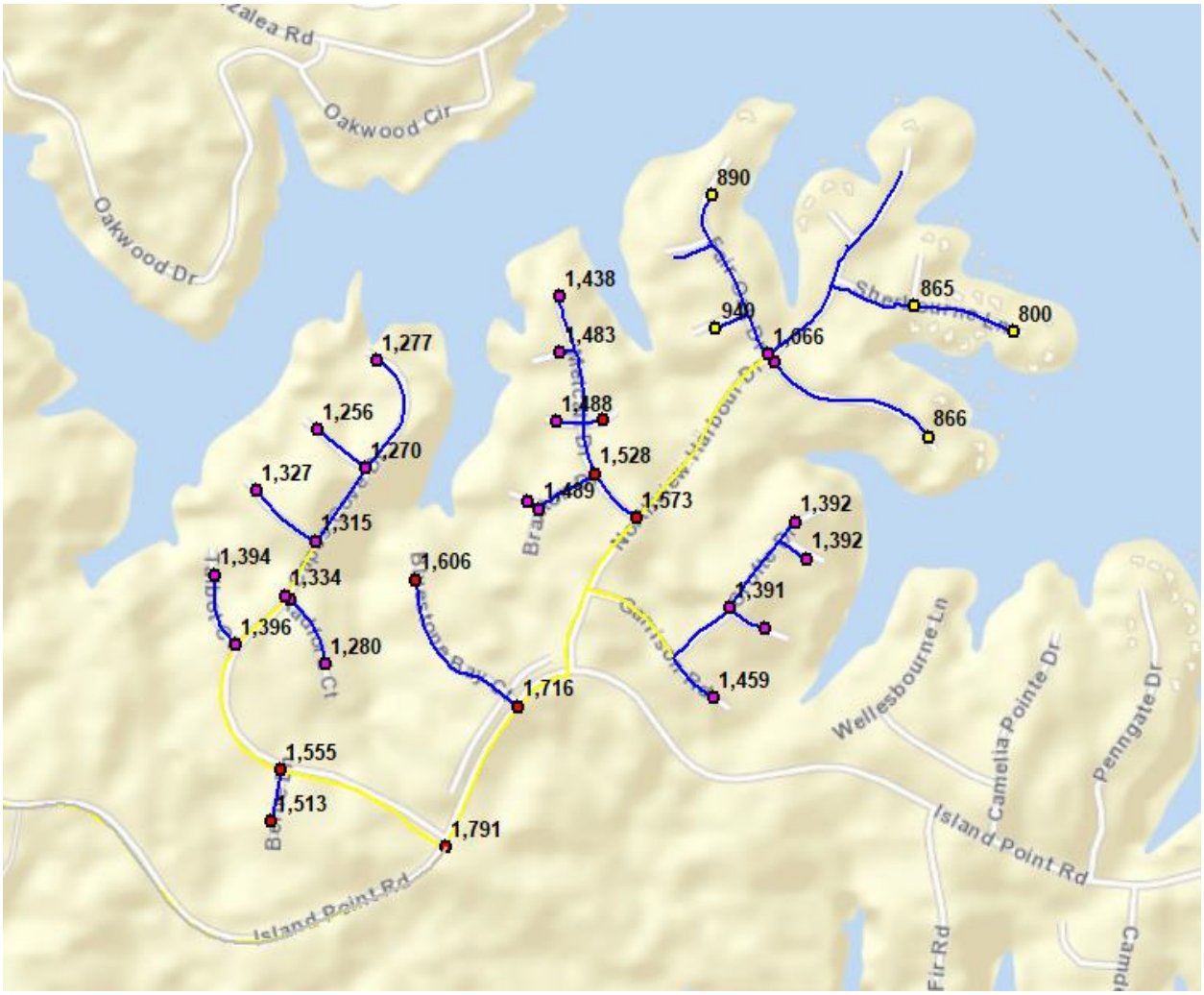
Figure 1.44 – Modeled 2038 Bandy's EST level fluctuations under MDD conditions after recommended improvements



1.4.2.3.3 2038 Maximum Day Demand Plus Fire Flow 2-hr EPS

The vast majority of the system is capable of supplying far more than 1,000 gpm under the revised operating conditions. The only area that consistently falls below this level of service is in the vicinity of Island Point Road as shown on **Figure 1.45**, with a low of 800 gpm.

Figure 1.45 – Location of marginal fire flow service near Island Point Road under 2028 MDD conditions after recommended infrastructure and operational modifications.



Note: Yellow nodes are those with a customer demand and a fire flow availability under 1,000 gpm during maximum day demand conditions.

1.4.2.3.4 Summary of 2038 Recommended Improvements and Recommendations

As shown in previous sections, both the Anderson Mountain GST and Bandy's EST drain during MDD conditions and are deficient under ADD conditions. As a result, the following improvements are recommended as remedies:

- 12,500 LF of 20" replacement pipe along East Maiden Road to Killian Crossroads
- Upgrade SWPZ BPS to produce 6,200 GPM at 275' total dynamic head (TDH)
- Add 4.0 MG of additional elevated storage to area of Sherrill's Ford Road an NC 150 E

The planning-level cost estimate for these improvements is $12,600,000. The proposed improvements are shown on **Figure 1.46**.

Table 1.9 presents a summary of all the projection scenario improvements. Timings shown are assumed to be improvements in operation by the end of the period of that scenario. Design and bidding time efforts have not been considered due to the individual nature and complexity of each project.

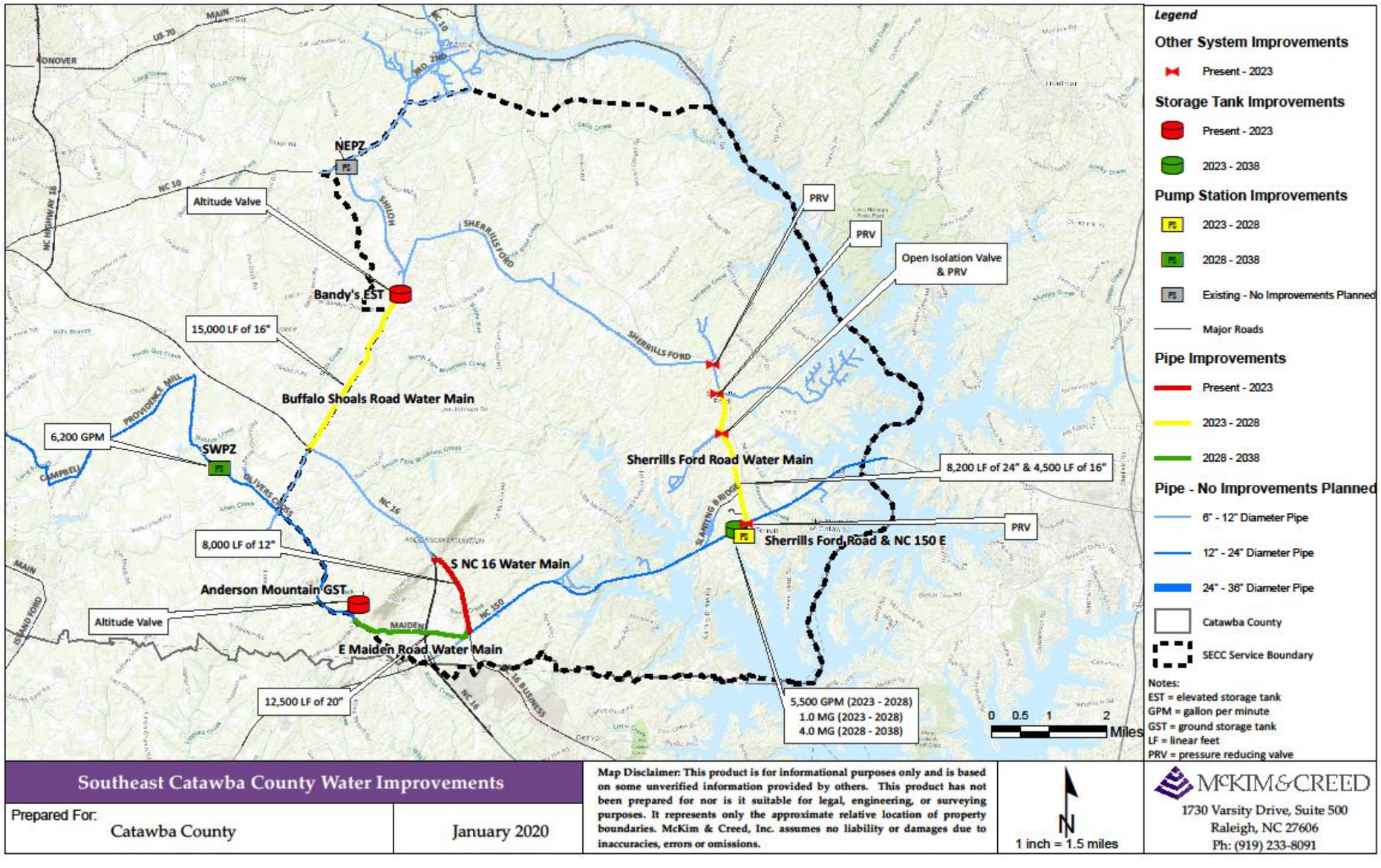
Additionally, growth trends and projections should be reviewed as growth manifests and every 5 years, so that master planning adjustments can be made proactively. The ratio of maximum day to average day should be noted and compared to the modeled value of 2.

Table 1.9 - Potable Water System Summary of Recommendations

PRESENT – YEAR 2023	
Description:	Cost:
S NC 16 Water Main - 8,000 LF of 12" new water main	$2,500,000
Anderson Mountain GST and Bandy's EST – Install altitude valves and appurtenance	$70,000
Sherrills Ford Road - Install 4 PRV stations	$200,000
(2019) Present Value:	$2,770,000
YEAR 2023 – 2028	
Description:	Cost:
Sherrills Ford Road and NC 150 E EST – 1.0 MG of elevated storage	$2,900,000
Sherrills Ford Road and NC 150 E BPS – New booster pump station	$1,580,000
Sherrills Ford Road Water Main Replacement – Upsize existing 12" water main to 8,200 LF or 24" and 4,500 LF of 16"	$3,780,000
Buffalo Shoals Road Water Main – 15,000 LF of 16" new water main	$5,100,000
(2019) Present Value:	$13,360,000
YEAR 2028-2038	
Description:	Cost:
SWPZ BPS – Upgrade booster station to 6,200 GPM with larger pumps	$1,800,000
E Maiden Road Water Main – Upsize 12,500 LF of existing piping to 20"	$5,040,000
Sherrills Ford Road and NC 150 E EST/GST – 4.0 MG of additional tank storage	$5,760,000
(2019) Present Value:	$12,600,000

Note: Construction cost estimates include a 20% contingency and are normalized to the June 2019 Engineering News Record Construction Cost Index of 11,268.

Figure 1.46 - Water Improvements Summary Map



Southeast Catawba County Water Improvements

Prepared For:	
Catawba County	January 2020

Map Disclaimer: This product is for informational purposes only and is based on some unverified information provided by others. This product has not been prepared for nor is it suitable for legal, engineering, or surveying purposes. It represents only the approximate relative location of property boundaries. McKim & Creed, Inc. assumes no liability or damages due to inaccuracies, errors or omissions.

N

1 inch = 1.5 miles

McKIM&CREED
1730 Varsity Drive, Suite 500
Raleigh, NC 27606
Ph: (919) 233-8091

2 WASTEWATER COLLECTION SYSTEM AND HYDRAULIC MODEL

As part of the SECC Master Plan, McKim & Creed developed hydraulic models of the existing wastewater/sewer collection systems within the service area to adequately evaluate the infrastructure needs of the system. For the wastewater system, the model also included the force main manifold that extended to the existing wastewater treatment facility (WWTF) located in the Town of Catawba.

The description of how the models were set up, calibrated, and tested for the selected future growth scenarios are described throughout this section. The hydraulic wastewater collection system models were built using Bentley's SewerCAD.

2.1 EXISTING FACILITIES DATA

The county provided GIS data to McKim & Creed for the existing water collection system. This GIS included force main, gravity sewers, and lift stations. The GIS data also included some facilities belonging to the City of Hickory. The steps taken to prepare the GIS data for model import included the following:

- Identified gravity lines versus force mains using available records drawings.
- Confirmed pipe sizes and materials with the record drawings.
- Matched pipeline horizontal alignment and connections with record drawings.
- Confirmed lift station locations using aerial and record drawings.

2.2 PRIMARY MODEL ELEMENTS

2.2.1 Pipeline

All County force mains were imported to the model, but only the gravity sewers connected to the County force mains were imported. All other pipelines deemed as non-major collectors were excluded from the model for the master plan analysis. Once imported, the record drawings were used to assign vertical data to the pipelines at key high and low points, add air release valves to the force main at high points, and input installation year and force main K factors for minor losses. Only key manholes and gravity conveyances were included, and their associated vertical data was added based on record drawings. Most elements in the system were constructed between 2010 to 2015. An appropriate roughness coefficient of 140 would normally be called for newer pipeline. However, a conservative C-factor of 120 was selected reflect an aged system in the future.

2.2.2 Flows

Flow into the system is very limited under existing conditions. Average daily flows totaling approximately 27 gpm were assigned to the closest manhole in the collection system to the location of the demand. Industry standard residential and commercial diurnal curves were assigned to these flows, dependent on the nature of the flow source. The diurnal curves used are shown as **Figure 2.1** and **Figure 2.2**.

Figure 2.1 - 24-Hour Residential Diurnal Curve

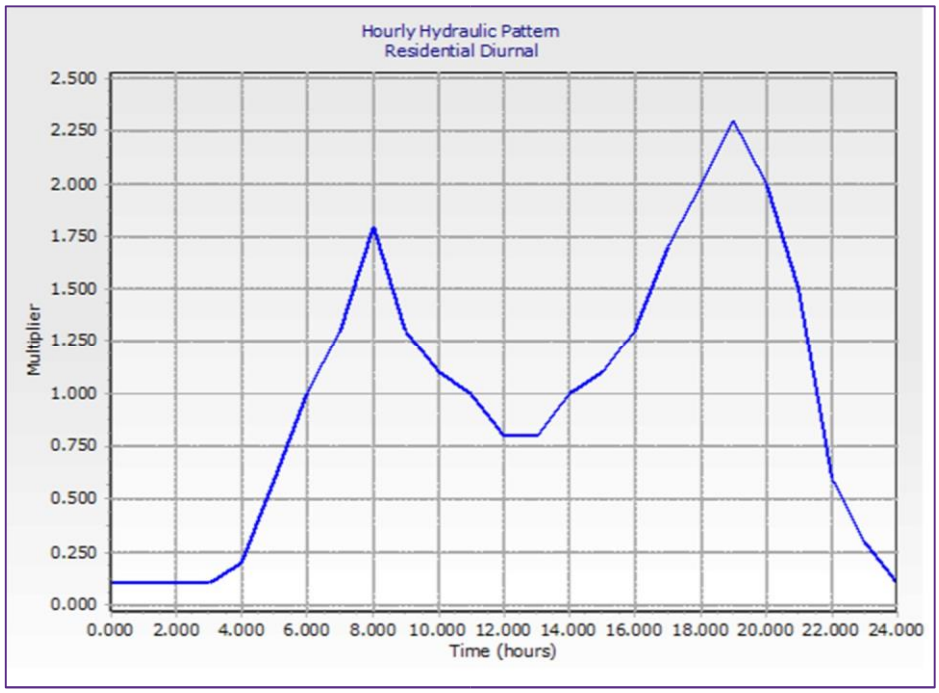
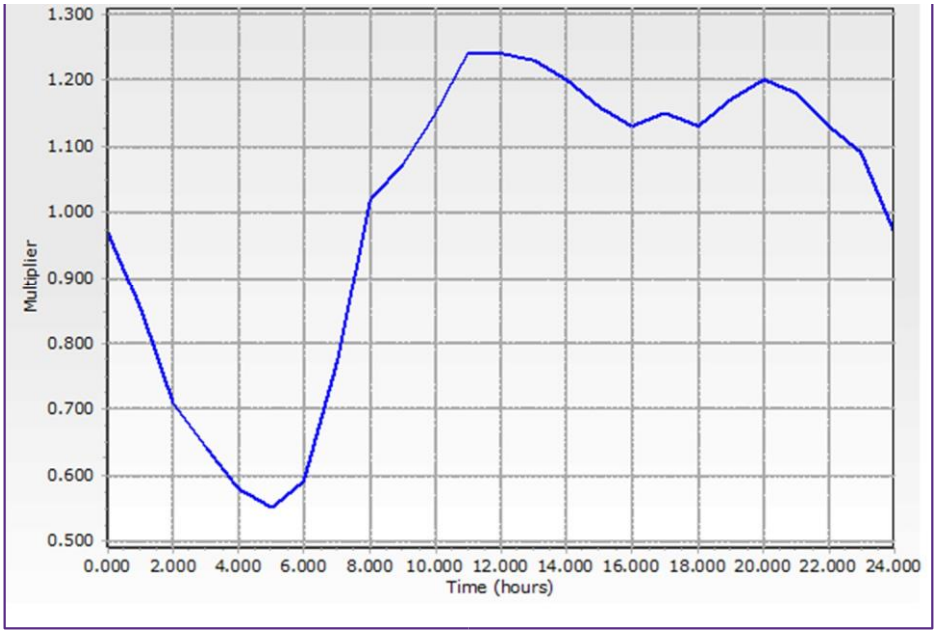


Figure 2.2– 24-Hour Commercial Diurnal Curve



2.2.3 Lift Station

Wet well elevations and dimensions were input into the model at each respective location using available record drawings. Pump curves were developed in the model from curves found in the record drawings

and pump model/impeller data. Lift station pump control schemes were input at each station based on an estimate of likely start/ stop levels in each wet well. Record drawing information is typically not as reliable for on/ off wet well control levels, as level controls are often adjusted by operations staff in the field to achieve a desired number of pump cycles per hour. Where variable frequency drives (VFDs) or soft starts were present, modeling tools in SewerCAD were implemented to mimic these devices.

Table 2.1 – Summary of Lift Station Data

Lift Station	Design Flow (gpm)	Design TDH (ft)	HP
New Hwy 16 PS	465	89	30
Old Hwy 16 PS	600	128	50
Marina PS	700	75	40
Village Center PS	1100	181	150
Terrell PS	400	90	25
Sherrills Ford PS	1200	103	60
Terrapin Creek PS	1300	206	135
Ball's Creek PS	1300	192	135

2.3 CALIBRATION

The calibration of wastewater models would typically be performed using a combination of manhole flow monitoring, pump station draw down testing, and visual verification of downstream pumping pressures at each lift station. Opportunities for calibration of the wastewater collection system model for the SECC service area are limited due to the lack of wastewater flows currently in the system. During system discussions with County Utilities & Engineering staff, and based on run time data, it is evident that most stations run as few as one cycle per day.

With this little flow currently in the system, typical calibration techniques are less useful. However, modeled pump flow rates were compared to design points and pump curves at each modeled pump station to ensure that the modeled flow/head conditions matched well with record drawing information. On average, modeled pumped flows were 17% higher than design flows, a condition that is normally attributed to a higher level of conservatism utilized in pump station design. It is not unusual for a new pump station to outperform its design condition during start-up.

Table 2.2 – Comparison of Design Flow and Modeled Flow

Lift Station	Design Flow (gpm)	Model Flow (gpm)	% Higher Modeled Flow vs. Design Flow
New Hwy 16 PS	465	500	8
Old Hwy 16 PS	600	755	26
Marina PS	700	760	9
Village Center PS	1100	1225	11

Terrell PS	400	460	15
Sherrills Ford PS	1200	1425	19
Terrapin Creek PS	1300	1525	17
Ball's Creek PS	1300	1700	31

2.4 WASTEWATER HYDRAULIC MODELING CRITERIA

2.4.1 Wastewater Hydraulic Criteria

With the future flow estimates established, the modeling of future wastewater scenarios primarily considered pumping capacities, wet well volumes, force main pipe velocities and the resultant losses attributed to these velocities, and the flow capacity of the gravity system conveyances. As stated prior, the modeling of future flow scenarios considered only major collection conveyances as depicted in figures included herein. These parameters were used to identify deficiencies, typically in the form of overflows and excessive velocities, and to size required system improvements at 5-year intervals.

2.4.1.1 Force Main Velocities

For the purposes of determining the timing for the upsizing (or paralleling of) existing force mains, a maximum allowable velocity of 7 fps was assumed to help reduce excessive dynamic (friction) losses in the lines. A minimum allowable velocity of 2 fps was also assumed, per NCDEQ regulations, to help avoid the accumulation of solids in the force main.

2.4.1.2 Pump Station Capacity

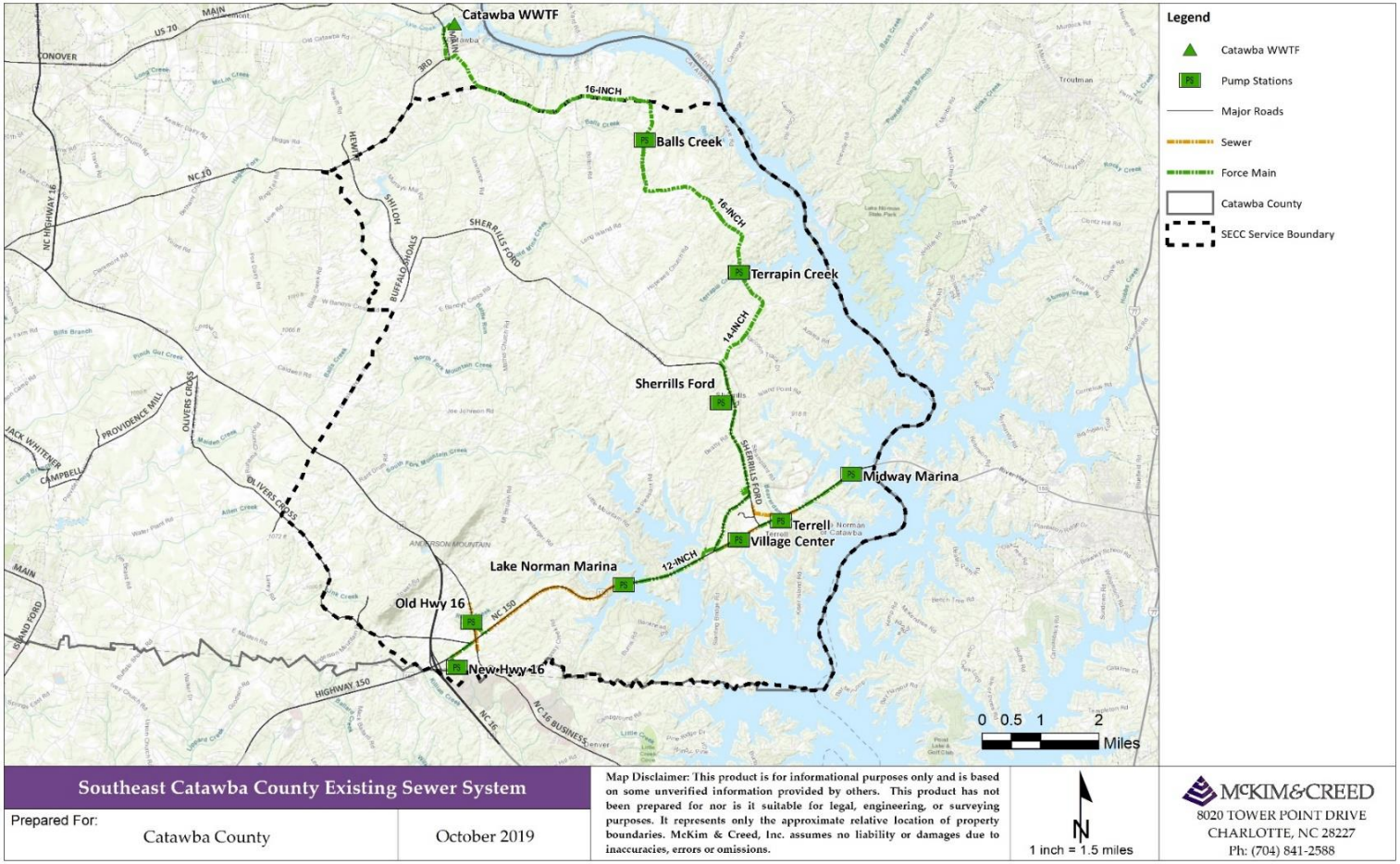
As future flows are projected to increase, pumping rates at each station must be able to meet or exceed the peak hourly inflow to avoid possible Sanitary Sewer Overflows (SSO's). For smaller pumping stations, simply ensuring the design peak pumping rate exceeds the peak hourly inflow can be sufficient, provided wet well volumes are sized appropriately. These stations typically utilize standard, across the line motor starters, set to run each pump at its full speed. Designs typically accommodate a cycle time, that is the total elapsed time between pump starts, greater than the recommended minimum duration of six minutes. For larger stations, sizing wet wells to provide enough volume to allow for simple on/off operation could result in excessive sizing, and the resulting cycle times could often be less than six minutes. This results in a higher capital cost, higher energy usage, and excessive equipment wear. To alleviate these issues, a VFD is added to replace the across the line starter, allowing the pump to operate at speeds less than full speed and accommodate a greater desired flow range. The future flow modeling uses this methodology to the extent feasible for the future upgrading of pump stations. This helps avoid replacing existing wet well structures with larger structures that may not otherwise be needed, and limits improvements to mechanical and electrical upgrades.

2.5 Wastewater Model Scenarios

2.5.1 Existing System Modeling

The development of the system model was discussed in previous sections. The model was prepared in Bentley's SewerCAD, primarily using available record drawings, County GIS information, and field data collected. A system-wide diurnal demand pattern was developed and applied to model inflows. This pattern was based on industry standards for wastewater generations.

Figure 2.3 – SECC Existing Wastewater System



2.5.2 Future Scenarios

The future scenarios were performed by adding future wastewater flow projections. The methodologies and distribution of the flow projections were discussed in prior sections. The flows were distributed at a junction (or manhole) location in geographic proximity to the proposed new development. For larger tracts, modeled flows were split between multiple access points to the parcel/track. Scenarios were created at five-year intervals and new *flow projections* added to each scenario. The ultimate scenario is defined as the full build-out of the service area. A table of flow projections has been included in **Table 2.3**.

Table 2.3 – Flow Projection

FLOW PROJECTIONS		
Scenarios	Water	Wastewater
	ADF (MGD)	
Existing	0.236	0.036
Year 5	1.00	0.67
Year 10	2.20	1.67
Year 15	3.75	2.97
Year 20	4.97	3.98
Ultimate	18.96	15.64

2.5.2.1 Five-Year Growth Projections or 2023 to 2028 Improvements

Five-year future flow estimates were input into the model and a 24-hour EPS run was completed. In general, the heavier concentration of growth is forecasted in the southern portion of the SWPZ service area, around the NC Highway 150 corridor, with the primary conveyance flowing south to north. These new flows will impact not only the collection infrastructure, but all pump stations and force mains conveying flows north to the Catawba WWTF.

With the additional future flows, each major conveyance system element was analyzed to determine if increased capacity was required. Pump station wet wells data were graphed (over the 24-hour flow period) individually to determine the number of pumping cycles per hour, and to determine if the stations experienced a SSO event. Profiles were developed within SewerCAD for each stretch of gravity conveyance to determine if additional upsizing was required for these sections. Force main velocities were checked for velocities greater than 7 fps, and/or to determine if force main upsizing could improve current pump performance (and eliminate a possible SSO) or reduce head for a concurrent pump station upgrade. Whenever possible, the upsizing (or paralleling) of a force main is assumed to be completed concurrent to a pump station upgrade. This is ideal as it allows for the optimization of hydraulic efficiency during design, i.e. the new pumps can be sized to match the hydraulic conditions of the new force main.

The five-year future flow scenario evaluation resulted in three major improvements needed to accommodate the increasing flows from new development. These improvements are in general focused along the NC Highway 150 corridor. The infrastructure north of NC Highway 150 can accommodate the additional five-year flows with only minor upgrades needed.

- Village Center Pump Station Upgrade – Upsize pumps and motors to approximately 150 HP and add VFDs for continuous pump operation. A new, larger wet well would be required to add additional storage volume for the new station, and to house the larger pumps. Electrical upgrades and a larger stand-by generator would be required for the larger pumps and motors.
- Village Center Force Main Upgrade – Add a new 12-inch force main to parallel the existing 14-inch force main between the Village Center Pump Station and the Sherrills Ford Pump Station, terminating at the manhole upstream of the Sherrills Ford Pump Station. The total length is approximately 19,500 linear feet.
- Sherrills Ford Pump Station Upgrade – Add a third pump (in-kind) to the space left available to create a triplex station. An additional VFD, power feed, and associated suction/discharge piping are also required to accommodate the additional pump.

2.5.2.2 Ten-Year Growth Projections or 2023 to 2028 Improvements

Ten-Year future flow estimates were input into the model and a 24-hour EPS run was completed. As with the previous future flow scenario, the heavier concentration of growth is again forecasted in the southern portion of the SWPZ service area around the NC Highway 150 corridor, and this growth impacts all conveyance elements to the north.

An identical model analysis (to the 2023) was performed for the ten-year flows (2028), and the same criteria for upsizing conveyance elements was utilized.

- Lake Norman Marina Pump Station Upgrade - Upsize pumps and motors (two) to approximately 120 HP and add VFDs for continuous pump operation. Electrical upgrades and a larger stand-by generator would be required for the larger pumps and motors.
- Old Highway 16 Pump Station Upgrade - Upsize pumps and motors to approximately 70 HP and add VFDs for continuous pump operation. Electrical upgrades and a larger stand-by generator would be required for the larger pumps and motors.
- Upsize the existing gravity sewer section downstream of the Old Highway 16 Pump Station from 12-inch diameter to 18-inch to increase flow capacity and eliminate modeled SSO at this location. The total length of upsizing is approximately 15,500 linear feet and would require temporary bypass pumping during construction.
- Terrapin Creek Pump Station Upgrade – Add a third pump (in-kind) to the space left available to create a triplex station. An additional VFD, power feed, and associated suction/discharge piping are also required to accommodate the additional pump.
- Balls Creek Pump Station Upgrade – Add a third pump (in-kind) to the space left available to create a triplex station. An additional VFD, power feed, and associated suction/discharge piping are also required to accommodate the additional pump.

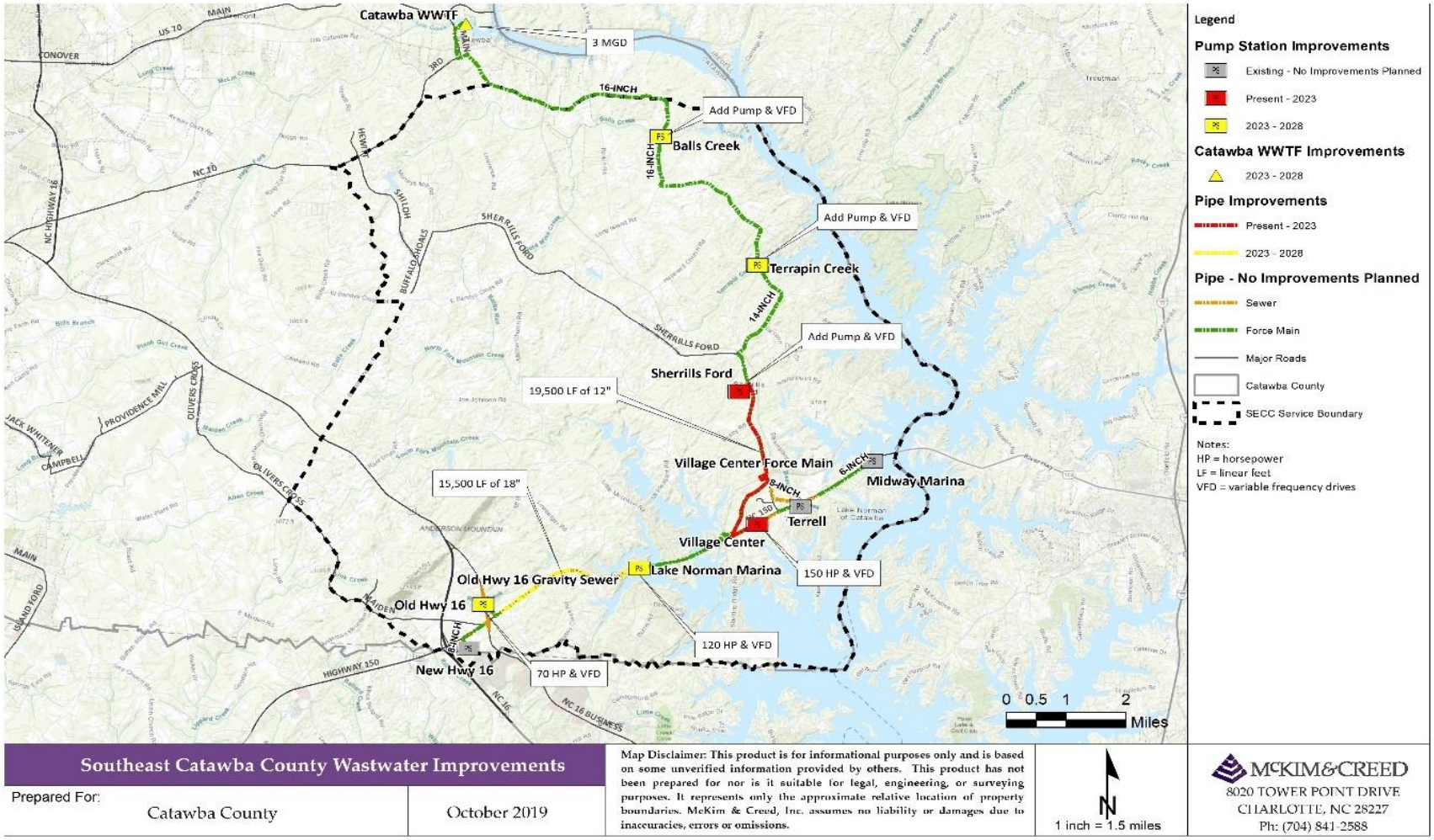
As detailed in **Table 2.4** below, an investment in the range of $1.5 – $2 million / year is estimated to accommodate the future development in the SWPZ study area. While this analysis included future flow estimates in 5-year intervals, proposed improvements can be staggered to help spread out expenditures. As development occurs, it is recommended that the wastewater

hydraulic model be updated to better reflect actual growth rates. In addition, pump station run times should be monitored regularly moving forward to help with future model calibrations. These steps will help ensure that both the timing and cost effectiveness of future upgrades is optimized.

Table 2.4 - Wastewater System Summary of Recommendations

PRESENT – YEAR 2023	
Description:	Cost:
Village Center Pump Station Upgrade - Upsized pumps, electrical, and wet well	$2,709,000
Village Center Force Main Upgrade - 19,500 LF of 12" force main	$3,330,000
Sherrills Ford Pump Station Upgrade - Add third pump and associated valves & electrical	$265,000
(2019) Present Value:	$6,304,000
YEAR 2023 – 2028	
Description:	Cost:
Lake Norman Marina Pump Station Upgrade - Upsized pumps and electrical	$609,000
Old Highway 16 Pump Station Upgrade - Upsized pumps and electrical	$520,000
Old Highway 16 Gravity Sewer Upgrade	$3,447,000
Terrapin Creek Pump Station Upgrade - Add third pump and associated valves & electrical	$315,000
Balls Creek Pump Station Upgrade - Add third pump and associated valves & electrical	$315,000
(2019) Present Value:	$5,206,000

Figure 2.4 – Wastewater Improvements Summary Map



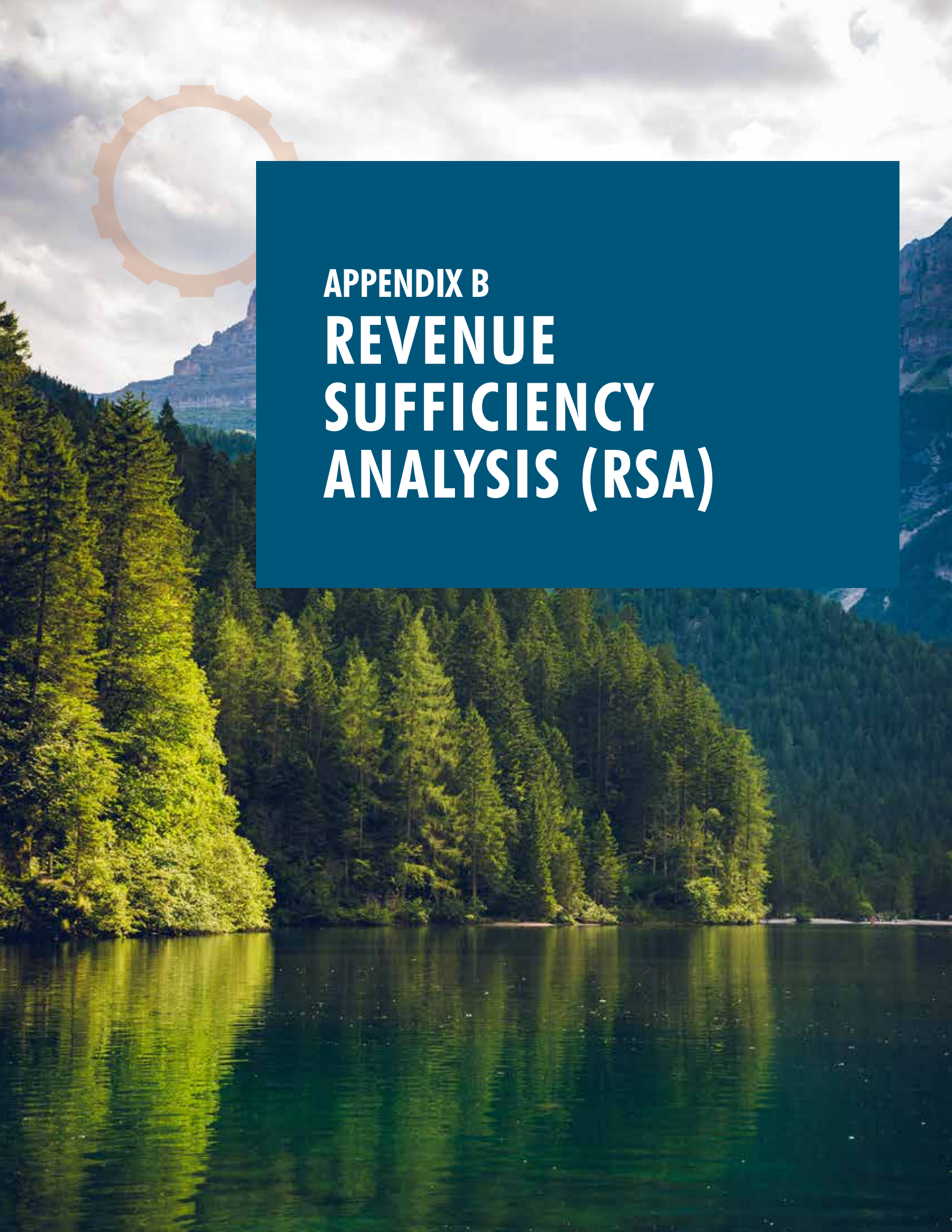
3 REFERENCES

American Water Works Association. Manual of Water Supply Practices M32 - Computer Modeling of Water Distribution Systems, Fourth Edition. 2017.

International Code Council. 2018 International Fire Code. 2017 (first printing).

Water Supply Committee of the Great Lakes. Recommended Standards for Water Works. 2012.

McKim & Creed. Existing Conditions Model Documentation. 2018.



APPENDIX B

REVENUE SUFFICIENCY ANALYSIS (RSA)

July 12, 2019

Jack Chandler
Interim Director –
Catawba County
Utilities & Engineering
25 Government Drive
Newton, NC 28658

Re: FY 2019 Water & Sewer Revenue Sufficiency Analysis– Draft Report

Dear Mr. Chandler:

Stantec Consulting Services Inc. is pleased to present this Draft Report summarizing the FY 2019 Water & Sewer Revenue Sufficiency Analysis performed for the County's Water and Sewer Fund.

We appreciate the assistance provided by you and all of the members of the County staff who participated in the analysis.

If you have any questions, please do not hesitate to call me at (813) 204-3331.

Sincerely,

Leticia Doohaluk

Leticia Doohaluk
Managing Consultant, Financial Services

Enclosure

TABLE OF CONTENTS

1. INTRODUCTION

Stantec Consulting Services Inc., (Stantec) has performed a Revenue Sufficiency Analysis (RSA) for Catawba County's (County) Water & Sewer Enterprise Fund (Utility or System). This Report describes the procedures, assumptions, and the results of the RSA. It also provides the final conclusions and recommendations.

1.1 BACKGROUND

Although Catawba County does not directly provide water and sewer service to County residents, it does share in water and sewer revenues generated by other Cities and Towns throughout unincorporated areas of the County. Historically, the County has facilitated the extension of water and sewer public service to more rural and unincorporated areas throughout the County by providing funding for distribution lines, collection lines and other water and sewer infrastructure. In return the Cities or Town servicing the unincorporated areas have agreed through contracts to share those revenues with the County.

For example, in 2006, the County installed a series of sanitary sewer lines to serve Bunker Hill High School and surrounding areas. Once the project was completed, the City of Conover took delivery of the lines and became responsible for providing sewer services in this area. As part of the agreement, the County has received and will continue to receive, for period of 40 years, one-half of all revenues generated by the City of Conover from services provided to customers through the installed sewer lines. The County maintains similar agreements with the Cities of Newton, Clermont, Hickory and the Town of Maiden.

In 2000, Catawba County entered into a similar revenue sharing agreement with the City of Hickory ("City"). Under this agreement, the City was to operate, manage, maintain and provide water services to an area of the County designed as Southeastern Catawba County ('SECC"). In 2006, the original agreement was amended to include wastewater services. Today, the SECC represents the fastest growing area of the County.

In 2017, the County engaged McKim and Creed to examine recent economic growth in the SECC area and to develop a master plan that would identify the water and sewer infrastructure the County would need to construct in order to provide future capacity for future growth in the SECC. In a combined effort with McKim and Creed, in early 2019, Stantec conducted a revenue sufficiency analysis which evaluated the ability of the County's current water and sewer revenues to provide adequate revenues over a multi-year projection period to meet the County's financial needs. This analysis also assisted in sizing future capital spending to levels reflective of the County's funding ability given current fund balances, current and projected revenues (inclusive of projected growth), and current and projected revenue requirements.

1.2 OBJECTIVES

The primary objective of the analysis is to evaluate the ability of the Utility's water and sewer revenues to meet the Utility's financial requirements over a multi-year projection period, including:

a) operations and maintenance costs,

b) capital improvement program costs (including renewal and replacement requirements),

c) all debt service requirements and corresponding net income to debt service coverage ratios, and

d) adequate operating reserves.

In most cases, the revenue sufficiency analysis relies on projected future expenses and future revenues, inclusive of customer growth and billed flow growth, to develop recommended rate adjustments to rates and charges in order to meet the projected operating and financial requirements of the Utility. Given that Catawba County does not have the ability to set its own utility rates, and instead shares in one-half[1] of revenues generated by the infrastructure it previously funded throughout the County, the RSA completed during the study incorporates a status quo financial management plan exclusive of any recommended annual rate adjustments but inclusive of assumed 2.0% annual rate increases to the City of Hickory's water and sewer rates[2].

1.3 STUDY PROCEDURES

During the conduct of this RSA, Stantec evaluated the Utility's financial management plan by examining the impact of key parameters such as; increase/decrease in customers and demand, multiple levels of capital projects spending, borrowing vs. cash funding of capital projects, fluctuations in transfers from the General Fund and/or levels of Utility receipts from County's quarter-cent Sales Tax. In this way, Stantec evaluated the sufficiency of the Utility's projected annual revenues to fund the Utility's cost requirements for FY 2019 and over the remainder of the projection period (FY 2020 through FY 2029).

In order to initiate the RSA, Stantec obtained the Utility's historical and budgeted financial information regarding the operation of the County's Water and Sewer Enterprise Fund. Stantec obtained the Utility's multi-year capital improvement program (CIP) and the Utility's current debt obligations and covenants, or promises made to bond holders or other lenders, relative to net income coverage requirements and reserves. Stantec also discussed with County staff other assumptions and policies that would impact the Water and Sewer Enterprise Fund, such as required levels of reserves, interest earnings rates, escalation (inflation) rates for operating costs, etc.

All this information was entered into Stantec's Financial Analysis and Management System (FAMS) interactive model. The FAMS model produces a multi-year projection of the sufficiency of the Utility's revenues to meet all of its current and projected financial requirements and determines the

[1] Rates are set in each service area by the City or Town serving that area. The City or Town charges double its water and sewer rates within unincorporated areas as part of this revenue sharing agreement. Then the City or Town remits those revenues to the County as shared revenues generated in each unincorporated area.

[2] Based on historical average annual rate adjustments to City of Hickory's water and sewer rates as provided by County staff.

level of rate revenue increases[3] necessary in each year to provide sufficient revenues to fund all of the Utility's requirements.

The FAMS model also utilizes all available and unrestricted cash funds in each year of the projection period to pay for capital projects, in accordance with the cash application rules in the model as defined with County staff. This produces a detailed summary of the funding sources to be used for each project in the CIP.

To the extent that current revenues and unrestricted reserves are not adequate to fund all capital projects in any year of the projection period, the FAMS model identifies a borrowing requirement to fund those projects or portions thereof that are determined to be eligible for borrowing. In this way, the FAMS model is used to develop a borrowing program that includes the required borrowing amount by year and the resultant annual debt service obligations of the Utility for each year in the projection period.

[3] The FAMS was not used to determine the level of annual rate increases required as discussed in Section 1.2 of this report. Instead, it assumed an annual rate adjustment of 2.0% to the SECC area water and sewer rates based on historical annual adjustments in the City of Hickory's water and sewer rates as provided by Staff.

2. SOURCE DATA & ASSUMPTIONS

This section of the Report presents a description of the source data and key assumptions utilized in the conduct of the revenue sufficiency analysis. The RSA relies on FY 2018 actual data and FY 2019 projected data to create an initial "test year" to serve a basis for the creation of future projections of revenues, expenses, and future fund balances. As such, for the purposes of this RSA, FY 2019 is not considered to be part of the 5-year planning period (FY 2020 – FY 2024) nor the 10-year projection period (FY 2020 – FY 2029).

2.1 SOURCE DATA

2.1.1 Beginning Balances

Fund balance information as of June 30, 2018 for the Utility's revenue fund was provided by County Staff and served as basis for beginning FY 2019 fund balances. It is important to note that funds included in beginning fund balances are not reserved or encumbered for any specific capital projects, and therefore are used to pay for the capital improvement program within the projection period based on funding rules identified by and discussed with Staff and incorporated into the model. Previously encumbered and reserved funds (approximately $17.7M) are not included in the beginning balances and neither are projects associated with these reserved funds. Fund balance details are shown in Schedule 2 of the Appendix.

2.1.2 Utility Revenues

The Utility's annual revenues consist of rate revenue (SECC Area Water and Sewer projected revenues), Non-SECC Area revenues (shared revenues with the City of Hickory, outside of the SECC area), other Municipality shared revenues (City of Conover, City of Newton & Town of Maiden), Sales Tax Revenues, Transfers from the General Fund, interest income, and other miscellaneous revenues.

For purposes of this Study, revenues were separated into three categories, rate revenues, other operating revenues and non-operating revenues. Only SECC area revenues were considered rate revenues. This is because both growth projection and City of Hickory rate increases were applied to SECC area revenues alone.

FY 2020 thru FY 2029 rate revenues were based upon FY 2019 estimated results[4], adjusted annually to reflect anticipated 2.0% annual rate increases on City of Hickory's rates[5], as well as

[4] FY 2019 water and sewer revenues for the SECC Area are calculated based on FY 2018 actual reported revenues adjusted for FY 2019 rate increase of 2.1%, as implemented by City of Hickory on July 1, 2018, and adjusted for projected FY 2019 growth as discussed with client.

[5] Based on historical average annual rate adjustments to City of Hickory's water and sewer rates as provided by County staff.

assumed customer growth and changes in water and sewer demands within the SECC Area as provided by McKim and Creed and discussed in section 2.2.1 Demand Growth of this report.

Non-SECC area revenues were considered other operating revenues and assumed to decrease by 1.00% in FY 2020 thru FY 2023. Beyond FY 2023 these revenues are projected to stay flat per discussion with County staff.

Other shared revenues from the City of Conover, City of Newton and Town of Maiden were also considered other operating revenues and in FY 2019 and FY 2020 reflected budgeted revenues as provided by County staff. Beyond FY 2020 these revenues were projected to increase by 1.00% each year of the projection per discussion with County staff.

Domestic Hauler revenues were considered other operating revenues and reflected budgeted revenues in FY 2019. However, starting in FY 2020 these revenues were removed from the projection as the County staff anticipates that the County will no longer serve haulers.

Water and sewer system development fees were calculated as a function of anticipated annual growth and the County's system development fee amounts as presented in Schedule 1 of the Appendix.

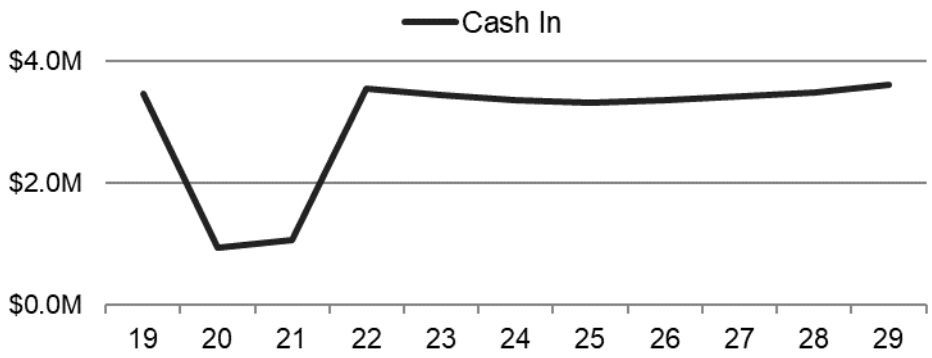
Interest income was calculated annually based on average fund balances and assumed average annual interest earnings rates, presented in Section 2.2.2 of this report and Schedule 1 of the Appendix.

Contributions from the General Fund were considered non-operating revenue and in FY 2019 reflected budgeted revenues as provided by County staff. No contribution from General Fund was projected for FY 2020 and FY 2021 per discussion with staff. Contributions in FY 2022 reflect the compounding of 3.00% annually over FY 2020 and FY 2021 followed by a 20% reduction to overall contributions as the Water and Sewer Enterprise Fund aims to reduce its reliance on General Fund subsidy. Starting in FY 2023 annual contributions from the General Fund were escalated by 3.00% annually and then reduced by 20% year over year. The assumptions were discussed and determined by County staff.

Allocations from the County's quarter-cent tax to the Water and Sewer Enterprise fund were considered non-operating revenue and in FY 2019 reflect budgeted revenues as provided by County staff. No quarter-cent tax revenues were projected for FY 2020 and FY 2021 per discussion with County staff. In FY 2022 quarter-cent revenues reflect the compounding of 1.00% annually over FY 2020 and FY 2021. Starting in FY 2023 annual revenues from quarter-cent tax were escalated by 1.00% annually as determined by County staff.

The RSA's projected annual revenues (cash inflows) are shown in Figure 1 below. Detailed revenue projections are presented in Schedule 3 of the Appendix.

Figure 1 Projected Annual Revenues



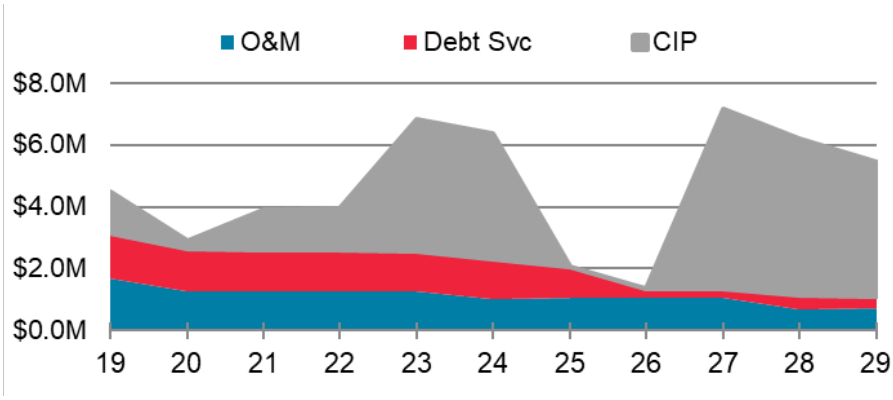
2.1.3 Utility Revenue Requirements

The FY 2019 revenue requirements are based principally upon the FY 2019 Approved Budget and FY 2020 revenue requirements upon FY 2020 Proposed Budget, which reflect all operations and maintenance (O&M) expenses, other miscellaneous expenses and debt service requirements. After FY 2020, expenditures were projected based on upon assumed cost escalation factors for individual expense categories, with the exception of debt service expenses, which reflect specific payment schedule for each respective financing. Annual cost escalation factors for various types of O&M expenses were discussed with County staff and are, presented in Schedule 5 of the Appendix. Detailed operating cost projections are presented in Schedule 4 of the Appendix.

The Capital Improvement Program (CIP) was provided by both County staff and McKim and Creed for the period of FY 2019 to FY 2029. It is important to note that an annual cost escalation factor has been applied to the capital improvement program starting in FY 2021, consistent with the Engineering News Record Construction Cost Index. The total identified capital investments in the CIP equal approximately $29.6 million. A detailed list of the specific projects and costs by year are presented in Schedule 6 of the Appendix.

The RSA's projected annual revenue requirements (cash outflows) are shown in Figure 2 below. Figure 2 segregates total revenue requirements between O&M costs, debt service costs and capital improvement costs.

Figure 2 Annual Revenue Requirements by Type



2.2 ASSUMPTIONS

The following summarizes the key assumptions utilized in the conduct of the RSA.

2.2.1 Demand Growth

Demand growth assumptions were provided by McKim and Creed and included in the analysis. Growth for planning purposes can often be over optimistic as that type of projection is used to guarantee that service is available when new units do connect in the future. As such, based on discussion with staff, the analysis includes a 60% reduction to growth in the number of new accounts originally provided by McKim and Creed. Growth projections for the 5-year planning period are shown in Figure 3. Schedule 1 of the Appendix includes a detailed 10-year projection of connections and billed flows for water and sewer service.

Figure 3 Planning Period (FY 2020 thru FY 2024) Growth Projection

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
Annual Growth						
Water						
Number of Connections	979	1,062	1,151	1,248	1,353	1,467
Annual Connection Growth [1]	N/A	83	89	97	105	114
Annual % Change in Connections [1]	*N/A*	*8.48%*	*8.38%*	*8.43%*	*8.41%*	*8.43%*
Projected Annual Billed Flows	75,856,565	82,327,129	89,151,589	96,710,412	104,741,095	113,565,123
Annual % Change in Billed Flows	*N/A*	*8.53%*	*8.29%*	*8.48%*	*8.30%*	*8.42%*
% Paying Capital Charges	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Sewer						
Number of Connections	158	241	330	427	532	646
Annual Connection Growth [1]	N/A	83	89	97	105	114
Annual % Change in Connections [1]	*N/A*	*52.38%*	*36.86%*	*29.35%*	*24.56%*	*21.41%*
Projected Annual Billed Flows	15,043,491	22,574,967	30,536,357	39,335,020	48,706,903	58,987,712
Annual % Change in Billed Flows	*N/A*	*50.06%*	*35.27%*	*28.81%*	*23.83%*	*21.11%*
% Paying Capital Charges	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

2.2.2 Interest Earnings on Invested Funds

The analysis assumed an interest earnings rate on the Operating Fund of 0.25% in FY 2019 and FY 2020, 0.50% in FY 2021, 0.75% in FY 2022, 1.00% in FY 2023 and 1.25% in FY 2024 and each year thereafter for the remainder of the projection period based on staff input.

2.2.3 O&M Cost Escalation

Annual cost escalation factors for the various types of O&M expenses were discussed with County staff and applied in each year of the projection period beginning in FY 2021. In general, operating expenses are projected to track with overall inflation patterns, and most cost line items are projected to increase at annual rates between 2.00% and 3.00%. There are few exceptions related to specific cost categories expected to experience different rates of change, such as group health insurance and retirement related costs. The specific escalation factors assumed for each type of expense are presented on Schedule 5 of Appendix.

2.2.4 Borrowing Assumptions

Any new debt required during the projection period is modeled under the assumed terms summarized below. These projected terms are not intended to serve as forecasts, they are intended to provide a reasonable basis for cost projections related to future capital expenditures

for rate planning purposes. The analysis projects approximately $4.6M of borrowing between FY 2028 and FY 2029.

Long-Term Debt Assumptions:

- Term: 30 Years
- Interest Rate: 3.50% in FY 2019, 4.00% in FY 2020, 4.50% in FY 2021, 5.00% in FY 2022, 5.50% in FY 2023 and each year thereafter
- Cost of Issuance: 2.00%
- Debt Service Reserve: 1 year

2.2.5 Debt Service and Coverage

Typically, utilities who have issued debt in the bond market are required to maintain annual net revenues (gross revenues minus operating expenses) that are at least 1.0x times greater than the utilities' annual debt service requirements. Debt service coverage can be as low as 1.0x but are typically set at a higher level.

At the time of this study, the Utility only holds privately placed or federally funded debt instruments[6]. As such, none of its current revenues are pledged and no specified debt service requirements exists.

If coverage requirements existed, the Utility would have a minimum bond covenant requirement. To the extent the Utility was unable to meet that requirement, it could be found in technical default, which could result in reductions in credit ratings, which would affect the interest rate and terms of future financing initiatives.

As a policy decision, well-managed utilities almost always measure revenue sufficiency and set rates based upon higher coverage levels to ensure compliance with these covenants in the event future projections of revenue and/or expenses do not occur as projected. As such this RSA includes a senior-lien coverage target of 1.70x, and a senior-lien and junior-lien coverage target of 1.70x. Detailed debt service calculations are presented in Schedule 8 of the Appendix.

2.2.6 Minimum Operating Reserves

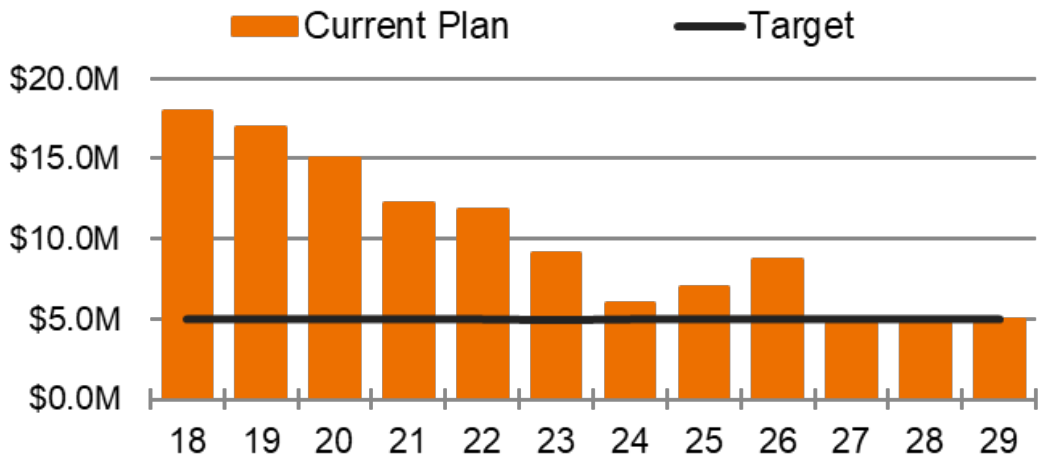
The maintenance of appropriate reserve levels is a primary management objective for effective utilities. Water and wastewater operations must continue, assets must be maintained, and projects must be implemented even during challenging financial circumstances. Funds must be set aside in advance to address these critical needs. Reserves are also an important financial indicator considered by rating agencies while establishing credit ratings for municipal utility systems, thereby impacting the terms and costs of future borrowing requirements. Rating agency guidance as to the level of operating reserves for utility systems tends to be consistent with levels recommended by AWWA (American Water Works Association) and our industry experience.

[6] With the exception of the Limited obligation, Series 2011 Refunding obligation which is secured by the County's pledge to annually budget or appropriate funds to make the debt service payments out of the County's general revenues not specifically water and sewer. The debt is further backed by lien on certain fixed assets.

Based upon our industry experience, effective utilities often target a minimum operating reserve in the range of 3 – 12 months of annual O&M expenses, depending on other reserve funds and practices, local economic conditions, and other financial management policies and procedures.

Catawba County's Water and Sewer Enterprise Fund has a more robust minimum operating target reserve of $5.0M which is equal to approximately 36 months of projected FY 2019 O&M expenditures. As displayed in Figure 4, the Utility is projected to maintain its $5.0M target fund balances through FY 2029.

Figure 4 Projected Annual Operating Reserves



3. RESULTS

Given the following major assumptions described by previous sections of this report

1. Projected account and billed flow growth
2. Assumed 2.0% annual rate increases to City of Hickory rates charged to customer in the SECC area.
3. Projected annual contribution from General Fund
4. Projected annual allocations from the County's quarter-cent sales tax
5. Projected annual level of O&M spending, including debt service
6. Projected annual level of CIP spending

The financial management plan concludes that the Water and Sewer Enterprise Fund is projected to stay within its $5.0M minimum reserve target, as displayed in Figure 5 below, while covering all O&M and debt service costs, as well as cash funding all projected capital improvement costs included in the 10-year projection, and displayed shown in Figure 6 below.

Figure 5 Projected Annual Operating Reserves

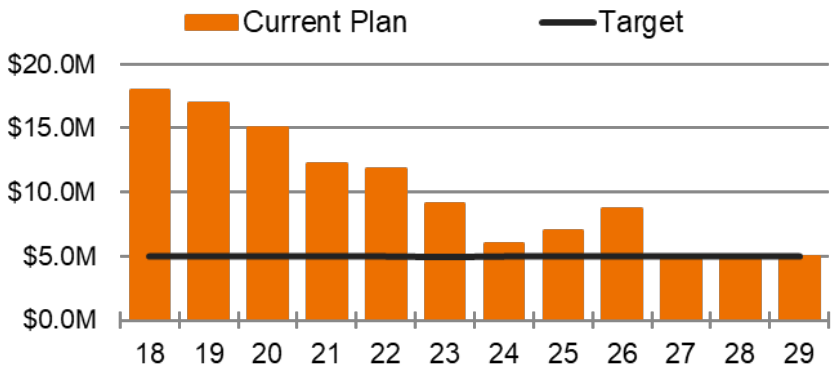
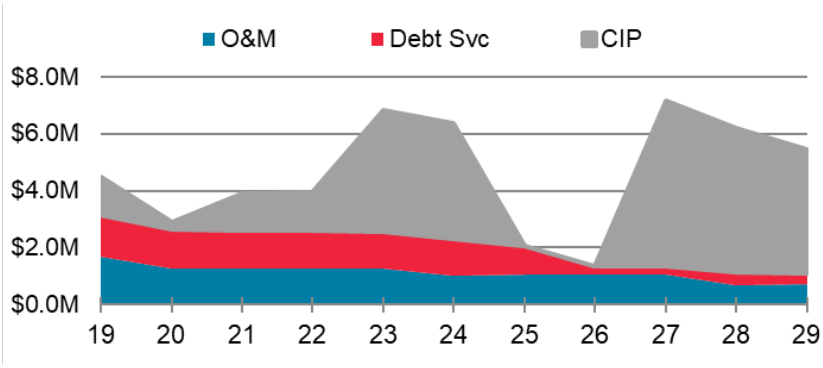


Figure 6 Projected Annual Revenue Requirements by Type



The supporting schedules for the full 10-year financial management plan are presented in detail in the Appendix. Projections beyond the next five years are valuable for planning, management, and policy purposes, but are generally not considered to be recommendations due to the potential effects of so many uncontrolled variables.

4. CONCLUSIONS & RECOMMENDATIONS

Based upon the analysis and results presented herein, Stantec has reached the following conclusions and recommendations:

- The Utility's current water and sewer revenues inclusive of transfers from General Fund and allocations from County's quarter Sales Tax revenues as presented herein are sufficient to meet operating, capital, debt service coverage, and minimum operating reserve requirements over the projection period as described herein.

- Stantec strongly recommends that the County continue to review the financial performance of the Utility on an annual or bi-annual basis and evaluate the adequacy of its revenues. Doing so will allow for the recognition of updated revenue and expense information and changes in economic conditions or structural changes with the Utility so that any necessary adjustments can be made to allow the Utility to meet its requirements during the projection period minimize impacts from future events occurring differently than projected.

APPENDIX – SUPPORTING FINANCIAL SCHEDULES FOR THE RSA

Supporting Schedules

Schedule 1	Assumptions
Schedule 2	Beginning Fund Balances
Schedule 3	Projected FY 2019 – FY 2029 Cash Inflows
Schedule 4	Projected FY 2019 – FY 2029 Cash Outflows
Schedule 5	Cost Escalation Factors
Schedule 6	Capital Improvement Program
Schedule 7	FAMS-XL Control Panel
Schedule 8	Forecast of Net Revenues and Debt Service Coverage
Schedule 9	Capital Projects Funding Summary
Schedule 10	Detailed Funding Summary
Schedule 11	Long Term Borrowing Projections

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Rate Increase Adoption Date	7/1/2018	7/1/2019	7/1/2020	7/1/2021	7/1/2022	7/1/2023	7/1/2024	7/1/2025	7/1/2026	7/1/2027	7/1/2028
Annual Growth											
Water											
Number of Connections	979	1,062	1,151	1,248	1,353	1,467	1,566	1,672	1,785	1,905	2,034
Annual Connection Growth [1]	N/A	83	89	97	105	114	99	106	113	120	129
Annual % Change in Connections [1]	*N/A*	*8.48%*	*8.38%*	*8.43%*	*8.41%*	*8.43%*	*6.75%*	*6.77%*	*6.76%*	*6.72%*	*6.77%*
Projected Annual Billed Flows	75,856,565	82,327,129	89,151,589	96,710,412	104,741,095	113,565,123	121,241,910	129,331,576	138,096,621	147,274,544	157,245,813
Annual % Change in Billed Flows	*N/A*	*8.53%*	*8.29%*	*8.48%*	*8.30%*	*8.42%*	*6.76%*	*6.67%*	*6.78%*	*6.65%*	*6.77%*
% Paying Capital Charges	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Sewer											
Number of Connections	158	241	330	427	532	646	745	851	964	1,084	1,213
Annual Connection Growth [1]	N/A	83	89	97	105	114	99	106	113	120	129
Annual % Change in Connections [1]	*N/A*	*52.38%*	*36.86%*	*29.35%*	*24.56%*	*21.41%*	*15.31%*	*14.22%*	*13.27%*	*12.44%*	*11.90%*
Projected Annual Billed Flows	15,043,491	22,574,967	30,536,357	39,335,020	48,706,903	58,987,712	67,929,680	77,373,216	87,582,372	98,293,096	109,912,745
Annual % Change in Billed Flows	*N/A*	*50.06%*	*35.27%*	*28.81%*	*23.83%*	*21.11%*	*15.16%*	*13.90%*	*13.19%*	*12.23%*	*11.82%*
% Paying Capital Charges	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Capital Spending											
Annual Capital Budget (Future Year Dollars)	$1,327,682	$250,000	$1,297,353	$1,336,274	$4,232,569	$4,359,546	$289,819	$298,513	$6,134,119	$5,393,907	$4,661,694
Annual % of CIP Executed	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Projected Annual System Development Fees $ Amount											
Water System	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250
Sewer System	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Average Annual Interest Earnings Rate											
On Projected Average Annual Fund Balances	0.25%	0.25%	0.50%	0.75%	1.00%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Operating Budget Reserve											
Annual Reserve Target Fund Balance	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000
Stated as Number of Months of Annual O&M Spending [2]	10.7	13.5	11.9	9.7	9.4	8.9	5.8	6.6	8.1	7.4	7.0
Operating Budget Execution Percentage											
Personal Services	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Variable Operations and Maintenance	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Fixed Operations and Maintenance	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Capital Outlay	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[1] *Growth projections provided by McKim & Creed and reviewed with County staff during client interactive on June 27, 2019.*

[2] *Projected O&M spending declines in FY 2020 driven by reductions in compost sludge. In FY 2026, pay off of debt related Highway 150 causes a subsequent O&M reduction. A third reduction is projected in FY 2028 driven to pay off of 1/2 debt service costs to City of Hickory. Lastly, O&M is projected to reduce one last time within the projection period due to pay off SECC Wastewater collection debt service.*

	Stantec Grouping of Funds in Model	Revenue Fund	Restricted Reserves	Water System Development Fees	Sewer System Development Fees	W&S Capital Fund	W&S Construction Fund
Current Unrestricted Assets							
Cash and Cash Equivalents		36,037,696	-	-	-	-	-
Due from Other Governments		525,503	-	-	-	-	-
Notes Receivable		816,558	-	-	-	-	-
Account Receivable (net of allowance)		31,654	-	-	-	-	-
Interest Receivable		126,363	-	-	-	-	-
Prepaid Items		195,608	-	-	-	-	-
TOTAL ASSETS		**37,733,382**	**-**	**-**	**-**	**-**	**-**
CURRENT LIABILITIES							
Accounts and Accrued Liabilities		(800,165)	-	-	-	-	-
Installment loan payable		(1,248,924)	-	-	-	-	-
Compensated Absences		(9,775)	-	-	-	-	-
Lease Payable		-	-	-	-	-	-
CALCULATED FUND BALANCE (ASSETS - LIABILITIES)		**35,674,518**	**-**	**-**	**-**	**-**	**-**
Plus/(Less): Construction Commitment		(17,673,354)	-	-	-	-	-
Available Fund Balance		**18,001,164**	**-**	**-**	**-**	**-**	**-**

Fund Summary		
Revenue Fund	$	18,001,164
Restricted Reserves		-
Water System Development Fees		-
Sewer System Development Fees		-
System Development Fees		-
W&S Capital Fund		-
W&S Construction Fund		-
Total Available Funds	**$**	**18,001,164**

Schedule 3: Projected FY 2019 – FY 2029 Cash Inflows

		FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
1	**Rate Revenue Growth Assumptions** [1]											
2	**Water**											
3	% Change in Base Revenue	N/A	8.48%	8.38%	8.43%	8.41%	8.43%	6.75%	6.77%	6.76%	6.72%	6.77%
4	% Change in Usage Revenue	N/A	8.53%	8.29%	8.48%	8.30%	8.42%	6.76%	6.67%	6.78%	6.65%	6.77%
5	**Sewer**											
6	% Change in Base Revenue	N/A	52.38%	36.86%	29.35%	24.56%	21.41%	15.31%	14.22%	13.27%	12.44%	11.90%
7	% Change in Usage Revenue	N/A	50.06%	35.27%	28.81%	23.83%	21.11%	15.16%	13.90%	13.19%	12.23%	11.82%
8	**Assumed Rate Revenue Increases** [2]											
9	Assumed Water Rate Increase	N/A	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
10	Assumed Sewer Rate Increase	N/A	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
11	**Water Rate Revenue**											
12	Base Rate Revenue	$182,052	$201,436	$222,684	$246,280	$272,340	$301,193	$327,949	$357,150	$388,913	$423,360	$461,069
13	Usage Rate Revenue	$118,716	$131,419	$145,159	$160,616	$177,432	$196,228	$213,682	$232,498	$253,220	$275,451	$299,982
14	**Total Water Rate Revenue** [3]	**$300,768**	**$332,855**	**$367,843**	**$406,895**	**$449,772**	**$497,420**	**$541,631**	**$589,649**	**$642,134**	**$698,811**	**$761,051**
15	**Sewer Rate Revenue**											
16	Base Rate Revenue	$52,778	$82,029	$114,509	$151,082	$191,956	$237,715	$279,600	$325,745	$376,354	$431,644	$492,649
17	Usage Rate Revenue	$46,259	$70,806	$97,693	$128,359	$162,120	$200,266	$235,237	$273,298	$315,546	$361,218	$411,998
18	**Total Sewer Rate Revenue** [3]	**$99,037**	**$152,836**	**$212,202**	**$279,441**	**$354,076**	**$437,981**	**$514,837**	**$599,043**	**$691,901**	**$792,862**	**$904,647**
19	**Other Operating Revenue**											
20	Domestic Haulers	$32,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
21	Domestic Haulers - Claremont	$23,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Domestic Haulers - Maiden	$24,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
25	City Of Conover-W & S	$75,000	$70,000	$70,700	$71,407	$72,121	$72,842	$73,571	$74,306	$75,049	$75,800	$76,558
27	Non-SECC Revenues	$281,816	$278,998	$276,208	$273,446	$270,711	$268,004	$268,004	$268,004	$268,004	$268,004	$268,004
28	Town Of Maiden-W & S	$22,000	$20,000	$20,200	$20,402	$20,606	$20,812	$21,020	$21,230	$21,443	$21,657	$21,874
29	City Of Newton-W & S	$47,000	$47,000	$47,470	$47,945	$48,424	$48,908	$49,397	$49,891	$50,390	$50,894	$51,403
30	**Total Other Operating Revenue**	**$504,816**	**$415,998**	**$414,578**	**$413,200**	**$411,863**	**$410,567**	**$411,993**	**$413,433**	**$414,887**	**$416,356**	**$417,839**
31	**Non-Operating Revenue**											
32	SalesTaxes - 1/4 cent - Art 46 [4]	$848,925	$0	$0	$939,008	$967,179	$996,195	$1,026,081	$1,056,864	$1,088,570	$1,121,228	$1,154,865
33	From General Fund [5]	$1,675,000	$0	$0	$1,428,140	$1,153,937	$932,381	$753,364	$608,718	$491,844	$397,410	$321,107
34	**Total Non-Operating Revenue**	**$2,523,925**	**$0**	**$0**	**$2,367,148**	**$2,121,116**	**$1,928,576**	**$1,779,445**	**$1,665,582**	**$1,580,414**	**$1,518,638**	**$1,475,972**
35	**Interest Income**											
36	Earngins on Unrestricted Fund Balance	$43,734	$40,034	$68,079	$90,022	$104,717	$94,592	$81,129	$98,015	$86,482	$63,305	$62,500
37	**Total Interest Income**	**$43,734**	**$40,034**	**$68,079**	**$90,022**	**$104,717**	**$94,592**	**$81,129**	**$98,015**	**$86,482**	**$63,305**	**$62,500**

Schedule 3: Projected FY 2019 – FY 2029 Cash Inflows

		FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
38	**System Development Fees**											
39	Water System Development Fees	$95,313	$103,750	$111,250	$121,250	$131,250	$142,500	$123,750	$132,500	$141,250	$150,000	$161,250
40	Sewer System Development Fees	$114,375	$124,500	$133,500	$145,500	$157,500	$171,000	$148,500	$159,000	$169,500	$180,000	$193,500
41	**Total System Development Fees**	**$209,688**	**$228,250**	**$244,750**	**$266,750**	**$288,750**	**$313,500**	**$272,250**	**$291,500**	**$310,750**	**$330,000**	**$354,750**
42	**Total Cash Inflows**	**$3,681,967**	**$1,169,973**	**$1,307,451**	**$3,823,456**	**$3,730,294**	**$3,682,636**	**$3,601,285**	**$3,657,221**	**$3,726,567**	**$3,819,971**	**$3,976,759**

[1] Growth projections provided by McKim & Creed and reviewed with County staff during client interactive on June 27, 2019.

[2] Based on historical annual rate changes observed at the City of Hickory and applied to SECC service area customers.

[3] Reflects projected annual rate revenues for South Eastern Catawba County Service area (SECC) only.

[4] Reflects FY 2019 approved budget. No revenues in FY 2020 and FY 2021 per discussion with staff. FY 2022 reflects the compounding of 1.00% annually over FY 2020 and FY 2021. Starting in FY 2023, annual transfers are calculated using a 1.00% annual escalation factor.

[5] Reflects FY 2019 approved budget. No transfers in FY 2020 and FY 2021 per discussion with staff. FY 2022 reflects the compounding of 3.00% annually over FY 2020 and FY 2021 followed by a 20% reduction as the Fund aims to reduce its reliance on General Fund subsidy. Starting in FY 2023, annual transfers are calculated using a 3.00% annual escalation factor and then reduced by 20% every year.

Schedule 4: Projected FY 2019 – FY 2029 Cash Outflows

	Expense Line Item [1]	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
1	**Water and Sewer Dept**											
2	**Personal Services**											
3	Regular Wages [2]	$76,495	$166,511	$171,506	$176,652	$181,951	$187,410	$193,032	$198,823	$204,788	$210,931	$217,259
4	Longevity	$2,426	$2,391	$2,463	$2,537	$2,613	$2,691	$2,772	$2,855	$2,941	$3,029	$3,120
5	FICA	$6,802	$13,610	$14,018	$14,439	$14,872	$15,318	$15,778	$16,251	$16,739	$17,241	$17,758
6	Local Gov'T Employees Retireme	$6,179	$13,812	$14,019	$14,229	$14,443	$14,659	$14,879	$15,102	$15,329	$15,559	$15,792
7	401-K Retirement	$765	$1,665	$1,715	$1,766	$1,819	$1,874	$1,930	$1,988	$2,048	$2,109	$2,172
8	Other Post Employment Benefits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	Net Pension Reserve Exp-State	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10	Group Health	$7,490	$14,980	$16,178	$17,473	$18,870	$20,380	$22,011	$23,771	$25,673	$27,727	$29,945
11	Group Dental	$397	$793	$817	$841	$867	$893	$919	$947	$975	$1,005	$1,035
12	Disability Long-Term	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
13	Basic Life Insurance	$73	$183	$188	$194	$200	$206	$212	$219	$225	$232	$239
14	Disability Short Term	$73	$146	$150	$155	$160	$164	$169	$174	$180	$185	$190
15	Part-Time Wages	$10,000	$9,000	$9,270	$9,548	$9,835	$10,130	$10,433	$10,746	$11,069	$11,401	$11,743
16	**Operations & Maintenance**											
17	Office Supplies	$1,000	$1,000	$1,020	$1,040	$1,061	$1,082	$1,104	$1,126	$1,149	$1,172	$1,195
18	Osha Supplies	$500	$500	$510	$520	$531	$541	$552	$563	$574	$586	$598
19	Travel Transportation	$3,090	$3,090	$3,152	$3,215	$3,279	$3,345	$3,412	$3,480	$3,549	$3,620	$3,693
20	Training And Education	$2,777	$2,777	$2,833	$2,889	$2,947	$3,006	$3,066	$3,127	$3,190	$3,254	$3,319
21	Dues Subscriptions	$2,345	$2,375	$2,423	$2,471	$2,520	$2,571	$2,622	$2,675	$2,728	$2,783	$2,838
22	Printing Binding	$50	$50	$51	$52	$53	$54	$55	$56	$57	$59	$60
23	Banking Service Charges	$250	$300	$306	$312	$318	$325	$331	$338	$345	$351	$359
24	Air Card Service	$460	$460	$469	$479	$488	$498	$508	$518	$528	$539	$550
25	Postage	$200	$200	$204	$208	$212	$216	$221	$225	$230	$234	$239
26	Electricity	$660	$660	$673	$687	$700	$714	$729	$743	$758	$773	$789
27	Water & Sewer	$19,300	$19,300	$19,686	$20,080	$20,481	$20,891	$21,309	$21,735	$22,170	$22,613	$23,065
28	Personnel Indirect Costs	$26,761	$22,406	$22,854	$23,311	$23,777	$24,253	$24,738	$25,233	$25,737	$26,252	$26,777
29	Other Professional Services	$204,950	$200,000	$204,000	$208,080	$212,242	$216,486	$220,816	$225,232	$229,737	$234,332	$239,019
30	*City Of Hickory Related Costs*											
31	1/2 of Hickory's Debt Svc	$391,216	$391,216	$391,216	$391,216	$391,216	$391,216	$391,216	$391,216	$391,216	$0	$0
32	1/2 of Hickory-Catawba' Operating Costs	$407,500	$285,000	$270,750	$257,213	$244,352	$0	$0	$0	$0	$0	$0
33	SECC Sewer Collection System Differential of Rev vs Exp	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000
34	SECC Water Quality Costs	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000
35	Sludge Compost Facility (Consortium Obligation)	$400,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
36	**Total Expenses by Category**											
37	Personal Services	$110,700	$223,091	$230,325	$237,834	$245,629	$253,725	$262,136	$270,877	$279,965	$289,418	$299,253
38	Operations & Maintenance	$1,571,059	$1,039,334	$1,030,146	$1,021,773	$1,014,179	$775,199	$780,679	$786,268	$791,969	$406,568	$412,499
39	**Total Expenses**	**$1,681,759**	**$1,262,425**	**$1,260,472**	**$1,259,606**	**$1,259,808**	**$1,028,924**	**$1,042,814**	**$1,057,145**	**$1,071,934**	**$695,986**	**$711,753**
40	**Expense Execution Factors**											
41	Personal Services	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
42	Operations & Maintenance	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Schedule 4: Projected FY 2019 – FY 2029 Cash Outflows

	Expense Line Item [1]	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
43	**Total Expenses at Execution**											
44	Personal Services	$110,700	$223,091	$230,325	$237,834	$245,629	$253,725	$262,136	$270,877	$279,965	$289,418	$299,253
45	Operations & Maintenance	$1,571,059	$1,039,334	$1,030,146	$1,021,773	$1,014,179	$775,199	$780,679	$786,268	$791,969	$406,568	$412,499
46	**Total Expenses at Execution**	**$1,681,759**	**$1,262,425**	**$1,260,472**	**$1,259,606**	**$1,259,808**	**$1,028,924**	**$1,042,814**	**$1,057,145**	**$1,071,934**	**$695,986**	**$711,753**
47	**Debt Service**											
48	U.S. BANK, NATIONAL ASSOCIATION	$747,677	$747,677	$747,677	$747,677	$747,677	$747,677	$747,677	$0	$0	$0	$0
49	NCDENR - DEH Public Drinking Water Supply 1634 Mail Service Center Raleigh NC 27699-1634	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000
50	DTC THRU U.S. BANK, NATINAL ASSOCIATION	$655,201	$551,734	$532,668	$513,409	$494,490	$453,122	$206,298	$200,778	$195,131	$188,759	$0
51	Cumulative Projected Annual Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$163,997	$323,236
52	**Total Debt Service**	**$1,477,878**	**$1,374,411**	**$1,355,346**	**$1,336,086**	**$1,317,167**	**$1,275,799**	**$1,028,976**	**$275,778**	**$270,131**	**$427,756**	**$398,236**
53	**Total Cash Outflows**	**$3,159,637**	**$2,636,836**	**$2,615,817**	**$2,595,693**	**$2,576,975**	**$2,304,723**	**$2,071,790**	**$1,332,923**	**$1,342,066**	**$1,123,742**	**$1,109,989**

[1] *FY 2019 expenses reflect FY 2019 Approved Budget and FY 2020 reflect Proposed Budget as provided by staff. Inflation factors are applied starting in FY 2021.*

[2] *Reflects one addtitonal fulltime employee in FY 2020.*

[3] *A project between Hickory and Claremont is currently underway which will allow Claremont to send all its wastewater to the Hickory-Catawba WTP. As such, Staff anticipates the plant will be self-supporting by FY 2024. Prior to FY 2024, Claremont flows are anticipated to increase annually, thereby reducing the County's portion of plant costs. The projection assumes a 5.0% each year reduction in FY 2020 thru FY 2023.*

[4] *Projected O&M spending declines in FY 2020 driven by reductions in compost sludge. In FY 2026, pay off of debt related Highway 150 causes a subsequent O&M reduction. A third reduction is projected in FY 2028 driven to pay off of 1/2 debt service costs to City of Hickory. Lastly, O&M is projected to reduce one last time within the projection period due to pay off SECC Wastewater collection debt service.*

Schedule 5: Cost Escalation Factors

Expense Line Item Description	Inflation Factor	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Regular Wages	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Longevity	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
FICA	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Local Gov'T Employees Retireme	Retirement	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
401-K Retirement	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Other Post Employment Benefits	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Net Pension Reserve Exp-State	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Group Health	Health Insurance	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%
Group Dental	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Disability Long-Term	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Basic Life Insurance	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Disability Short Term	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Office Supplies	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Osha Supplies	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Travel Transportation	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Training And Education	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Dues Subscriptions	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Printing Binding	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Banking Service Charges	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Air Card Service	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Postage	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Electricity	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Water & Sewer	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Personnel Indirect Costs	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Other Professional Services	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
City Of Hickory	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
1/2 of Hickory's Debt Svc	Debt Service	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1/2 of Hickory-Catawba' Operating Costs	No Escalation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SECC Sewer Collection System Differential of Rev vs Exp	No Escalation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SECC Water Quality Costs	No Escalation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sludge Compost Facility (Consortium Obligation)	No Escalation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Small Tools & Minor Equipment	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Minor IT Equipment	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Part-Time Wages	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Other - Salaries & Wages Reser	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Other Benefits Reserve	Salaries & Wages	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Other Misc Operating Supplies	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Loss on Fixed Assets	O&M	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Weighted Average Increase in O&M Expenses [1] [2]		-0.15%	-0.07%	0.02%	-18.33%	1.35%	1.37%	1.40%	-35.07%	2.27%

[1] *The Weighted Average change in O&M Expenses is reflective of the cost escalation factors presented on this schedule and the cost execution factors on Schedule 1.*

[2] *Projected O&M spending declines in FY 2020 driven by reductions in compost sludge. In FY 2026, pay off of debt related Highway 150 causes a subsequent O&M reduction. A third reduction is projected in FY 2028 driven to pay off of 1/2 debt service costs to City of Hickory. Lastly, O&M is projected to reduce one last time within the projection period due to pay off SECC Wastewater collection debt service.*

Schedule 6: Capital Improvement Program

		FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
1	Farmfield Acres Water	$254,075	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	Hickory-Catawba WWTP Future Expansion	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000
3	McLin/Lyle Creek Sewer Outfall Loan Project 2	$423,607	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Sludge Compost Facility	$400,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	Bunker Hill Bridge Water (20019)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	SECC Water Supply Loop (21020)	$0	$0	$1,009,566	$1,009,566	$0	$0	$0	$0	$0	$0	$0
7	Village Center Triplex	$0	$0	$0	$0	$1,625,400	$1,625,400	$0	$0	$0	$0	$0
8	Village Center FM	$0	$0	$0	$0	$1,998,000	$1,998,000	$0	$0	$0	$0	$0
9	Old Highway 16 PS Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$624,000
10	Lake Norman Marina PS Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$730,800
11	Terrell PS Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$525,600	$0	$0
12	Sherrills Ford PS Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$1,063,200	$0	$0
13	Sherrills Ford FM Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,968,000	$1,968,000
14	Terrapin Creek PS Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$1,108,800	$0	$0
15	Terrapin Creek FM Upgrade	$0	$0	$0	$0	$0	$0	$0	$0	$2,040,000	$2,040,000	$0
16	**Total CIP Budget (in current dollars)**	**$1,327,682**	**$250,000**	**$1,259,566**	**$1,259,566**	**$3,873,400**	**$3,873,400**	**$250,000**	**$250,000**	**$4,987,600**	**$4,258,000**	**$3,572,800**
17	Cumulative Projected Cost Escalation[1]	0.0%	0.0%	3.0%	6.1%	9.3%	12.6%	15.9%	19.4%	23.0%	26.7%	30.5%
18	**Resulting CIP Funding Level**	**$1,327,682**	**$250,000**	**$1,297,353**	**$1,336,274**	**$4,232,569**	**$4,359,546**	**$289,819**	**$298,513**	**$6,134,119**	**$5,393,907**	**$4,661,694**
19	Annual CIP Execution Percentage	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20	**Final CIP Funding Level**	**$1,327,682**	**$250,000**	**$1,297,353**	**$1,336,274**	**$4,232,569**	**$4,359,546**	**$289,819**	**$298,513**	**$6,134,119**	**$5,393,907**	**$4,661,694**

[1] *CIP Escalation factors are consistent with the Engineering News Record Construction Cost Index.*

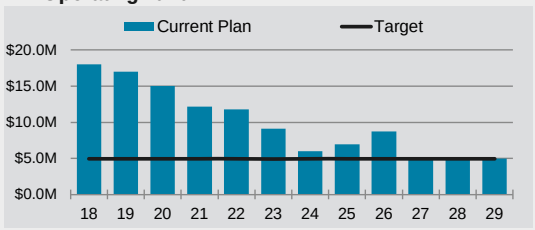
FAMS-XL | CATAWBA COUNTY, NC

Stantec

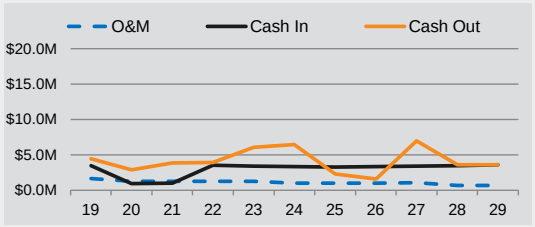
CALC | SAVE | CTRL | LAST | OVR

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2023	FY 2028
Override ►	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	Cumulative	
Water Rate Plan	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	10.38%	21.85%
Override ►	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%		
Sewer Rate Plan	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	10.46%	21.93%
Total Residential W&S Bill	$109.56	$111.72	$113.95	$116.27	$118.61	$120.99	$123.44	$125.90	$128.40	$130.92	$133.53		

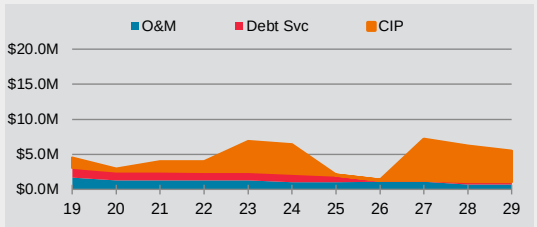
Operating Fund



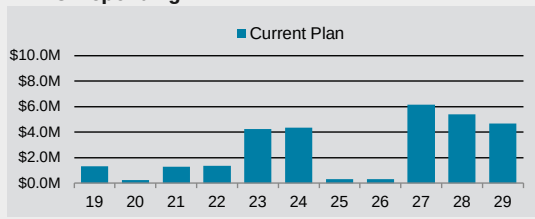
Revenues vs. Expenses



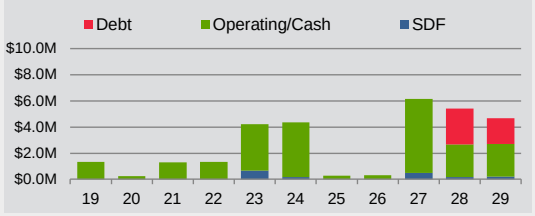
Expenses by Type



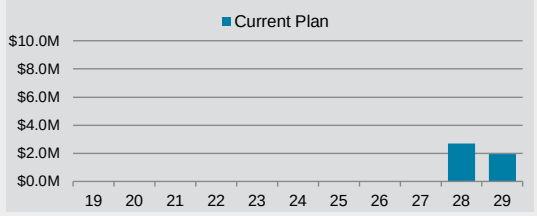
CIP Spending



CIP Funding



Borrowing



Schedule 8: Forecast of Net Revenues and Debt Service Coverage

			FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
1	**Operating Revenue**												
2	Water and Sewer Rate Revenue [1]		$399,804	$399,804	$485,691	$580,045	$686,336	$803,848	$935,401	$1,056,468	$1,188,691	$1,334,034	$1,491,673
3	Change in Revenue From Growth		$0	$76,363	$82,980	$92,834	$101,751	$113,211	$100,352	$108,915	$119,185	$128,390	$141,364
4	Subtotal		$399,804	$476,168	$568,671	$672,878	$788,087	$917,060	$1,035,753	$1,165,384	$1,307,877	$1,462,424	$1,633,037
5	*Weighted Average Rate Increase*		*0.00%*	*2.00%*	*2.00%*	*2.00%*	*2.00%*	*2.00%*	*2.00%*	*2.00%*	*2.00%*	*2.00%*	*2.00%*
6	Additional Rate Revenue From Rate Increase		$0	$9,523	$11,373	$13,458	$15,762	$18,341	$20,715	$23,308	$26,158	$29,248	$32,661
7	Total Rate Revenue [1]		$399,804	$485,691	$580,045	$686,336	$803,848	$935,401	$1,056,468	$1,188,691	$1,334,034	$1,491,673	$1,665,698
8	Plus: Other Operating Revenue [2]		$504,816	$415,998	$414,578	$413,200	$411,863	$410,567	$411,993	$413,433	$414,887	$416,356	$417,839
9	**Equals: Total Operating Revenue**		**$904,621**	**$901,689**	**$994,622**	**$1,099,535**	**$1,215,711**	**$1,345,968**	**$1,468,461**	**$1,602,124**	**$1,748,921**	**$1,908,028**	**$2,083,537**
10	**Less: Operating Expenses**												
11	Personal Services		($110,700)	($223,091)	($230,325)	($237,834)	($245,629)	($253,725)	($262,136)	($270,877)	($279,965)	($289,418)	($299,253)
12	Operations & Maintenance Costs		($1,571,059)	($1,039,334)	($1,030,146)	($1,021,773)	($1,014,179)	($775,199)	($780,679)	($786,268)	($791,969)	($406,568)	($412,499)
13	**Equals: Net Operating Income**		**($777,138)**	**($360,736)**	**($265,849)**	**($160,071)**	**($44,097)**	**$317,044**	**$425,647**	**$544,979**	**$676,987**	**$1,212,042**	**$1,371,784**
14	**Plus: Non-Operating Income/(Expense)**												
15	Non-Operating Revenue [3]		$2,523,925	$0	$0	$2,367,148	$2,121,116	$1,928,576	$1,779,445	$1,665,582	$1,580,414	$1,518,638	$1,475,972
16	Interest Income		$43,734	$40,034	$68,079	$90,022	$104,717	$94,592	$81,129	$98,015	$86,482	$63,305	$62,500
17	Water System Development Fees		$95,313	$103,750	$111,250	$121,250	$131,250	$142,500	$123,750	$132,500	$141,250	$150,000	$161,250
18	Sewer System Development Fees		$114,375	$124,500	$133,500	$145,500	$157,500	$171,000	$148,500	$159,000	$169,500	$180,000	$193,500
19	**Equals: Net Income**		**$2,000,208**	**($92,452)**	**$46,980**	**$2,563,849**	**$2,470,487**	**$2,653,712**	**$2,558,471**	**$2,600,076**	**$2,654,633**	**$3,123,985**	**$3,265,006**
20	**Less: Revenues Excluded From Coverage Test**												
21	System Development Fees		-$209,688	-$228,250	-$244,750	-$266,750	-$288,750	-$313,500	-$272,250	-$291,500	-$310,750	-$330,000	-$354,750
22	**Equals: Net Income Available For Debt Service**		**$1,790,521**	**-$320,702**	**-$197,770**	**$2,297,099**	**$2,181,737**	**$2,340,212**	**$2,286,221**	**$2,308,576**	**$2,343,883**	**$2,793,985**	**$2,910,256**
23	**Senior Lien Debt Service Coverage Test**												
24	Net Income Available for Senior-Lien Debt Service		**$1,790,521**	**($320,702)**	**($197,770)**	**$2,297,099**	**$2,181,737**	**$2,340,212**	**$2,286,221**	**$2,308,576**	**$2,343,883**	**$2,793,985**	**$2,910,256**
25	Existing Senior-Lien Debt [4]		$655,201	$551,734	$532,668	$513,409	$494,490	$453,122	$206,298	$200,778	$195,131	$188,759	$0
26	Cumulative New Senior Lien Debt Service (calculated)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$163,997	$323,236
27	**Total Annual Senior-Lien Debt Service**	**Req.**	**$655,201**	**$551,734**	**$532,668**	**$513,409**	**$494,490**	**$453,122**	**$206,298**	**$200,778**	**$195,131**	**$352,756**	**$323,236**
28	*Calculated Senior-Lien Debt Service Coverage*	**1.70**	**2.73**	**(0.58)**	**(0.37)**	**4.47**	**4.41**	**5.16**	**11.08**	**11.50**	**12.01**	**7.92**	**9.00**
29	**Subordinate Debt Service Coverage Test**												
30	Net Income Available for Subordinate Debt Service		**$676,679**	**($1,258,649)**	**($1,103,306)**	**$1,424,304**	**$1,341,104**	**$1,569,905**	**$1,935,514**	**$1,967,252**	**$2,012,160**	**$2,194,299**	**$2,360,755**
31	Existing Subordinate Debt [5]		$822,677	$822,677	$822,677	$822,677	$822,677	$822,677	$822,677	$75,000	$75,000	$75,000	$75,000
32	Cumulative New Subordinate Debt Service (calculated)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
33	**Total Annual Subordinate Debt Service**	**Req.**	**$822,677**	**$822,677**	**$822,677**	**$822,677**	**$822,677**	**$822,677**	**$822,677**	**$75,000**	**$75,000**	**$75,000**	**$75,000**
34	*Calculated Subordinate Debt Service Coverage*	**1.70**	**0.82**	**(1.53)**	**(1.34)**	**1.73**	**1.63**	**1.91**	**2.35**	**26.23**	**26.83**	**29.26**	**31.48**
35	**Total All-In Debt Service Coverage Test**												
36	Net Income Available for Subordinate Debt Service		**$1,790,521**	**($320,702)**	**($197,770)**	**$2,297,099**	**$2,181,737**	**$2,340,212**	**$2,286,221**	**$2,308,576**	**$2,343,883**	**$2,793,985**	**$2,910,256**
37	Total Senior-Lien Debt Service		$655,201	$551,734	$532,668	$513,409	$494,490	$453,122	$206,298	$200,778	$195,131	$352,756	$323,236
38	Total Subordinate Debt Service		$822,677	$822,677	$822,677	$822,677	$822,677	$822,677	$822,677	$75,000	$75,000	$75,000	$75,000
39	**Total Annual Debt Service**		**$1,477,878**	**$1,374,411**	**$1,355,346**	**$1,336,086**	**$1,317,167**	**$1,275,799**	**$1,028,976**	**$275,778**	**$270,131**	**$427,756**	**$398,236**
40	*Calculated All-In Debt Service Coverage*		**1.21**	**(0.23)**	**(0.15)**	**1.72**	**1.66**	**1.83**	**2.22**	**8.37**	**8.68**	**6.53**	**7.31**
41	**Cash Flow Test**												
42	Net Income Available For Debt Service		$1,790,521	($320,702)	($197,770)	$2,297,099	$2,181,737	$2,340,212	$2,286,221	$2,308,576	$2,343,883	$2,793,985	$2,910,256
43	Less: Non-Operating Expenditures												
44	Net Debt Service Payment		($1,477,878)	($1,374,411)	($1,355,346)	($1,336,086)	($1,317,167)	($1,275,799)	($1,028,976)	($275,778)	($270,131)	($427,756)	($398,236)
45	**Net Cash Flow**		**$312,642**	**-$1,695,113**	**-$1,553,116**	**$961,013**	**$864,569**	**$1,064,413**	**$1,257,245**	**$2,032,797**	**$2,073,752**	**$2,366,229**	**$2,512,020**

Schedule 8: Forecast of Net Revenues and Debt Service Coverage

		FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
46	**Unrestricted Reserve Fund Test**											
47	Balance At Beginning Of Fiscal Year	$18,001,164	$16,986,124	$15,041,011	$12,190,542	$11,815,282	$9,128,128	$6,006,611	$6,974,038	$8,708,322	$5,128,761	$5,000,000
48	Cash Flow Surplus/(Deficit)	$312,642	$0	$0	$961,013	$864,569	$1,064,413	$1,257,245	$2,032,797	$2,073,752	$2,366,229	$2,512,020
49	Reserve Fund Balance Used For Cash Flow Deficit	$0	($1,695,113)	($1,553,116)	$0	$0	$0	$0	$0	$0	$0	$0
50	Projects Paid With Non Specified Funds	($1,327,682)	($250,000)	($1,297,353)	($1,336,274)	($3,551,724)	($4,185,929)	($289,819)	($298,513)	($5,653,312)	($2,494,990)	($2,512,020)
51	**Balance At End Of Fiscal Year**	**$16,986,124**	**$15,041,011**	**$12,190,542**	**$11,815,282**	**$9,128,128**	**$6,006,611**	**$6,974,038**	**$8,708,322**	**$5,128,761**	**$5,000,000**	**$5,000,000**
52	Minimum Working Capital Reserve Target	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000
53	**Excess/(Deficiency) Of Working Capital To Target**	**$11,986,124**	**$10,041,011**	**$7,190,542**	**$6,815,282**	**$4,128,128**	**$1,006,611**	**$1,974,038**	**$3,708,322**	**$128,761**	**$0**	**$0**

[1] *Reflects projected water and sewer revenues from SECC Area*

[2] *Reflects revenues from domestic haulers, City of Conover, Town of Maiden, City of Newtown and City of Hickory (non-SECC area).*

[3] *Reflects sale tax revenues (1/4 cent) and transfers from general fund.*

[4] *Reflects Series 2011 Refunding Limited Obligation Bonds (12.7188% Sanitary Sewer / Highway 150).*

[5] *Reflects $8.0M Water and Sewer Bonds (U.S. Bank National Association/SECC Wastewater Collection) and $1.5M Water & Sewer American Recovery & Reinvestment Act DEH Public Drinking Water Supply (Blackburn-Plateau Water Loop).*

Schedule 9: Capital Projects Funding Summary

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Water System Development Fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sewer System Development Fees	$0	$0	$0	$0	$680,845	$173,617	$0	$0	$480,806	$181,946	$193,512
Revenue Fund	$1,327,682	$250,000	$1,297,353	$1,336,274	$3,551,724	$4,185,929	$289,819	$298,513	$5,653,312	$2,494,990	$2,512,020
Subordinate Debt Proceeds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Senior-Lien Debt Proceeds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,716,971	$1,956,161
Other Debt Proceeds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Projects Designated To Be Paid With Cash	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Projects Paid	**$1,327,682**	**$250,000**	**$1,297,353**	**$1,336,274**	**$4,232,569**	**$4,359,546**	**$289,819**	**$298,513**	**$6,134,119**	**$5,393,907**	**$4,661,694**

Projection does not include water related capital projects. As such, no projects in the projection are funded by water system development fees as discussed with Staff.

Schedule 10: Detailed Funding Summary

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2029
Water System Development Fees [1]											
Balance At Beginning Of Fiscal Year	$0	$95,432	$199,550	$312,076	$436,121	$572,388	$722,934	$856,494	$1,000,528	$1,155,168	$1,320,545
Annual Revenues	$95,313	$103,750	$111,250	$121,250	$131,250	$142,500	$123,750	$132,500	$141,250	$150,000	$161,250
Less: Annual Expenses	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Payment Of Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$95,313	$199,182	$310,800	$433,326	$567,371	$714,888	$846,684	$988,994	$1,141,778	$1,305,168	$1,481,795
Less: Restricted Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Amount Available For Projects	$95,313	$199,182	$310,800	$433,326	$567,371	$714,888	$846,684	$988,994	$1,141,778	$1,305,168	$1,481,795
Amount Paid For Projects	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$95,313	$199,182	$310,800	$433,326	$567,371	$714,888	$846,684	$988,994	$1,141,778	$1,305,168	$1,481,795
Add Back: Restricted Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plus: Interest Earnings	$119	$368	$1,276	$2,795	$5,017	$8,045	$9,810	$11,534	$13,389	$15,377	$17,515
Less: Interest Allocated To Cash Flow	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Balance At End Of Fiscal Year	**$95,432**	**$199,550**	**$312,076**	**$436,121**	**$572,388**	**$722,934**	**$856,494**	**$1,000,528**	**$1,155,168**	**$1,320,545**	**$1,499,310**
Sewer System Development Fees											
Balance At Beginning Of Fiscal Year	$0	$114,518	$239,460	$374,491	$523,345	$2,617	$16	$149,445	$311,306	$1,946	$12
Annual Revenues	$114,375	$124,500	$133,500	$145,500	$157,500	$171,000	$148,500	$159,000	$169,500	$180,000	$193,500
Less: Annual Expenses	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Payment Of Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$114,375	$239,018	$372,960	$519,991	$680,845	$173,617	$148,516	$308,445	$480,806	$181,946	$193,512
Less: Restricted Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Amount Available For Projects	$114,375	$239,018	$372,960	$519,991	$680,845	$173,617	$148,516	$308,445	$480,806	$181,946	$193,512
Amount Paid For Projects	$0	$0	$0	$0	($680,845)	($173,617)	$0	$0	($480,806)	($181,946)	($193,512)
Subtotal	$114,375	$239,018	$372,960	$519,991	$0	$0	$148,516	$308,445	$0	$0	$0
Add Back: Restricted Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plus: Interest Earnings	$143	$442	$1,531	$3,354	$2,617	$16	$928	$2,862	$1,946	$12	$0
Less: Interest Allocated To Cash Flow	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Balance At End Of Fiscal Year	**$114,518**	**$239,460**	**$374,491**	**$523,345**	**$2,617**	**$16**	**$149,445**	**$311,306**	**$1,946**	**$12**	**$0**
W&S Construction Fund											
Balance At Beginning Of Fiscal Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Revenues	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Annual Expenses	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Payment Of Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Restricted Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Amount Available For Projects	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Amount Paid For Projects	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add Back: Restricted Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plus: Interest Earnings	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Interest Allocated To Cash Flow	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Balance At End Of Fiscal Year	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Schedule 10: Detailed Funding Summary

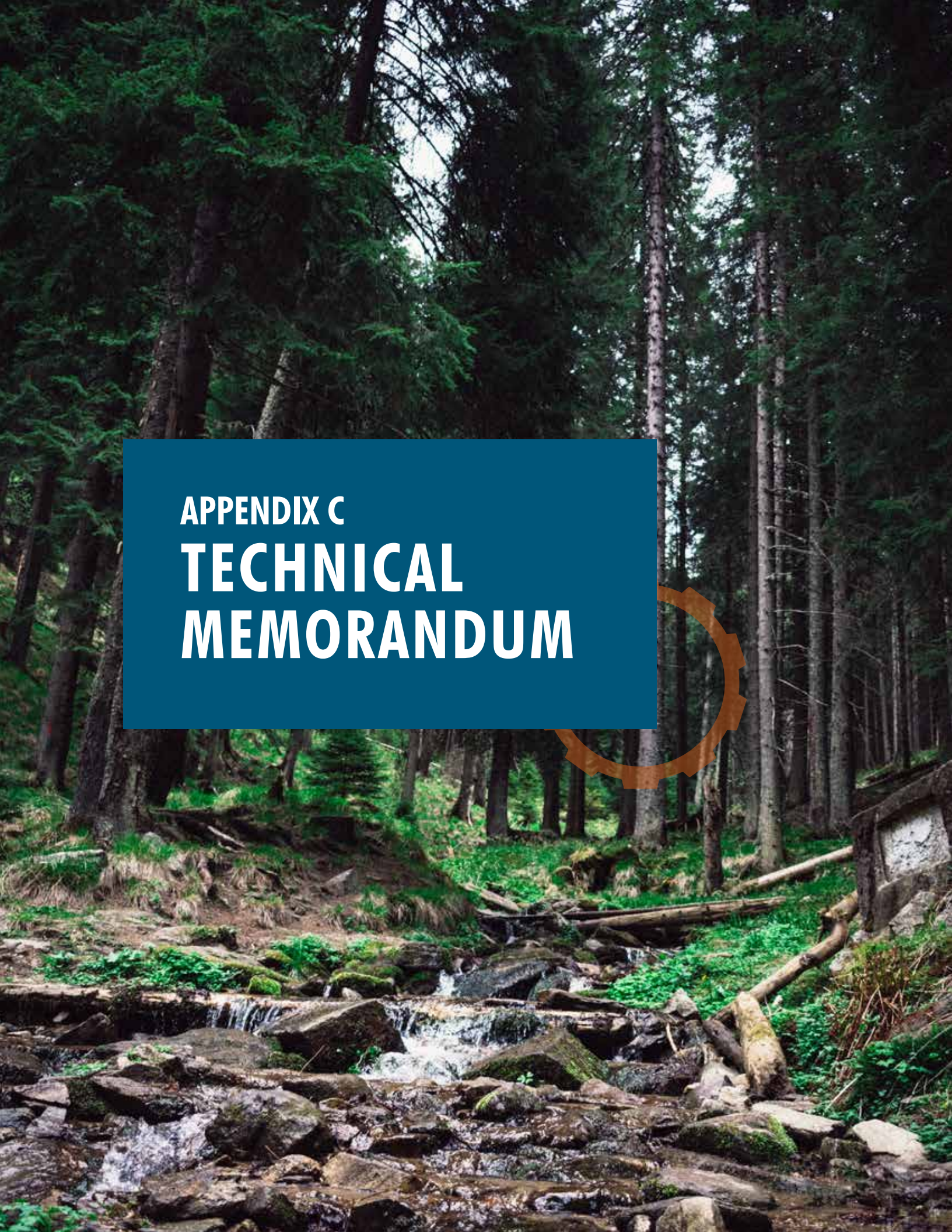
	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2029
Revenue Fund											
Balance At Beginning Of Fiscal Year	$18,001,164	$16,986,124	$15,041,011	$12,190,542	$11,815,282	$9,128,128	$6,006,611	$6,974,038	$8,708,322	$5,128,761	$5,000,000
Net Cash Flow	$312,642	($1,695,113)	($1,553,116)	$961,013	$864,569	$1,064,413	$1,257,245	$2,032,797	$2,073,752	$2,366,229	$2,512,020
Less: Cash-Funded Capital Projects	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Payment Of Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$18,313,806	$15,291,011	$13,487,895	$13,151,555	$12,679,851	$10,192,541	$7,263,856	$9,006,835	$10,782,074	$7,494,990	$7,512,020
Less: Restricted Funds	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)	($5,000,000)
Total Amount Available For Projects	$13,313,806	$10,291,011	$8,487,895	$8,151,555	$7,679,851	$5,192,541	$2,263,856	$4,006,835	$5,782,074	$2,494,990	$2,512,020
Amount Paid For Projects	($1,327,682)	($250,000)	($1,297,353)	($1,336,274)	($3,551,724)	($4,185,929)	($289,819)	($298,513)	($5,653,312)	($2,494,990)	($2,512,020)
Subtotal	$11,986,124	$10,041,011	$7,190,542	$6,815,282	$4,128,128	$1,006,611	$1,974,038	$3,708,322	$128,761	$0	$0
Add Back: Restricted Funds	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000
Plus: Interest Earnings	$43,734	$40,034	$68,079	$90,022	$104,717	$94,592	$81,129	$98,015	$86,482	$63,305	$62,500
Less: Interest Allocated To Cash Flow	($43,734)	($40,034)	($68,079)	($90,022)	($104,717)	($94,592)	($81,129)	($98,015)	($86,482)	($63,305)	($62,500)
Balance At End Of Fiscal Year	**$16,986,124**	**$15,041,011**	**$12,190,542**	**$11,815,282**	**$9,128,128**	**$6,006,611**	**$6,974,038**	**$8,708,322**	**$5,128,761**	**$5,000,000**	**$5,000,000**
Restricted Reserves											
Balance At Beginning Of Fiscal Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$206,444
Additional Funds:	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service Reserve On New Debt	$0	$0	$0	$0	$0	$0	$0	$0	$0	$205,162	$147,712
Other Additional Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$205,162	$354,156
Plus: Interest Earnings	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,282	$3,504
Less: Interest Allocated To Cash Flow	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Balance At End Of Fiscal Year	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$206,444**	**$357,660**

[1] *Projection does not include water related capital projects. As such, no projects in the projection are funded by water system development fees as discussed with Staff.*

Schedule 11: Long Term Borrowing Projections

			FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Term (Years)			30	30	30	30	30	30	30	30	30	30	30
Interest Rate			3.50%	4.00%	4.50%	5.00%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%	5.50%
Sources of Funds													
Par Amount			$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,981,768	$2,146,810
Uses of Funds													
Proceeds			$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,716,971	$1,956,161
Cost of Issuance	2.00%	of Par	$0	$0	$0	$0	$0	$0	$0	$0	$0	$59,635	$42,936
Debt Service Reserve	1	Year(s) of Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$205,162	$147,712
Total Uses			$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,981,768	$2,146,810
1 Year Interest			$0	$0	$0	$0	$0	$0	$0	$0	$0	$163,997	$118,075
Annual Debt Service			$0	$0	$0	$0	$0	$0	$0	$0	$0	$205,162	$147,712
Total Debt Service			$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,154,851	$4,431,363
Cumulative New Annual Senior Lien Debt Service[1]			**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$163,997**	**$323,236**

[1]Reflects interest-only payment due in year of issuance.



APPENDIX C
TECHNICAL MEMORANDUM

8020 TOWER POINT DRIVE, CHARLOTTE, NC 28227
TEL (704) 841-2588 • FAX (704) 841-2567

MEMORANDUM (DRAFT)

TO:	Jonathan Greer
FROM:	Chris Rosenboom, PE
DATE:	6/21/2018
RE:	Existing Conditions Model Documentation
McKIM & CREED #:	01215-0003

As part of the Southeast Catawba County (SECC) Master Plan, McKim & Creed developed hydraulic models of the existing water and wastewater systems serving the project area to adequately simulate the collection and distribution systems. For the water distribution system, this includes an additional waterline that extends beyond the SECC study area to the Catawba County (County) connection point with the City of Hickory. For the wastewater collection system, this includes the force main manifold system that extends to the existing wastewater treatment plant located in the Town of Catawba (Catawba WWTP). The wastewater model was built using Bentley's SewerCAD, while the water model was constructed using elements of the City of Hickory's existing model, which was in Innovyze Infowater. Moving forward, these models are being used to develop alternative improvement strategies for accommodating and supporting projected growth in the area. The purpose of this technical memorandum is to document the methods and assumptions used for creating the hydraulic models of the existing systems.

WASTEWATER SYSTEM HYDRAULIC MODEL

Existing Facilities Data

The County provided GIS data to McKim & Creed for the existing wastewater collection system. This GIS data included force main, gravity sewers and lift stations. The GIS data also included some facilities belonging to the City of Hickory. The steps taken to prepare the GIS data for model import included the following:

- Identified gravity lines versus force main using available record drawings
- Confirmed pipe sizes and materials with the record drawings
- Matched pipeline horizontal alignment and connections with record drawings
- Confirmed lift station locations using aerials and record drawings

There were facilities in the GIS data that are proposed and were noted as such. The record drawings that were available for preparing the existing data for modeling were as follows:

- Catawba County SECC Wastewater Collection System – March 2010
- NC Highway 150 Sewers – Catawba County – May 2015
- NC Highway 150 Sewer Line Extension – Catawba County – March 2016 (Sheet C-101)

Primary Model Elements

Pipeline:
All County force mains were imported to the model. Only the gravity sewers that were connected to the County force mains were imported to the model. All other pipelines deemed as non-major collectors were excluded from the model for the master plan analysis. Once imported, the record drawings were used to assign vertical data to the pipelines at key high and low points, add air release valves to the force main at high points, and input installation year and force main K factors for minor losses. Only key manholes and gravity conveyances were included, and their associated vertical data was added based on record drawings. Most elements in the system were constructed between 2010 to 2015. An appropriate roughness coefficient of 140 would normally be called for newer pipeline. However, a conservative C-factor of 120 was selected reflect an aged system in the future.

Flows:
Flow into the system is very limited under existing conditions. Average daily flows totaling approximately 27 gallons per minute (gpm) were assigned to the closest manhole in the collection system to the location of the demand. Industry standard residential and commercial diurnal curves were assigned to these flows, dependent on the nature of the flow source. The diurnal curves used are shown as **Figure 1 and Figure 2**.

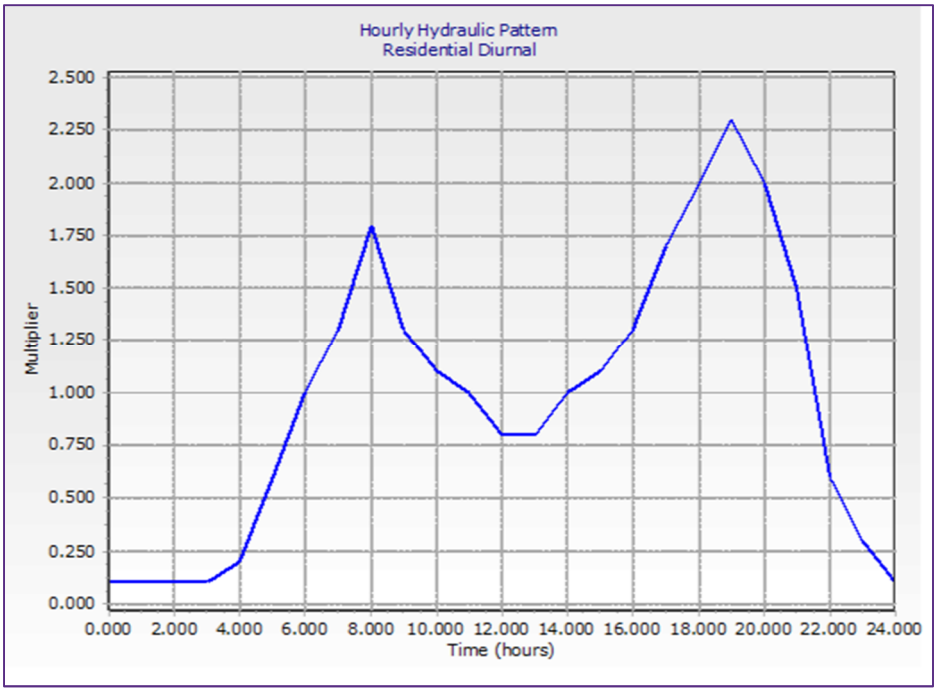


Figure 1 – 24-Hour Residential Diurnal Curve

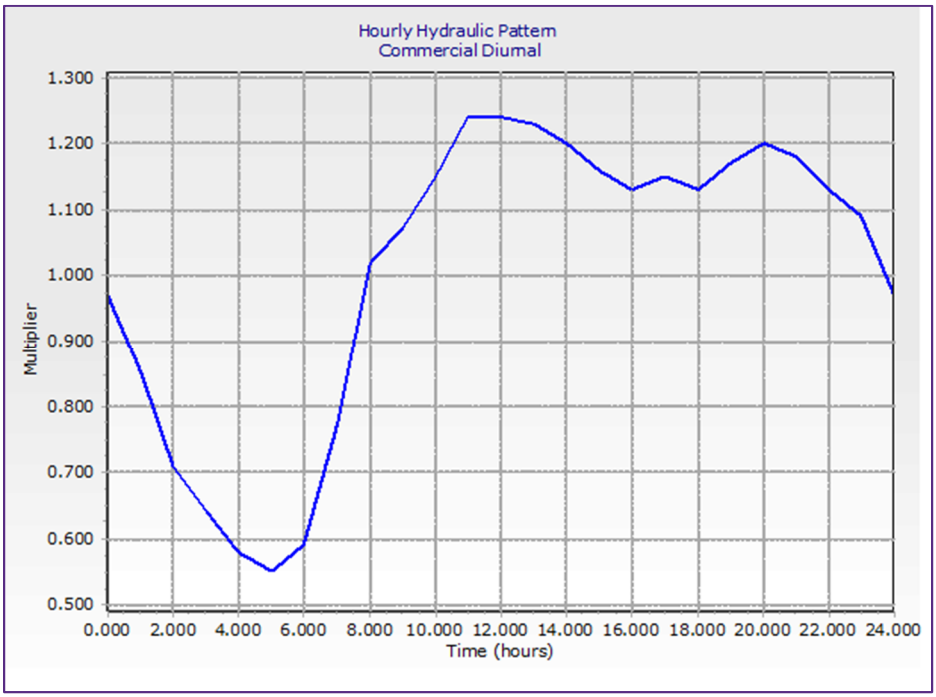


Figure 2 – 24-Hour Commercial Diurnal Curve

Lift stations:
Wet well elevations and dimensions were input into the model at each respective location using available record drawings. Pump curves were developed in the model from curves found in the record drawings and pump model/impeller data. Lift station pump control schemes were input at each station based on an estimate of likely start/stop levels in each wet well. Record drawing information is typically not as reliable for on/off wet well control levels, as level controls are often adjusted by operations staff in the field to achieve a desired number of pump cycles per hour. Where VFD's or soft starts were present, modeling tools in SewerCAD were implemented to mimic these devices.

Table 1 – Summary of Lift Station Data

Lift Station	Design Flow (gpm)	Design TDH (ft)	HP
New Hwy 16 PS	465	89	30
Old Hwy 16 PS	600	128	50
Marina PS	700	75	40
Village Center PS	1100	181	150
Terrell PS	400	90	25
Sherrills Ford PS	1200	103	60
Terrapin Creek PS	1300	206	135
Ball's Creek PS	1300	192	135

Catawba Wastewater Treatment Plant:
The discharge elevation at the upstream end of the Catawba Wastewater Treatment Plant was input into the model as the point of free discharge.

Calibration

The calibration of wastewater models would typically be performed using a combination of manhole flow monitoring, pump station draw down testing, and visual verification of downstream pumping pressures at each lift station. Opportunities for calibration of the wastewater collection system model for the Southeast Catawba County service area are limited due to the lack of wastewater flows currently in the system. During system discussions with County U&E staff, and based on run time data, it is evident that most stations run as little as a single cycle per day.

With this little flow currently in the system, typical calibration techniques are less useful. However, modeled pump flow rates were compared to design points and pump curves at each modeled pump station to ensure that the modeled flow/head conditions matched well with

record drawing information. On average, modeled pumped flows were 17% higher than design flows, a condition that is normally attributed to a higher level of conservatism utilized in pump station design. It is not unusual for a new pump station to outperform its design condition during start-up.

Table 2 – Comparison of Design Flow and Modeled Flow

Lift Station	Design Flow (gpm)	Model Flow (gpm)	% Higher Modeled Flow vs. Design Flow
New Hwy 16 PS	465	500	8
Old Hwy 16 PS	600	755	26
Marina PS	700	760	9
Village Center PS	1100	1225	11
Terrell PS	400	460	15
Sherrills Ford PS	1200	1425	19
Terrapin Creek PS	1300	1525	17
Ball's Creek PS	1300	1700	31

WATER SYSTEM HYDRAULIC MODEL

Existing Facilities Data

Southeast Catawba County utilizes the southeast portion of the City of Hickory water system. The City of Hickory developed a water model of their entire water system for the West Hickory Elevated Storage Tank Analysis Memo in June 2017. This model was used as the basis for developing a Southeast Catawba County water model. The City of Hickory water system portion of the model was inactivated, and only the Southeast Catawba County system was left active.

Existing pipeline data already input in the model was verified against available GIS linework. In addition, booster station information including pump curves, tank sizes, and station piping were verified using available record information. The Southeast Catawba County connections to both the City of Hickory and Conover water mains were represented in the model by fixed head reservoirs. The pressures at these reservoirs were set manually based on the range of pressures recorded during hydrant pressure readings taken from November 8, 2017 to November 17t, 2017. The results of the hydrant pressure reading are summarized in **Table 3**.

Table 3 – Summary of Hydrant Pressure Readings

	Pressures near City of Hickory Connection	Pressures near City of Conover Connection	Pressures at NC 150 Hwy. and Sherrills Ford R.
Location	Beverly St.	Shiloh Road	Sherrills Ford Road
Minimum Reading	179.2 psi (1265 ft)	45.6 psi (1082 ft)	131.0 psi (1158 ft)
Average Reading	194.6 psi (1301 ft)	83.0 psi (1169 ft)	161.0 psi (1227 ft)
Maximum Reading	213.6 psi (1344 ft)	102.8 psi (1215 ft)	180.6 psi (1272 ft)

Flows during the time of the pressure readings were not available. However, the City of Hickory provided SCADA data that gives the water levels in the water storage tanks during that same time period. This information can be used as an indication of the magnitude of water demand over time and can serve to compare with model results. The changes in water levels are represented in **Figure 3 and Figure 4**.

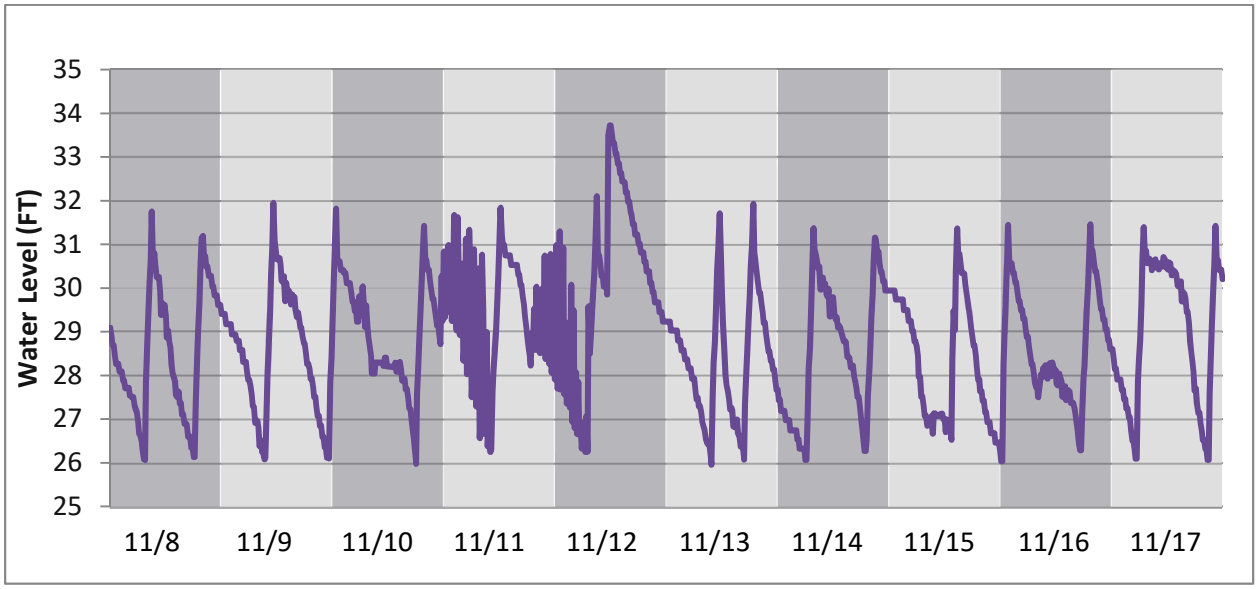


Figure 3 – SCADA Data for Bandy's Elevated Water Storage Tank in November 2017

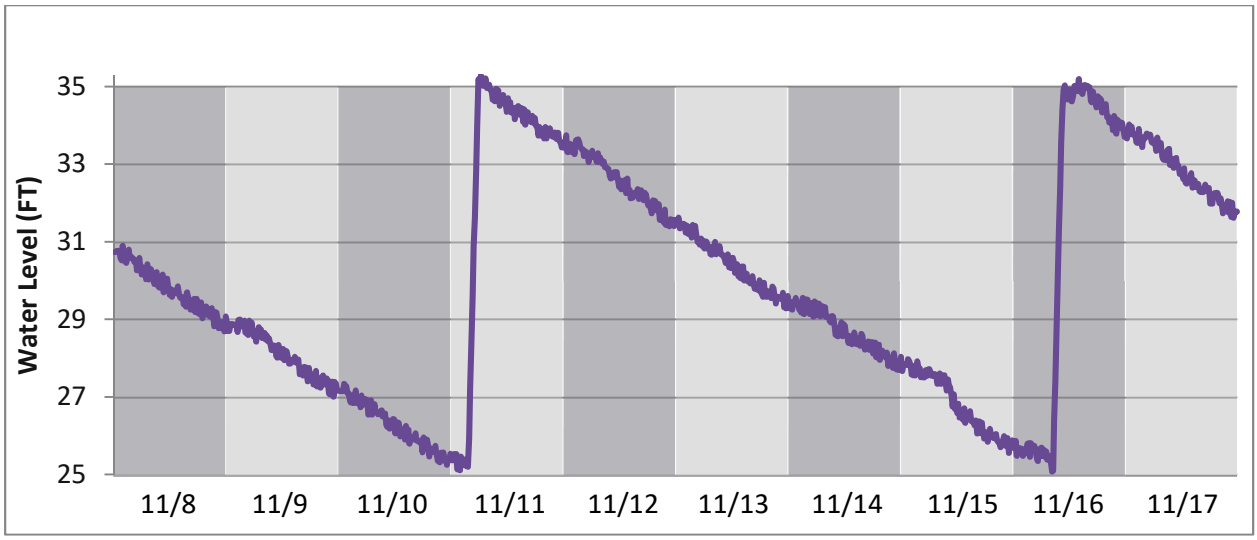


Figure 4 – SCADA Data for SECC Ground Water Storage Tank in November 2017

The system elements include two booster pump stations, two water storage tanks and pipe. Existing pipe diameters were verified using available GIS linework for the system. The properties of the two booster pumps stations and water storage tanks were modified based on available record drawings and pump curves provided by the County. The data from the County resources are summarized in **Table 4 and Table 5**.

The Southeast Catawba County water system is split into two regions: "Southeast Catawba County" (SECC) and "Shiloh." The SECC region begins at the connection with the City of Hickory 36-inch water main on Startown Road and Kirsten Street, and then ends at a normally-closed isolation valve that splits the SECC and Shiloh regions. The isolation valve is located near the intersection of Sherrills Ford Road and Beatty Road. The Shiloh region begins at the connection with the City of Conover 12-inch water main on NC Highway 10 and Shiloh Road, then ends at the isolation valve that separates the SECC and Shiloh regions. These features of the Southeast Catawba County existing water system can be seen in **Figure 5** on the next page.

Table 4 – Summary of County Data for Booster Pump Stations

	SE Catawba Booster Pump Station	Shiloh Booster Pump Station
Elevation (ft)	1,012	973.5
No. of Duty Pumps	2	1
No. of Standby Pumps	1	1
Design Flow - each (gpm)	1,700[1]	700
Design Flow - each (MGD)	2.45[1]	1
Design Head (ft)	63[1]	195
Rated Capacity - Each (gpm)	2,850	700
Rated Capacity - Each (MGD)	4.11	1
Rated Head (ft)	75	195
HP	75	60
Drive	VFD	Constant Speed
Type	Horizontal Split Case	Horizontal Split Case

[1]*These numbers were inferred from the pump test data provided in the booster station O&M manual.*

Table 5 – Summary of County Data for Water Storage Tanks

	Southeast Catawba GST	Bandy's EST
Volume (MG)	1	0.5
Diameter (ft)	65	50
Ground Elevation (ft)	1,195	1,030.17
Tank Bottom Elevation (ft)	1,195	1,195
High Water Elevation (ft)	1,235.33	1,232.17

The existing water demands for Southeast Catawba County were estimated from water usage data provided by the City of Hickory for January through December 2017. This data was imported into the water model and the demands were allocated to the nearest junction. The resulting existing water demands by region are summarized in **Table 6**. These demands do not include the volume of water that the County flushes periodically to maintain water quality.

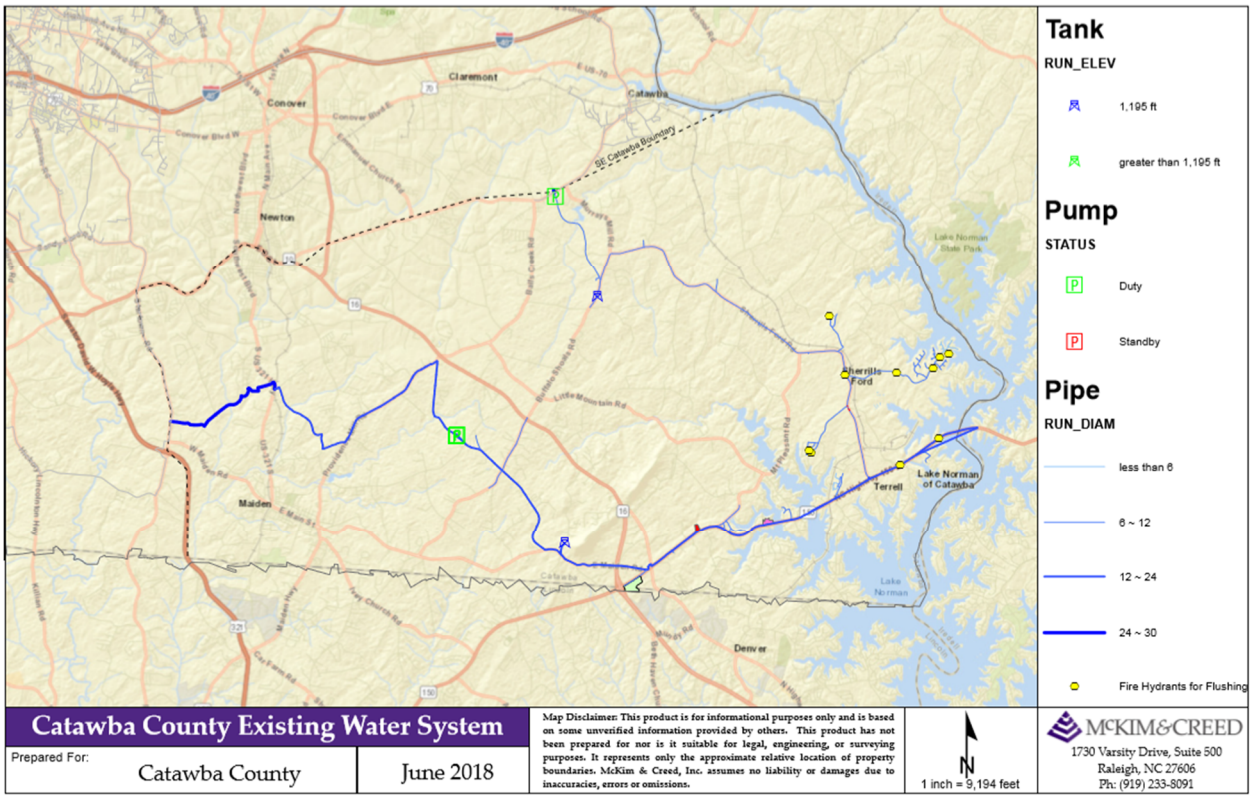


Figure 5 – Southeast Catawba County Existing Water System

Table 6 – Existing Water Demands

SECC Region Average Daily Flow (ADF)	65 gpm
Shiloh Region ADF	99 gpm
Total Southeast Catawba County ADF	164 gpm

In order to run extend period simulations, a generic system-wide diurnal demand pattern was assumed based on typical industry patterns and applied to the existing water model. This allows the evaluation of the water system's performance throughout the day's peaks and lows. Only one diurnal pattern has been applied to all consumers at this point and it is shown in **Figure 6**. Additional curves will be added to reflect future zoning assumptions. A C-factor of 120 was used to estimate the friction loss in all water mains. This factor represents the possibility of higher friction in older pipes and allows for conservative evaluation of the system pressures.

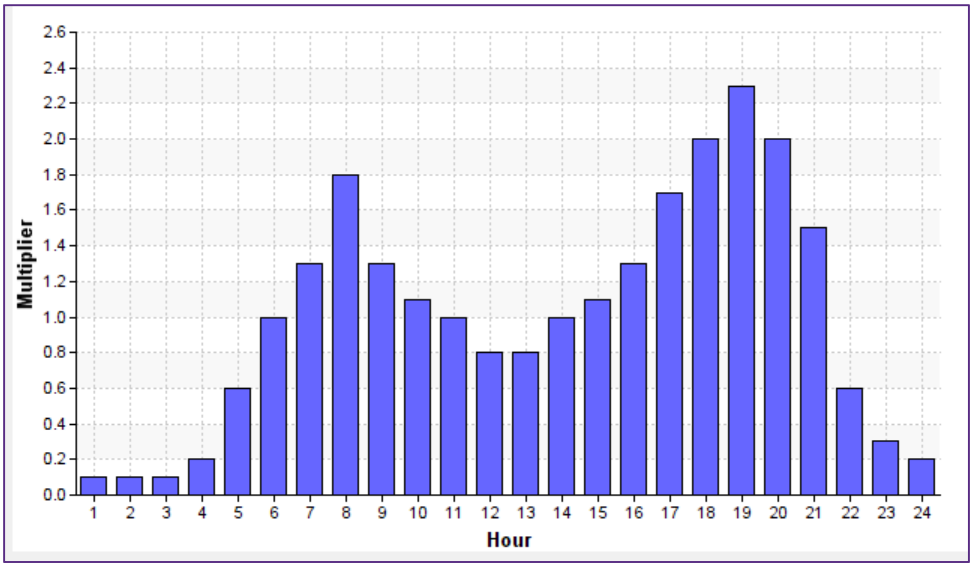


Figure 6 – Diurnal Pattern

Model Control Settings for Existing Scenario:
To create the existing scenario, a new scenario was made from the base scenario that came with the original model. The existing scenario was then named "2018_ADD" (which stands for 2018 Average Day Demand) and described as "Existing Scenario." Then the demand set for the existing scenario was changed to include the Southeast Catawba County water demands. The base data set was kept for all other data sets.

As discussed previously, the properties of the model elements had to be modified to update the model to reflect existing conditions. The Shiloh Reservoir was first set to the average pressure recorded in the field during the hydrant pressure readings (1,169 ft), but this resulted in the pump running off of its curve to the right. This was investigated by making a field visit to the Shiloh Booster Pump Station on June 5, 2018. It was observed that when Pump No. 1 was turned on, the suction pressure was 62 psi (143 ft.), the discharge pressure was 125 psi (289 ft.) and the flow was 875 gpm. These points were plotted on the pump curve that was provided by the County, and a new curve was drawn to represent actual existing performance. This modified pump curve for the Shiloh Booster Pump Station was added to the model and is shown in **Figure 7**.

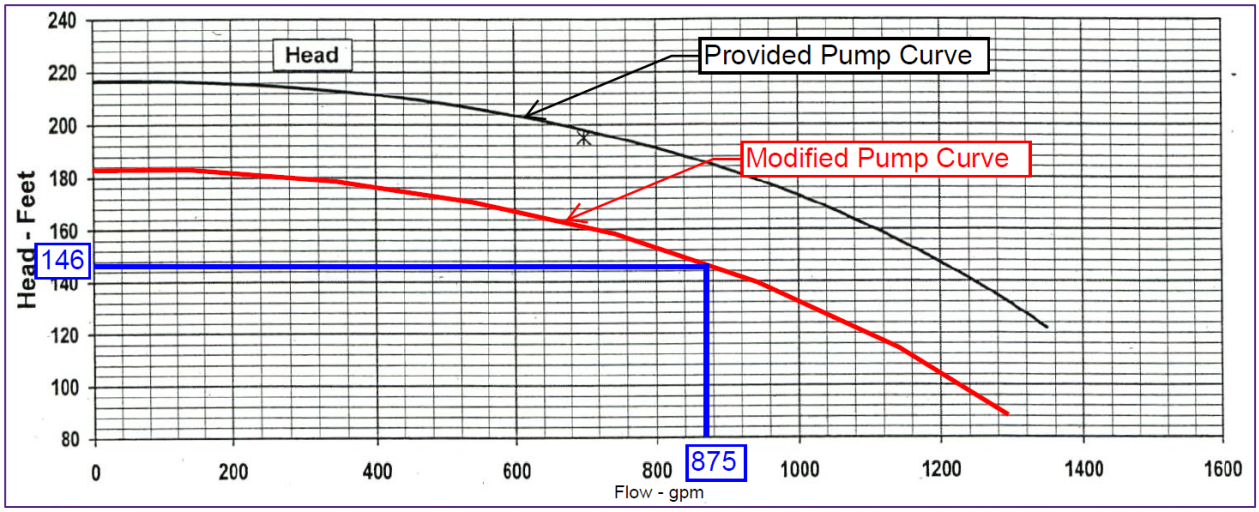


Figure 7 – Modified Pump Curve for the Existing Shiloh Booster Pump Based on Field Data

Since the Shiloh Booster Pump Station pulls water from the City of Conover connection, the suction pressure measured in the field is representative of the City of Conover pressure at that time. In order to set the model to reflect the field data, the elevation of the pump station (973.5 ft.) was added to the observed suction pressure (143 ft.) to determine the pressure needed at the Shiloh Reservoir. The SECC reservoir was set to the average pressure that was recorded in the field during the hydrant pressure readings. The settings for both reservoirs are show in **Table 7**.

Table 7 – Reservoir Settings for Existing Scenario

	Head (ft)
SECC Reservoir	1,300
Shiloh Reservoir	1,117

As seen in **Figure 3,** the Bandy's EST typically begins to fill when the water level reaches 26 feet and then finishes filling when the water level reaches 32 feet. In **Figure 4**, the SECC GST (ground storage tank) typically begins to fill when the water level reaches 25 feet and finishes filling when the water level reaches 35 feet. These set points were used to control when the pumps turn on and off in the model. The pump control settings are listed in **Table 8**. The speed setting for the SECC booster pumps was calculated from the pump test data given in the pump station O&M Manual.

Table 8 – Pump Control Settings for Existing Scenario

Parameter	SECC Booster Pumps	Shiloh Pump
Number of Pumps Activated	2	1
Initial Status of Pumps	Closed	Closed
Variable Speed Setting	85%	100% (Constant Speed)
Control Logic	On: If GST water level < 25 ft Off: If GST water level > 35 ft	On: If EST water level < 26ft Off: If EST water level > 32ft

Existing Scenario – Model Results:
After running the extended period simulation (EPS), system pressures were graphed. The minimum pressure in the SECC region is 44 psi. This occurs at the intersection of E Maiden Road and Anderson Mountain Road, near the ground storage tank. The minimum pressure in the Shiloh region is 83 psi at the intersection of Buffalo Shoals Road and W Bandy's Cross Road.

The model successfully produced results within expectations based on the available data records. **Figure 8** shows the SECC booster pumps operating at 1540 gpm each and 67 ft. head. The time that the pumps turned on correctly corresponds to the time the model shows the SECC GST filling. As seen in **Figure 10**, the tank only fills up once within the 24 hour period when we initially set the tank at 26 feet. This reflects the very low demands in the SECC region.

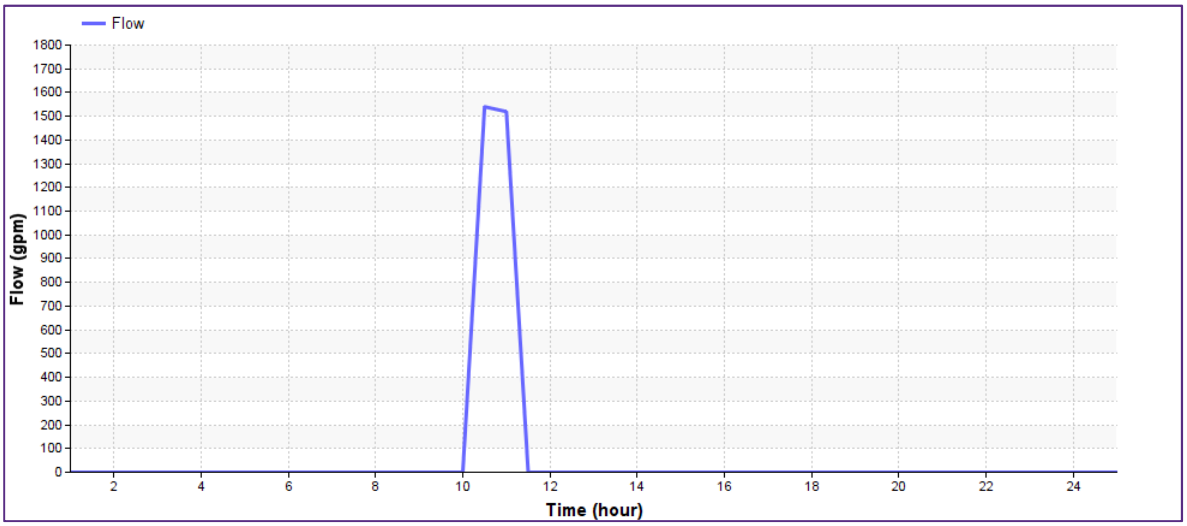


Figure 8 – SECC Booster Pump Flow in the Existing Scenario

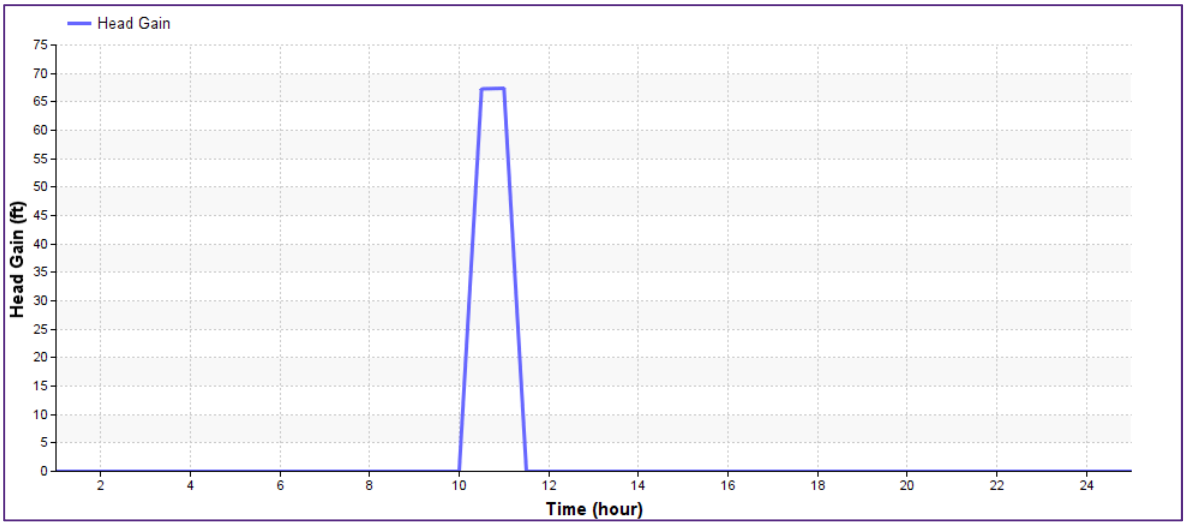


Figure 9 – SECC Booster Pump Head Gain in the Existing Scenario

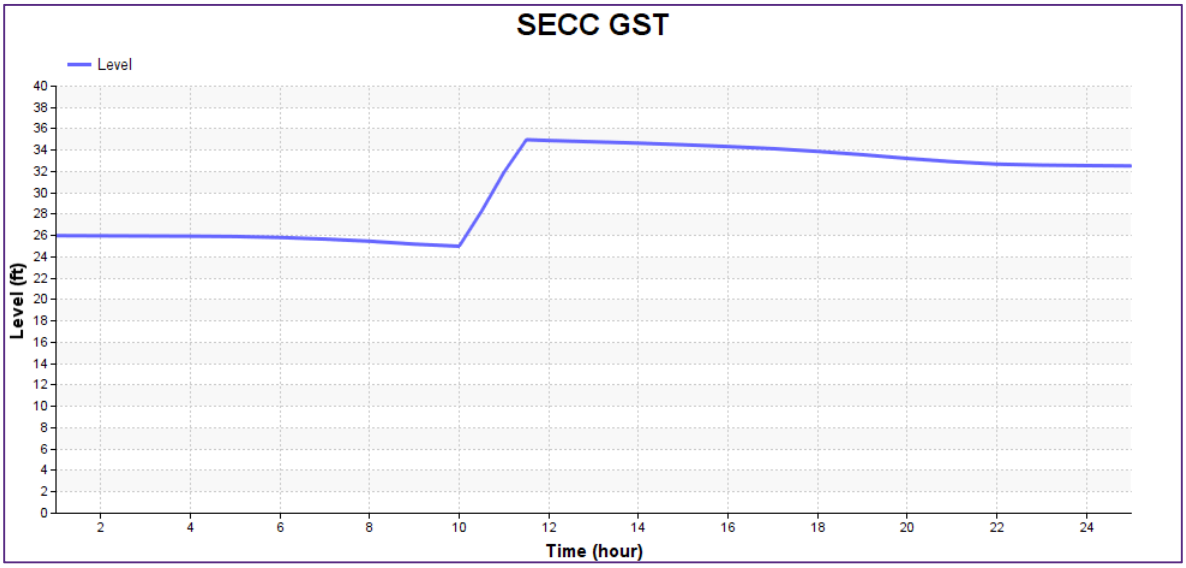


Figure 10 – SECC GST Water Level in the Existing Scenario

The model estimated the Shiloh booster pump performing at 918 gpm and 141 ft. head. The time that the pumps turned on correctly corresponds to the time the model shows the Bandy's EST filling. As seen in **Figure 13**, the tank only fills up once within the 24 hour period when we initially set the tank at 32 feet. This reflects how the Shiloh region has a greater water demand than the SECC region. However, demands are still well below the capacity of the existing system.

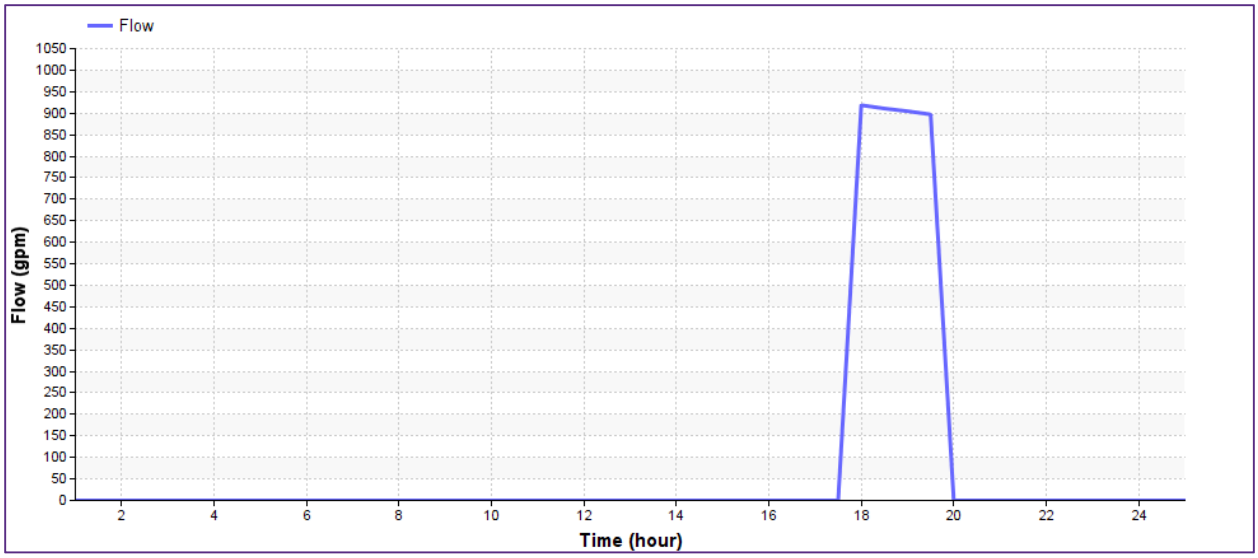


Figure 11 – Shiloh Booster Pump Flow in Existing Scenario

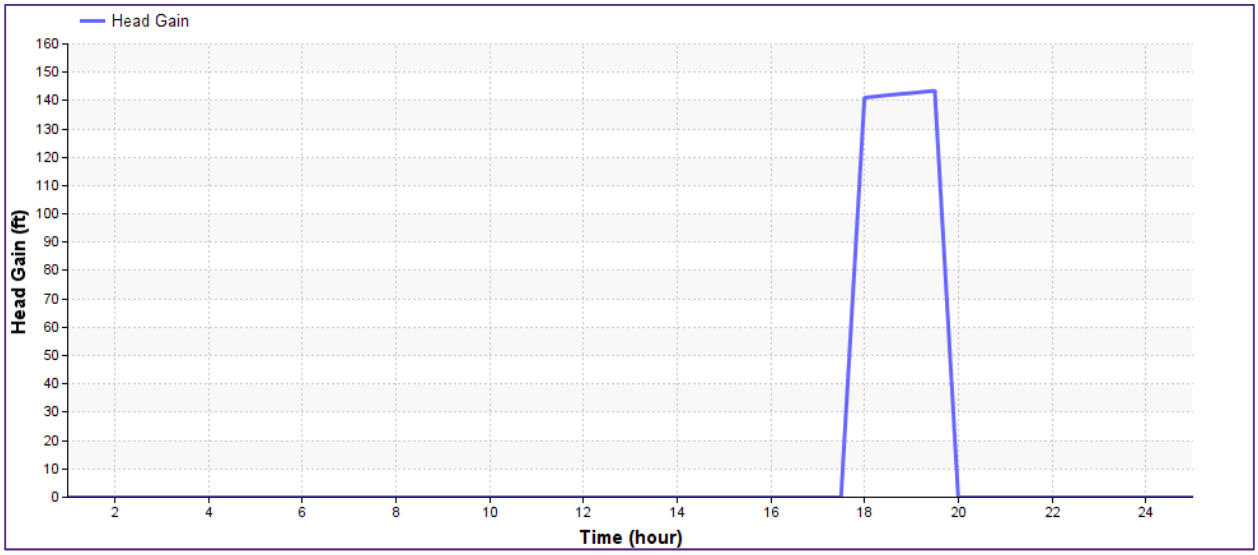


Figure 12 – Shiloh Booster Pump Head Gain in Existing Scenario

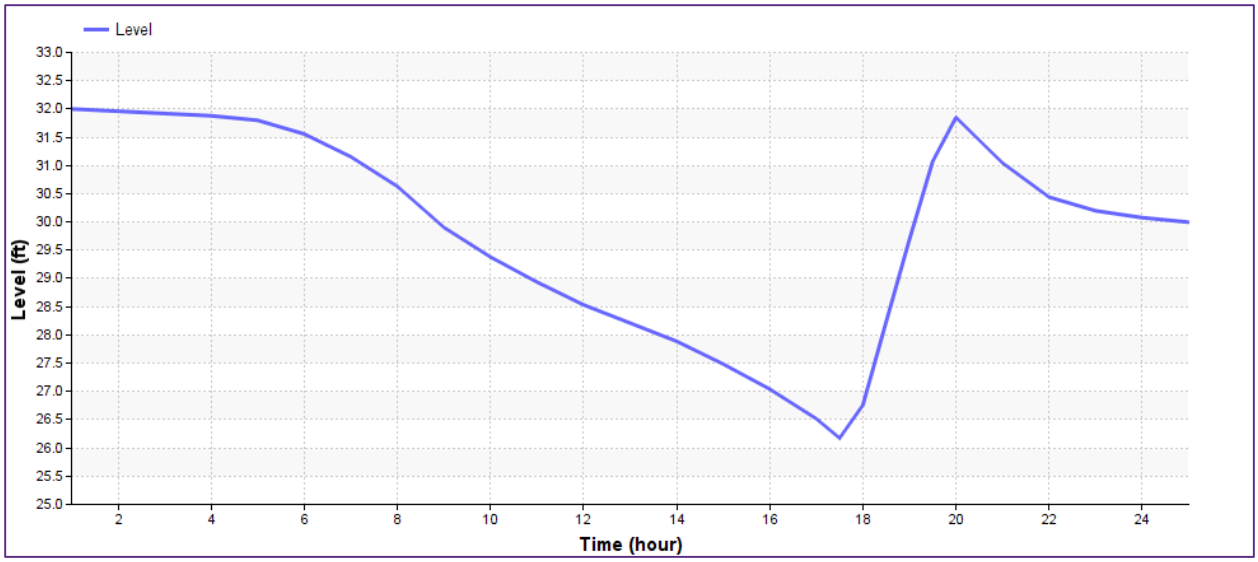


Figure 13 – Bandy's EST Water Level in Existing Scenario

APPENDIX D
NCGS 162A ARTICLE 6

APPENDIX D – NCGS 162A ARTICLE 6

SOUTHEAST CATAWBA COUNTY

WATER AND SEWER/WASTEWATER MASTER PLAN

Catawba County
Newton, NC
Date: May 23, 2019
Revised: October 21, 2019

Prepared for:
Catawba County
Government Center
25 Government Drive
Newton, NC 28658

Prepared by:
McKim & Creed, Inc.
8020 Tower Point Drive
Charlotte, NC 28277
McKim & Creed Project # 01215-0003

Article 6.
County Water and Sewer Districts

§ 162A-86. Formation of district; hearing.

(a) The board of commissioners of any county may create a county water and sewer district.

(a1) The governing board of a consolidated city-county, as defined by G.S. 160B-2(1), may create a water and sewer district pursuant to this Article. For the purposes of this Article, the term "board of county commissioners" shall also mean the governing board of a consolidated city-county and the term "county water and sewer district" also means a water and sewer district created by the governing board of a consolidated city-county.

(b) Before creating such a district, the board of commissioners shall hold a public hearing. Notice of the hearing shall state the date, hour, and place of the hearing and its subject and shall set forth a description of the territory to be included within the proposed district. The notice shall be published once a week for three weeks in a newspaper that circulates in the proposed district and in addition shall be posted in at least three public places in the district. The notice shall be posted and published the first time not less than 20 days before the hearing.

(b1) Before creating such a district, the board of commissioners shall hold a public hearing. Notice of the hearing shall state the date, hour, and place of the hearing and its subject and shall set forth a description of the territory to be included within the proposed district. The notice shall be published once in a newspaper that circulates in the proposed district and in addition shall be posted in at least three public places in the district. The notice shall be posted and published not more than 30 nor less than 14 days before the hearing. The newspaper notice and the public hearing may cover more than one district covered by this subsection.

This subsection applies only when the local Health Director or the State Health Director has certified that there is a present or imminent serious public health hazard caused by the failure of a low-pressure pipe sewer system within the area of the proposed district, and in such case the board of commissioners may proceed either under subsection (a) of this section or under this subsection.

(c) At the public hearing, the commissioners shall hear all interested persons and may adjourn the hearing from time to time. (1977, c. 466, s. 1; 1979, c. 624, ss. 2, 3; 1993 (Reg. Sess., 1994), c. 696, s. 1; c. 714, s. 1; 1995, c. 461, s. 7.)

§ 162A-87. Creation of district; standards; limitation of actions.

(a) Following the public hearing, the board of commissioners may, by resolution, create a county water and sewer district if the board finds that:

(1) There is a demonstrable need for providing in the district water services, or sewer services, or both;

(2) The residents of all the territory to be included in the district will benefit from the district's creation; and

(3) It is economically feasible to provide the proposed service or services in the district without unreasonable or burdensome annual tax levies.

Territory lying within the corporate limits of a city or town may not be included in the district unless the governing body of the city or town agrees by resolution to such inclusion. Otherwise, the board of commissioners may define as the district all or any portion of the territory described in the notice of the public hearing.

(b) Upon adoption of a resolution creating a county water and sewer district, the board of commissioners shall cause the resolution to be published once in each of two successive weeks in the newspaper in which the notices of the hearing were published. In addition, the commissioners shall cause to be published with the resolution a notice in substantially the following form:

"The foregoing resolution was adopted by the _____ County Board of Commissioners on _____ and was first published on _____.

Any action or proceeding questioning the validity of this resolution or the creation of the _____ Water and Sewer District of _____ County or the inclusion in the district of any of the territory described in the resolution must be commenced within 30 days after the first publication of the resolution.

_____

Clerk, _____County Board of Commissioners"

Any action or proceeding in any court to set aside a resolution creating a county water and sewer district, or questioning the validity of such a resolution, the creation of such a district, or the inclusion in such a district of any of the territory described in the resolution creating the district must be commenced within 30 days after the first publication of the resolution and notice. After the expiration of this period of limitation, no right of action or defense founded upon the invalidity of the resolution, the creation of the district, or the inclusion of any territory in the district may be asserted, nor may the validity of the resolution, the creation of the district, or the inclusion of the territory be open to question in any court upon any ground whatever, except in an action or proceeding commenced within that period.

Notwithstanding any other provision of this section, in the case of any county water and sewer districts created under G.S. 162A-86(b1):

(1) A resolution may cover the creation of more than one district;

(2) The board of commissioners shall cause the resolution to be published once in the newspaper in which the notice of the hearing was published; and

(3) References in this subsection to "30 days" are instead "21 days". (1977, c. 466, s. 1; 1979, c. 624, s. 4; 1993 (Reg. Sess., 1994), c. 696, s. 2; c. 714, s. 2.)

§ 162A-87.1. Extension of water and sewer districts.

(a) Standards. – The board of commissioners may, by resolution, annex territory to any water and sewer district upon a finding that:

(1) The area to be annexed is contiguous to the district, with at least one eighth of the area's aggregate external boundary coincident with the existing boundary of the district;

(2) The residents of the territory to be annexed will benefit from the annexation; and

(3) It is economically feasible to provide the proposed service or services in the annexed district without unreasonable or burdensome annual tax levies.

(b) Annexation by Petition. – The board of commissioners may, by resolution, extend by annexation the boundaries of any water or sewer district when one hundred percent (100%) of the real property owners of the area to be annexed have petitioned the board for annexation to the water and sewer district.

(c) Annexation of Property within a City or Sanitary District. – Territory lying within the corporate limits of a city or sanitary district may not be annexed to a water and sewer district unless the governing body of the city or sanitary district agrees, by resolution, to the annexation.

(d) Report. – Before the public hearing required by subsection (e) of this section, the board of commissioners shall have prepared a report containing:

(1) A map of the water and sewer district and the adjacent territory, showing the present and proposed boundaries of the district; and

(2) A statement showing that the area to be annexed meets the standards and requirements established in subsections (a), (b), or (c) of this section.

The report shall be available for public inspection in the office of the clerk of the board of commissioners for at least two weeks before the date of the public hearing required by subsection (e) of this section.

(e) Hearing and Notice. – The board of commissioners shall hold a public hearing before adopting any resolution extending the boundaries of a water and sewer district. Notice of the hearing shall state the date, hour, and place of the hearing and its subject, and shall include a statement that the report required by subsection (d) of this section is available for inspection in the office of the clerk of the board of commissioners. The notice shall be published at least once not less than one week before the date of the hearing. In addition, unless the hearing is because of a petition for annexation submitted under subsection (b) of this section, the notice shall be mailed, at least four weeks before the date of the hearing, to the owners, as shown by the county tax records as of the preceding January 1, of all property located within the area to be annexed. The notice may be mailed by any class of U.S. mail which is fully prepaid. The person designated by the board of commissioners to mail the notice shall certify to the board of commissioners that the mailing has been completed, and his certificate shall be conclusive in the absence of fraud.

(f) Effective Date. – The resolution extending the boundaries of the district shall take effect at the beginning of a fiscal year commencing after its passage, as determined by the board of commissioners. (1985, c. 627, s. 1; 1989, c. 543.)

§ 162A-87.1A. Initial boundaries of district.

(a) The initial boundaries of a district may exclude areas contained solely within the external boundaries of the district.

(b) The initial boundaries of a district may include noncontiguous portions, as long as the closest distance from a noncontiguous piece to the part of the district containing the greatest area does not exceed one mile.

(c) This section does not invalidate any district created prior to the effective date of this section. (1993 (Reg. Sess., 1994), c. 696, s. 3; c. 714, s. 3.)

§ 162A-87.1B. Transfer of State-owned property from one district to another.

If any property owned by the State is located in a county water and sewer district, the board of commissioners of that county by resolution may transfer the property to another county water and sewer district in that county. This section only applies if the State acquired the property from the county. Any such resolution shall become effective on the date specified in the resolution, and a copy of the resolution shall be sent to the Department of Administration. (2005-127, s. 1; 2006-226, s. 29.)

§ 162A-87.2. Abolition of water and sewer districts.

(a) Upon finding that there is no longer a need for a water and sewer district and that there are no outstanding bonds or notes issued to finance projects in the district, the board of commissioners may, by resolution, abolish that district. The board of commissioners shall hold a public hearing before adopting a resolution abolishing a district. Notice of the hearing shall state the date, hour, and place of the hearing and its subject, and shall be published at least once not less than one week before the date of the hearing. The abolition of any water and sewer district shall take effect at the end of a fiscal year following passage of the resolution, as determined by the board of commissioners.

(b) If the:

(1) Terms of any contract between a county water and sewer district and a city provide that upon certain conditions, all the property of the district is conveyed to that city; and

(2) District has at the time of abolition no existing bonds or notes issued as authorized by G.S. 162A-90 to finance projects in the district,

then such contract may also provide that no earlier than such conveyance the district may be abolished by action of the governing board of the city. If the district has any other indebtedness, a contract providing for conveyance of all of the assets of a district to a city must provide for assumption of such other

indebtedness by the city. If the district is owed any assessments, then the right to collect such assessments becomes that of the city. The governing board of the city shall hold a public hearing before adopting a resolution abolishing a district. Notice of the hearing shall state the date, hour, and place of the hearing and its subject, and shall be published at least once not less than one week before the date of the hearing. The abolition of any water and sewer district shall take effect at the end of a fiscal year of the district following passage of the resolution, as determined by the governing board. This subsection applies only to a county water and sewer district created under G.S. 162A-86(b1).

(c) If the:

(1) Terms of any contract between a county water and sewer district and a private person provide that upon certain conditions, all the property of the district is conveyed to that private person; and

(2) District has at the time of abolition no existing bonds or notes issued as authorized by G.S. 162A-90 to finance projects in the district,

such contract may also provide that no earlier than such conveyance the district may be abolished by action of the Utilities Commission. If the district has any other indebtedness, a contract providing for conveyance of all of the assets of a district to a private person must provide for assumption of such other indebtedness by the private person. If the district is owed any assessments, then the private person may collect the assessment under the same procedures as if it was the district. The Utilities Commission shall hold a public hearing before adopting a resolution abolishing a district. Notice of the hearing shall state the date, hour, and place of the hearing and its subject, and shall be published at least once not less than one week before the date of the hearing. The abolition of any water and sewer district shall take effect at the end of a fiscal year of the district following passage of the resolution, as determined by the Utilities Commission. This subsection applies only to a county water and sewer district created under G.S. 162A-86(b1).

(d) Any resolution of abolition adopted under this section on or after the effective date of this section shall be filed with the Secretary of State. (1985, c. 627, s. 2; 1993 (Reg. Sess., 1994), c. 696, s. 4; c. 714, s. 4.)

§ 162A-87.3. Services outside the district.

(a) A county water and sewer district may provide water or sewer services, or both, to customers outside the district, but in no case shall the county water and sewer district be held liable for damages to those outside the district for failure to furnish such services.

(b) A county water and sewer district may provide a different schedule of rents, rates, fees, and charges for services provided outside the district.

(c) A county water and sewer district may not extend service to customers lying within the corporate limits of a city or sanitary district unless the governing body of a city or sanitary district agrees, by resolution, to the extension.

(d) A county water and sewer district may not extend service to customers lying within another county unless the board of commissioners of that county agrees, by resolution, to the extension. (1989, c. 726, s. 1.)

§ 162A-88. District is a municipal corporation.

(a) The inhabitants of a county water and sewer district created pursuant to this Article are a body corporate and politic by the name specified by the board of commissioners. Under that name they are vested with all the property and rights of property belonging to the corporation; have perpetual succession; may sue and be sued; may contract and be contracted with; may acquire and hold any property, real and personal, devised, sold, or in any manner conveyed, dedicated to, or otherwise acquired by them, and from time to time may hold, invest, sell, or dispose of the same; may have a common seal and alter and renew it at will; may establish, revise and collect rates, fees or other charges and penalties

for the use of or the services furnished or to be furnished by any sanitary sewer system, water system or sanitary sewer and water system of the district; and may exercise those powers conferred on them by this Article.

(b) The district board may require system development fees only in accordance with Article 8 of this Chapter. (1977, c. 466, s. 1; 1979, c. 624, s. 5; 2011-284, s. 124; 2017-138, s. 9.)

§ 162A-88.1. Contracts with private entities.

A county water and sewer district may contract with and appropriate money to any person, association, or corporation, in order to carry out any public purpose that the county water and sewer district is authorized by law to engage in. (1993 (Reg. Sess., 1994), c. 696, s. 5; c. 714, s. 5.)

§ 162A-89. Governing body of district; powers.

(a) The board of commissioners of the county in which a county water and sewer district is created is the governing body of the district.

(b) The governing board of a consolidated city-county in which a water and sewer district is created is the governing body of the district. (1977, c. 466, s. 1; 1995, c. 461, s. 8.)

§ 162A-89.1. Eminent domain power authorized.

A county water and sewer district shall have the power of eminent domain, to be exercised in accordance with the provisions of Chapter 40A of the General Statutes, over the acquisition of any improved or unimproved lands or rights in land, within or without the district. (1977, c. 466, s. 1; 1983, c. 735, s. 1.; 1987, c. 2, s. 2)

§ 162A-90. Bonds and notes authorized.

A county water and sewer district may from time to time issue general obligation and revenue bonds and bond anticipation notes pursuant to the Local Government Finance Act, for the purposes of providing sanitary sewer systems or water systems or both.

A county water and sewer district may from time to time issue tax and revenue anticipation notes pursuant to Chapter 159, Article 9, Part 2. (1977, c. 466, s. 1.)

§ 162A-91. Taxes authorized.

The governing body of a county water and sewer district may levy property taxes within the district in order to finance the operation and maintenance of the district's water system or sewer system or both and in order to finance debt service on any general obligation bonds or notes issued by the district. No voter approval is necessary in order for such taxes to be levied. (1977, c. 466, s. 1.)

§ 162A-92. Special assessments authorized.

A county water and sewer district may make special assessments against benefited property within the district for all or part of the costs of:

(1) Constructing, reconstructing, extending, or otherwise building or improving water systems;

(2) Constructing, reconstructing, extending, or otherwise building or improving sewage disposal systems.

A district shall exercise the authority granted by this section according to the provisions of Chapter 153A, Article 9. For the purposes of this section references in that Article to the "county" and the "board of commissioners" are deemed to refer, respectively, to the "district" and the "governing body of the district." (1977, c. 466, s. 1.)

§ 162A-93. Certain city actions prohibited.

(a) No city may duplicate water or sewer services provided by a district under this Article by installing parallel lines and requiring owners of improved property in territory annexed by the city to connect, except with consent of the district governing body.

(b) The provisions of subsection (a) shall not apply if the city council adopts an annexation ordinance including an area served by a district and finds, after a public hearing, that adequate fire protection cannot be provided in the area because of the level of available water service. Notice of the public hearing shall be provided by first class mail to each affected customer and by publication in a newspaper having general circulation in the area, each not less than 10 days before the hearing. The clerk's certification of the mailing shall be deemed conclusive in the absence of fraud. Any resident of the annexed area aggrieved by such a finding of the council may file a petition for review in the superior court in the nature of certiorari, within 30 days after the finding. The petition for review in the nature of certiorari shall comply with G.S. 160A-393.

(c) Provision of public water and sewer services by a district under this Article to an area annexed by a city shall satisfy the city's obligation to provide for water and sewer services under G.S. 160A-35 and G.S. 160A-47. The city may negotiate for purchase of the lines or systems owned and operated by the district.

(d) Upon annexation by a city of an area served by a district under this Article, the city may provide for installation of and use fire hydrants on the district water lines, by arrangement with the district and at the city's cost. (1989, c. 741, s. 1; 2009-421, s. 4.)

§ 162A-94. Certain actions validated.

Any contract entered into by a county water and sewer district on or before February 1, 1995, is not invalid because of failure to comply with Article 8 of Chapter 143 of the General Statutes. (1995, c. 266, s. 1.)

§§ 162A-95 through 162A-100. Reserved for future codification purposes.

MAKING.
LIVING.
BETTER.

catawba county